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How did automobility studies changed throughout history?

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Abstract: The aim of the thesis is to highlight by tracing back the history of the emergence and consolidation of the 20th century automobility paradigm, when and how both societal and industrial pressures to change began to challenge it. Drawing from both the extremely rich literature on the automobile and periodical press, the thesis will shed light on the resilience of both automotive industry and automobile users to the challenges coming from both technology and part of public opinion towards a model of automobility, which had its roots in the 20th century and became more and more unsustainable and obsolete in the 21st century. The dialectics between a public opinion more and more aware of the problems caused by a system based on individual automobility, and other actors eager to keep the status quo and resisting to change will be analyzed both in the American and Italian public debate on automobility. Finally, it will be shown that mobility paradigm of the future, may not be based on ownership of cars, but it will be a service-based paradigm, just like it was in the last decades of the 19th century.

Introduction

Since the turn of the century, it has become very clear that the way in which we all are living is not sustainable in the long run. In the next future, sources will become scarcer and scarcer, and it will be impossible, at current rate, to keep up with the increasing global demand for consumption goods. Global population will grow and following UN's estimates, in 2030 there will be 8.6 billion people and in 2050 9.8 billion.[1]

[1] "World Population Prospects - Population Division - United Nations," population.un.org, https://population.un.org/wpp/Graphs/DemographicProfiles/Line/900.

With such worries, the need to change the current mobility paradigm is evident, and automobility is on the fire line.

Mobility based on automobiles initially started as a substitute for horses and taxis, so its niche was relatively small. During the first decade of the 20th century, thanks to Henry Ford and the Model T, it became a product for the masses, thus completely revolutionizing people's lives in many different aspects: it connected people and cities that previously seemed extremely far away, it created job opportunities, it allowed people to explore new places and it had positive spillovers on many different industries like for example steel, glass, petroleum and even hospitality.

The automotive system that we all know today, based on personal ownership of cars, which are mostly powered by an internal combustion engine (ICE), was not the only one possible, actually, there were alternatives that could have become dominant. For example, during the last decades of the 19th century, electric vehicles occupied a large share of the market, since many taxi companies believed this technology could be very beneficial. Because of a series of circumstances, which will be deeply analyzed and commented in the next pages, starting from the early 20th century, this specific paradigm was considered, by both drivers and system builders, the most advantageous.

For a long time, scholars and mass media have emphasized the "positive" aspects of the automotive system, its "modernity" and contribution to social and economic modernization. More recently, their focus has shifted towards the problems that a mobility paradigm based on individually owned gasoline automobiles has created, as city congestion, mobility poverty (as a consequence of a model based on individual mobility - inefficient public transport hit in particular less wealthy\disabled\marginal people, or residents of rural and poorer areas) and environmental pollution causing premature deaths and diseases are just few of the problems that many were not aware of.[2] Many critics have become more and more vocal about the flaws and the limitations of this model, calling for the shift to another, more economically, socially and environmentally sustainable.

[2] For loss of lives: Sasha Khomenko et al., "Premature Mortality due to Air Pollution in European Cities: A Health Impact Assessment," *The Lancet Planetary Health*, (January 2021): 7, https://doi.org/10.1016/S2542-5196(20)30272-2
For diseases: David Briggs, "Environmental Pollution and the Global Burden of Disease," *British Medical Bulletin* 68, no. 1 (December 1, 2003): 18-20, https://doi.org/10.1093/bmb/ldg019

The aim of the present thesis is to reconstruct the curve of the automobility paradigm from the end of 19th century to the first decade of the 20th century shedding light on the emergence of both pressures towards and resistances against the change in mobility practices and engine propulsion.

The work starts from the American experience which for a long time has been the reference model for studies on both automotive industry and mobility practices, and it is incredibly well studied and documented.

The second part of the thesis intends to use the American experience as a benchmark to propose a short reflection on the history of Italian automobility and aims at verifying if, starting from the 1970s, the Italian responses to the emergent challenges to automobility paradigm were idiosyncratic.

The thesis reconstructs the history of the car and its uses in the framework of the relatively recent mobility turn in history of transport, which looks at automobility as an ensemble\ a system of technological and cultural practices, as well as technical artefacts, which together form the mobility experience of individuals. As such the mobility turn overcomes a purely functionalistic approach to the study of transport and transport artefacts.[3]

The point is not to describe the car as a technological artefact or to simply describe the evolution of product and process technologies in the automotive industry, but to show how the car is part of a larger and complex mobility system. In this light, the present work focuses on how the use and perception of cars by both users and designers have evolved over time and in different ways according to different contexts, and how, especially since the 1970s, small incremental changes at different level of the system have led to the emergence of an alternative paradigm which is becoming dominant.[4]

The analysis stays at the level of a partial reconstruction of public debate (through journals and magazines) and secondary literature but the red thread of the work is to

[3] C. Divall and G. Revill, 'Cultures of transport: representation, practice and technology', Journal of Transport History 26, 1 (2005), 99–117, and M. Freeman's reply; G. Mom, 'What kind of transport history did we get? Half a century of the Journal of Transport History and the future of the field', Journal of Transport History 24, 2 (2003), 121–38.

[4] Urry J. The 'System' of Automobility. Theory, Culture & Society. 2004;21(4-5):25-39. doi:10.1177/0263276404046059

shed light on the historical, century long, emergence of opposite forces, on a one side pushing towards change in mobility practices and propulsion, on the other strongly opposing them. Through the analysis of the literature and public debate, and in relation to the social construction of technology theories, the thesis enlightens the evolution of the use and perception of the car by both users and system builders, the evolution in the symbolic function of the car and of its propulsion in both US and Italy.[5] It is in this broader picture that it is possible to observe the crisis of Fordist paradigm and the emergence of alternatives on the one side, on the other, the enormous resistance to change which characterize many actors in the system.

The thesis is structured in four main chapters which roughly follow Robin Cowan and Staffa Hultén's chronology of the development of the automobile industry: [6]

1. 1830-1884. Many different inventors, both in the US and Europe, develop the so called "horseless carriage", using either electric power, steam or oil (chapter 1).
2. 1885-1905. The early beginnings of the car, in which the there is a great expansion of the EV. In this stage, automobiles are used as taxicab, making it a service-based business model (chapter 1).
3. 1906-1920. The growth of the internal-combustion engine (ICE) and the consequent decline of the EV (chapter 1).

   Growing population, bigger cities, the discovery of big oil reserves (especially in Texas), which decreased dramatically the price of oil, Henry Ford's mass production methods which made the car affordable enough are just few of the reasons why this was the chosen technology. Furthermore, as it will be shown later, the characteristics that made ICE unfavorable were readily solved, enhancing the benefits of it over steam and electric vehicles.
4. 1921-1973. The consolidation of the gasoline car as the dominant vehicle shapes Western societies (chapter 1-2).

[5] Trevor J. Pinch and Wiebe E. Bijker, "The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," *Social Studies of Science* 14, no. 3 (1984): 399–441

[6] Robin Cowan and Staffan Hultén, "Escaping Lock-In: The Case of the Electric Vehicle," *Technological Forecasting and Social Change* 53, no. 1 (September 1996): 61–62, https://doi.org/10.1016/0040-1625(96)00059-5

5. 1974-1998. The initial signs of weakness of the automotive industry. A general. consensus on the link between car emissions, pollution and global warming arose Furthermore, oil price shocks of 1973-74, due to oil embargo by Arab producers, made the whole world aware of its dependence of oil (chapter 3).[7]
6. 1999- . The push for alternative sources of power for vehicles, like full electrics and hybrids, as well as new modes of transportation, like car sharing (chapter 3 and 4).

The first chapter offers the reader a comprehensive picture of the history of the early American car as a product and artefact and the origins of the 20th century automobile paradigm. It has as main sources, beside scholarly literature, some volumes destined to a larger audience as David Kirsch and John Rae's volume and the magazine "The Horseless Age", whose publication started in 1895 and was one of the first magazine to discuss the spread of automobiles. Browsing the magazine helped me to grasp the public discussion around the vehicle, which at the time was a revolutionary invention. From both literature and articles in "The Horseless Age", it emerges that at the origins of individual automobility and of the car, there was a very complex and not at all straightforward history.

The history of early automobility shows how the prevalence of the internal-combustion engine was not obvious and it was instead the result of a series of events and decisions which had not only to do with the alleged technological superiority of ICE vehicles. It is however evident how Henry Ford managed to mass produce in an extremely efficient way enormous quantities of ICE vehicles, which were much cheaper than the EVs and suit the needs and expectations of population better than EVs. Ford Motor company was able to create a huge market, that was inexistent before, and led to a sort of snowballing effect where all the related industries, like steel, glass, and oil, benefitted and grew supporting the model of privately owned ICE vehicles. Path dependency grew from this system, creating a preference for ICE vehicles. From the 1930's on, thanks to the Fordist paradigm, even middle and lower-class citizens were able to afford a car,

[7] Michael Corbett, "Oil Shock of 1973–74 | Federal Reserve History," www.federalreservehistory.org, 2013, https://www.federalreservehistory.org/essays/oil-shock-of-1973-74

previously destined exclusively to the very wealthy part of the population. This shaped society, creating an extremely strong bond between Western culture, democracy of consumption and the car.

In the second and third chapters, I have tried to shed light on the emergence since the 1930s of two opposing trends: on the one side, the increasing awareness of the major problems that individual automobility based on internal combustion engines could create, nurtured a debate on how to change the current paradigm and mobility practices to solve these problems; on the other, forms of resistance to change and interest towards both maintaining and reinforcing the status quo were expressed by different key actors (companies, users, etc.).

In the second chapter, issues arising between the 50's and the 80's are discussed. One of the first relates to the coexistence between individual mobility and public transport services. Thanks to motorization, the phenomenon of suburbanization happened, allowing people to live in the outskirt parts of the cities. With such increased distances and lack of proper urban planning, the car became fundamental for housing development. This was reinforced by the fact that buses, trains and others were not able to satisfy the demand accordingly. The problem of transport poverty thus became more important, with important implications for those who could not and cannot afford to buy a vehicle.

A second topic addressed is environmentalism. Thanks to the work of Ralph Nader "*Unsafe at Any Speed*", published in 1965, the American society started to understand the link between cars' emissions and air pollution, which became a public hazard. Increasing attention was dedicated to the issue and thus both local and federal governments passed laws aimed at controlling the levels of pollutants.

Finally, during the 70's and the 80's, two major events happened: the Yum-Kippur war and the Iranian revolution. These occurrences led to large decrease of oil supplies and the so-called oil crises that were felt worldwide. They deeply impacted the mobility paradigm and made many people question its sustainability in the long run. Since then, alternatives were proposed. During those years, the EVs came back in popularity and their technology improved.

During those years, the main opposition to the change that was present was the love of American citizens for their cars. Since the automobility system was rather new and

everyone saw the benefits, rather than the flaws, the automotive industry did not really need additional power to obstruct the pressures cited above.

In the third chapter, the same interpretative frame is applied (identifying pressures and resistance to change), but the chronological focus is between 1980's and 2000's. The most pressing issues identified were congestion, the social costs of high levels of motorization and the need to find alternative power sources. Thus, during those decades, it is possible to note a rise in interest in EVs, that make their return after the decline of the 1930's.

The opposition that I have been able to pinpoint relate not only to the importance of the automotive industry for the job market as well as for GDP of many countries and the lobbying actions put in place by many companies, generally car manufacturers and energy companies but also to mobility practices and individual habits.

With such knowledge, the last chapter will be presented the Italian case. In order to explore the Italian debate on automobility, I browsed a car magazine, "Quattroruote". Thanks to its articles and to Federico Paolini's volume, I reconstructed how Italian society reacted to the spread of automobility and which were the most pressing issues for Italian users. Anticipating the analysis, it is possible to say that the Italian debate closely mirrored the one in the United States.

Due to Covid related constraints affecting both personal mobility and access to libraries and archives, this research had to be based mainly on published sources or studies available on the web, which were the only ones easily available. This represented a burden to the possibility of analyzing the topic using primary or original sources.

Nonetheless, especially in the first chapter dedicated to tracing back the history of vehicles and the last one, which is focused on uncovering the Italian debate around automobility, I managed to browse magazines and articles of the time.

Chapter 1. At the Origins the Automobility in the 19th Century, Europe and USA. Three Alternative Trajectories (Steam, EV, Gasoline)

Europe, at the beginning was the leading force in the industry, because of a more widespread and better net of roads and highways, that allowed for and pushed the development of innovations in this field. On the other hand, USA lacked such infrastructures, and the spread of the bicycle stressed this inadequacy. This is because the origin of the car is totally European, regardless of the source of power. John B. Rae wrote "The automobile is European by birth, American by adoption", highlighting the fact early inventors were European and that their ideas were later imported and developed in the USA.[8]

During the end of 19th century and the first decades of the 20th century, steam, electric and gas were all used as power sources for vehicles and, since they all had benefits and flaws over one another, each had a specific niche of operation.

ICE vehicles were best for wealthy men who wanted to tour outside the city without being constrained by batteries' capacity and rather slow charging wait times. They were also lighter, faster and the accessibility to fuel was much more convenient and easier, when compared to EV.

The main problems with ICE were the noise they made while driving, both mechanically and due to the exhausts, the stains of oil it often left, the odors, the unreliability of the engine and the fact that at the beginning, the car was extremely hard (and sometimes dangerous) to start. Records show that there were cases in which the crank handle kicked back and injured or killed in some instances men and women trying to start their car. Furthermore, there were constantly burning combustibles, which made the car very dangerous, especially since at the time, the technology was still new.

On the other hand, the electric vehicle was clean, quiet, reliable and easy to start and drive, so easy that some papers and study of the time, considered it suitable for both women and children.

[8] John B. Rae, "*The American Automobile : A Brief History.*"(Chicago & London: Univ. Of Chicago Press, 1967), 1.

This was further stated by the press. Writers of one of the major automobile magazines at the time, The Horseless Age, declared:

"Electricity, in its cleanliness and ease of control, has undoubted advantages for the ladies' use.". Moreover: "… and surely find liberal patronage among our aristocratic ladies, who will soon be as enthusiastic over the motor carriage as the French chauffeuses are."[9]

The main hassles were the price, since EVs were generally more expensive than gas cars and the battery range. Even though developments made it possible to increase the miles guaranteed, at a certain point, cities grew so much that such distances became an insurmountable obstacle and technology was not able to catch up.

Some magazines of the time gathered some important data which exemplified the differences between ICE and EV. The former had an average milage capacity of about 100 against 60 of the former, and the cost of running a petroleum and gas car was 0.25$ per hour less that the electric counterpart. Moreover, the fact that the battery was extremely heavy had a big impact of the performance.[10]

When ICE technology developed, some constraints fell while some others became actual benefits. The noisiness, the dirt and the sense of freedom of not being dependent on charging station became synonymous of masculinity. While the EV was considered more "gentle" and "quiet", thus more suitable for women. On the other hand, a certain level of "masculinity" became attached to ICE vehicles.

Finally, the steam engine was the less popular among the three. It had the big inconvenience that it took around 20 minutes to start, it needed water change after a certain number of miles travelled and, most importantly, since it required lots of maintenance work, it was not suitable for mass production. Even though it was generally more expensive, it was also more powerful, it did not require any complicated transmission

[9] Electric Carriages for Ladies, The Horseless Age, May 24th, 1899

[10] Designs for Electric Vehicles – The Problem from an Engineering Point of View, The Horseless Age, January 1896

1.1 – Early beginnings of the horseless carriage

Many inventors, starting from the second half of the 19th century, tried to create an alternative solution to the horse-based transportation.

One of the sources of energy that was most used and most promising was steam.

Nicholas Joseph Cugnot exploited this method and in 1769, managed to build the first self-propelling vehicle.

The French engineer used a two-cylinder engine supplied by a boiler which powered the front wheel, that served as steering as well. After just a few feet travelled, the boiler already needed new water and the speed attained was not exceptional. Even though his creation could not match horses' performances yet, it was a remarkable moment in the history, as it was the first of its kind. Thanks to Cugnot, the technology, as well as the idea of a self-propelling vehicle that could substitute the horse which had many flaws, spread all over Europe, making something that was previously unthinkable, a reality.

William Murdock, an English mechanic advanced and innovated Cugnot's road carriage. In 1784 he patented his idea and named the carriage "Pickard".[11]

It took about twenty more years to see a steam-powered vehicle in the streets. More specifically, in 1801 Richard Trevithick built a vehicle that could transport six people and the first day of trial it managed to go over a hill.[12]

In the US, the twin brother Francis E. and Feelan O. Stanley produced a steam automobile, which eventually became commercially available in 1897.[13]

Nonetheless, the steam engine was expensive and not efficient, so more effort was shifted towards electric and the internal combustion engine vehicles. ICE had a greater thermal efficiency that the steam engine, thus resulting in better results when compared.

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[11] BBC "A History of the World - Object : William Murdock's Steam Locomotive,", http://www.bbc.co.uk/ahistoryoftheworld/objects/1h1Eko8qR_WF9MhWcySpuA

[12] H. L. Barber, "*Story of the Automobile, Its History and Development from 1760 to 1917, with an Analysis of the Standing and Prospects of the Automobile Industry"* (Nabu Press, 2011): 56.

[13] John B. Rae, "*The American Automobile : A Brief History."* (Chicago & London: Univ. Of Chicago Press, 1967): 13-15

For the electric vehicle, it is difficult to assign its invention to exactly one person, because many inventors, around the 30's of the 19th century, built carriages with a battery.

Some attribute the first experimental electric vehicle to the Hungarian inventor Jedlik Ànyos in 1828, who created a very rudimental version, others to think it was Robert Davison, as he built a model of electric locomotive in 1837 and a four-wheeled machine powered by zinc-acid batteries in 1842, while for others Thomas Davenport was the true inventor of the EV, since he was the one to register the patent for an electric motor in 1837.[14]

In the following decades, other visionaries perfected and improved the technology.

Gustave Planté, developed and refined the zinc-acid batteries and created a rechargeable lead-acid battery.

Gustave Trouvé applied Planté's breakthrough for his tricycle, which was revealed at an exhibition in Paris in 1881.[15]

It is possible to say that at the time, the battery was extremely fashionable and interesting for many inventors and entrepreneurs and the automobile was a great way to show off what this technology was able to achieve. Thomas Edison was one of them, and his contribution to the development of the battery led to the nickel-iron battery, which increased storage capacity, the main issue with the electric vehicle.

In the USA, the electric vehicle was brought in the country by William Morrison, a chemist from Iowa. He created the first four-wheel electric vehicle in the continent and was shown at the Seni Om Sed Celebration Parade in 1890.[16]

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[14] For Jedlik Ànyos: Masayuki Morimoto, "*Which Is the First Electric Vehicle*?," *Electrical Engineering in Japan* 192, no. 2 (April 1, 2015): 31, https://doi.org/10.1002/eej.22550
For Thomas Davenport: Miguel Edgar Morales Udaeta et al., "*Electric Vehicles Analysis inside Electric Mobility Looking for Energy Efficient and Sustainable Metropolis*," *Open Journal of Energy Efficiency* 04, no. 01 (2015): 5-9, DOI: 10.4236/ojee.2015.41001
Curtis D Anderson and Judy Anderson, *Electric and Hybrid Cars : A History* (Jefferson, N.C.: Mcfarland, 2010): 21-40.

[15] Karl Georg Høyer, "*The History of Alternative Fuels in Transportation: The Case of Electric and Hybrid Cars*," *Utilities Policy* 16, no. 2 (June 2008): 63–71, https://doi.org/10.1016/j.jup.2007.11.001

[16] Len Larson, "*Dreams to Automobiles"* (Xlibris Corp, 2008).

Many attempted to build a horseless carriage powered by a combustion engine.

Benz was the most important inventor in this field. In 1886 he managed to patent his creation, thus making him the father of today's internal combustion engine (ICE) car. His creation was a one-cylinder three-wheeler with a top speed of 10mph.[17]

Another very significant figure is Gottlie Wilhel Daimler which, just like Benz, built a one-cylinder vehicle, but he actually chose a four-wheeler.

Benz and Daimler are probably the two most important figures in the automotive industry because they created the ancestor of what we consider today as a car.

The decade of 1890's saw Europe, especially France, Germany and England leading the way towards the horseless carriage revolution, even though the lead was short-lived.

USA was lagging behind in the rush towards the automobile. Even though the skills, know-how and knowledge about early European experiments were already in the country. The main problem was that it lacked the proper infrastructure, so that a car seemed utterly impractical and interested had a hard time spreading. This was mainly due to the fact that governments did not feel the need to build an extensive net of highways since the railroad, at the time, was the most economical and fastest way of travelling and transporting goods. But this was until the bicycle allowed people to travel more easily and autonomously.

In 1885, J.K Starley introduced a low-wheeled bike, called "safety bicycle". After some attempts to modify the design of the bike in order to make it less dangerous and more easily usable by everyone, Starley built the bicycle that we all know today.[18]

This became very popular, so that suddenly the need for better roads and streets arrived.

Cyclists' agitation, asking for improved roads came together creating the "Good Roads Movement" in the 1870s and in 1892 the "Good Roads Magazine" was published. The main goal of the movement was to pressure local governments to invest in more

[17]Daimler, "*The First Automobile*," Daimler, 2018, https://www.daimler.com/company/tradition/company-history/1885-1886.html.

[18] Science Museum Group Collection, "*Rover 'Safety' Bicycle*, 1885 | Science Museum Group Collection," collection.sciencemuseumgroup.org.uk, https://collection.sciencemuseumgroup.org.uk/objects/co25833/rover-safety-bicycle-1885-bicycle.

advanced and wide-spread highways and roads.[19] Farmers further increased the pressure as they saw the opportunity to exploit roads and highways in order to enter new markets and escape the geographical isolation.

On October 3rd, 1893, farmers' and Good Roads Movement's requests were accommodated: the "Office of Road Inquiry" was established in order to collect and disseminate information about road management and roadbuilding materials.[20]

The rise in popularity of the bicycle not only influenced policymakers to improve and enlarge the highways net, but also gave a spark of interest in individual mobility, pushing the boundaries of how far people could go and paving the way for the automobile.

The first decade of the 20th century signaled the end of European supremacy in the automotive industry and established the American lead. Before the century, the engines were imported, especially from France, but by 1904, American manufacturers became leaders in the industry.[21]

In 1893, J. Frank Duryea and the brother Charles E., built a one-cylinder gasoline engine carriage and rode it the streets of Springfield, Massachusetts. They were bicycle mechanists, so it is important to note the fact that the bike, not only contributed to the development of streets, the idea of individual mobility, but it also had some important practical application for the development of the automobile.

In 1894, Pedro Salom and Henry Morris tested a prototype of the electric vehicle in Philadelphia, called "Electrobat". It resembled exactly a horseless carriage, looking like buggies weighting around 2000 kg, with wheels made of wood, pneumatic tires and room for two people. The prototype was supported by the leading battery company, the Electric Storage Battery company, which supplied the inventors with lead-acid batteries. More specifically, there were four sets of twelve cells each, with a capacity of fifty ampere hour per cell and a weight of more than 700kg.[22]

They also participated at the Times-Herald contest of 1895. Even though they could not run the entire race, because of constraints from the battery and lack of charging

[19] Susan Croce Kelly, "*Good Roads Movement | United States History*," Encyclopedia Britannica, accessed April 24, 2021, https://www.britannica.com/event/Good-Roads-movement.

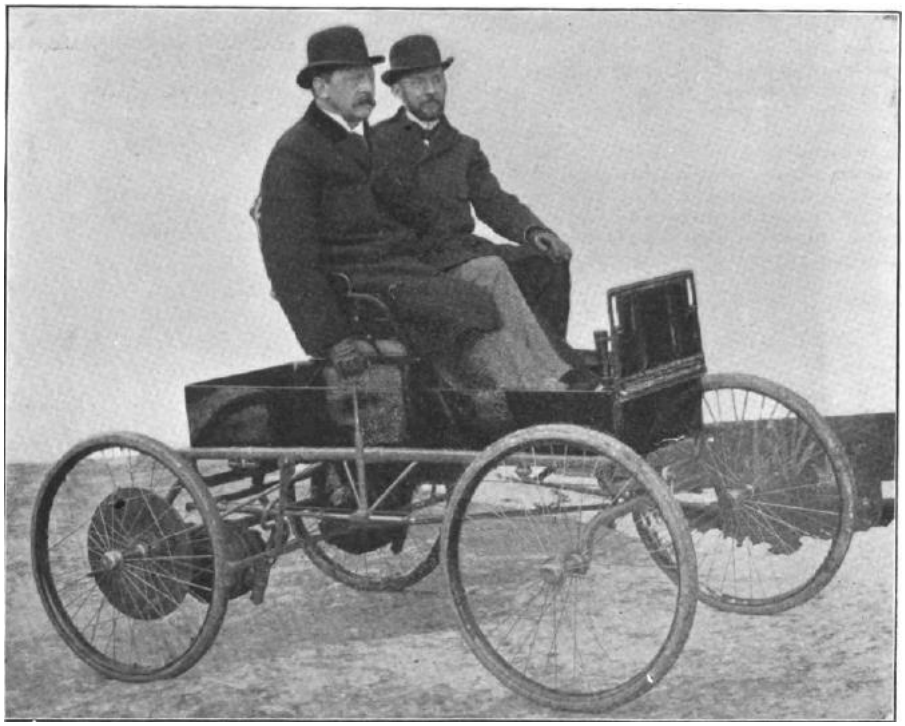
[20] National Archives "*Records of the Bureau of Public Roads*", August 15, 2016, https://www.archives.gov/research/guide-fed-records/groups/030.html#30.1.

[21] Rudi Volti, "*A Century of Automobility*," *Technology and Culture* 37, no. 4 (October 1996): 663, https://doi.org/10.2307/3107094

[22] The "Electrobats", The Horseless Age, December 1895

stations, they still were awarded for “best showing made in the official tests, for safety, ease of control, absence of noise, vibration, heat or odor, cleanliness and general excellence of design and workmanship”.[23] Such award basically summarizes all the benefits of EV over other technologies of engines.

Two years later, Salom and Morris founded the Morris & Salom Electric Carriage and Wagon Company, for the manufacturing, sale and rental of EV.[24] Even though it was not the first company producing electric vehicles, it was the first to try integrating them in the city’s transportation system. Their idea was to replace horses with their own vehicles, as well as implement a net of battery charging and exchange stations, in order to bypass the limitations of the battery itself which could range from forty to fifty km.



Morris and Salom on their electric buggy[25]

In 1897, Pope Manufacturing Company developed electric vehicles, Stanleys made commercially available steam engine cars and Ransom E. Olds and Alexander Winton focused on ICE cars. Olds Motor Works became the leading automotive company in the world, producing 5000 cars in 1905.

[23] Times-Herald Contest, The Awards, The Horseless Age, January 1896
[24] Morris & Salom’s Prospectus, The Horseless age, January 1896
[25] Morris & Salom’s Prospectus, The Horseless age, January 1896

The popularity of such vehicles grew every year, pushed by publications like "Horseless Age" or "Motorcycle". Races were another major factor, serving as a sort of advertisement for the technology.

1.2 – Rise and fall of the EV

One of the most important books documenting the history of the EV in the USA David A. Kirsch's "The Electric Vehicle and the Burden of History", which gives a perfect image of the journey of this technology.

Between 1885 and 1905, it is possible to notice how electric vehicles develop at a much faster pace, when compared to steam or gasoline. This is thanks to important investments made by many taxi companies, both in Europe and in the U.S. who centered their business model around this technology.

While Morris and Salom perfected their Electrobars, many other entrepreneurs and engineer were following the same path.

In June 1895, Hiram Percy Maxim, an engineer graduate from MIT, was hired as chief engineer by the Motor Vehicle Department of the Pope Manufacturing Company. While he was attending the Times-Herald race, he witnessed Morris and Salom's Electrobat and started to appreciate the electric engine.

Once back in Hartford, he started working on his own electric vehicle project, called the "Mark 1", which impressed Pope's board. His third version, the Mark 3 was eventually commercialized in small batches in 1897.

In January 1896, the Electric Carriage and Wagon Company (ECWC) was incorporated, even though in 1897, Morris and Salom gave up ownership and control of the company. Isaac Rice and W.W. Gibbs, both senior manager of the Electric Storage Battery Company, took the position of president and vice president, respectively.[26]

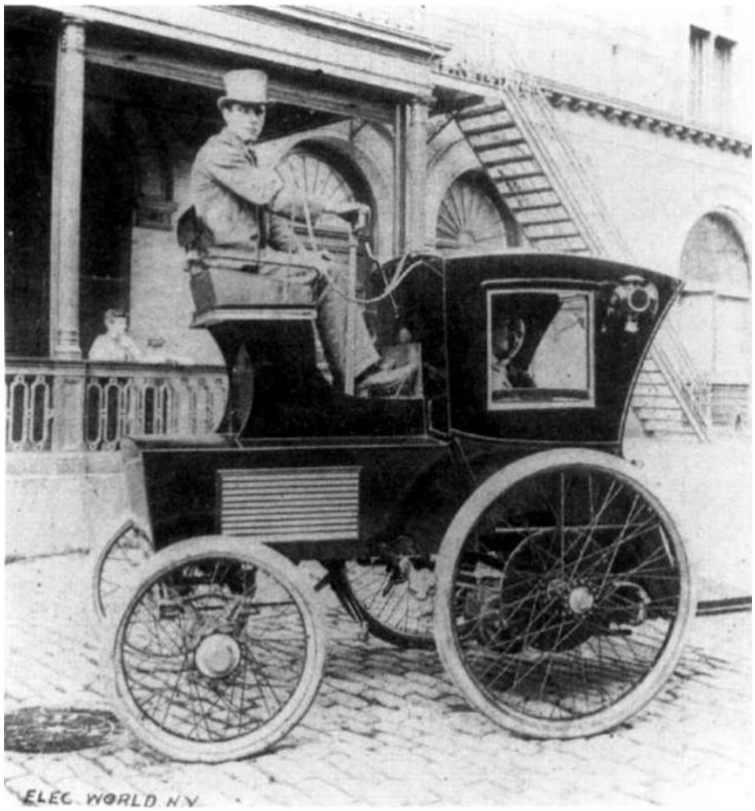
The new owners followed the philosophy of Salom and Morris, thus providing cabs which were usually available on call, rather than driving around the streets waiting for customers.

[26] David A Kirsch, "*The Electric Vehicle and the Burden of History"* (New Brunswick, N.J.: Rutgers University Press, 2000): 36-37

In March 1897 the operation of the newly acquired Electric Carriage and Wagon Company (ECWC) started and six months later Rice incorporated the Electric Vehicle Company (EVC) in New Jersey.[27]

The cabs were either parked near sites of interests like for example hotels or private residences or stayed in garages ready to come when an order was placed.

The total fleet was composed of twelve vehicles, which was accompanied by stations supplying twenty sets of battery, ready for the exchange when needed. Furthermore, there was an entire team supporting the vehicles, since the technology was still very new. There were technicians supervising the batteries as well as the vehicle itself, like for example a starter and a washer.[28]



Electric hansom cab produced by the ECWC, 1897, Electric Motor Cab Service in New York City, Electrical World, August 14th, 1897[29]

[27] "TO RUN ELECTRIC CABS.; a Public Service of Horseless Carriages Promised.," *The New York Times*, March 7, 1897, sec. Archives, https://www.nytimes.com/1897/03/07/archives/to-run-electric-cabs-a-public-service-of-horseless-carriages.html.

[28] David A Kirsch, "*The Electric Vehicle and the Burden of History*" (New Brunswick, N.J.: Rutgers University Press, 2000):38-39

[29] David A Kirsch, "*The Electric Vehicle and the Burden of History* "(New Brunswick, N.J.: Rutgers University Press, 2000):40

Later that year, Isaac Rice, announced that the fleet would expand, adding one hundred more cabs.[30] Such optimism was not fulfilled and in 1898 the additional cabs were just eight, making the total fleet achieve the number of twenty.

After almost 4 months in service, the cabs averaged eleven miles per day and a total of passengers carried of 4,765. Furthermore, the number of accidents or delays was 40, around one every 360 miles, which considering the inexperience of drivers and the difficulties a new technology could carry, is remarkable. This is a perfect example showing the general reliability of the EV. The results were satisfactory, said the company in an interview in the Horseless Age magazine.[31]

Since the company was privately owned, it was not forced to disclose any financial documents, so there are not many records to look through in order to understand whether or not the business model was profitable and sustainable. Nonetheless, from the paper written by Kirsch and Mom "Visions of Transportation: The EVC and the Transition from Service- to Product-Based Mobility", it is possible to note that in 1899 there were around forty-five operating cabs, running on average twenty-seven miles, 40% of which were not paid since they were the journey made back to the garages. Nonetheless, it seems the company was able to generate a surplus, even though thin.

The expansion Rice promised was extremely difficult to achieve. First of all, it needed a large sum initial capital in order to scale operations. Moreover, the EVC preferred not to vertically integrate processes but instead kept purchasing different components from different suppliers.

Car components were made by different makers, so there was not a single contract with a specific shop, thus making it very hard to achieve standardization and economies of scale, which could have driven down the costs. This lack of standardization stemmed from the fact that car production was considered a skilled and almost artisanal process and mass production was probably not even considered.[32]

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[30] Kirsch, D. A. and Mom, G. P. A. (2002) "Visions of Transportation: The EVC and the Transition from Service- to Product-Based Mobility," *Business History Review*. Cambridge University Press, 76(1), pp. 75–110. doi: 10.2307/4127752.

[31] Work of the Electric Hansom in New York, Horseless Age, August 1897

[32] David A Kirsch, "*The Electric Vehicle and the Burden of History*" (New Brunswick, N.J.: Rutgers University Press, 2000): 38

Moreover, a common tactic to prevail over competitors was simply to acquire their facilities, causing and extra outlay of capital.

All these factors prevented EVC to become a mass manufacturer of cars.

Of course, during the years the cab faced many improvements and updates. For example, in order to increase profitability and margins, the new versions of the electric cab used by EVC underwent some important changes and updates.

First of all, it was the pneumatic tires and wheels. Unlike previous versions, the new versions had wheels of identical size, but the pneumatics were wider. This was necessary because the narrower tires frequently failed on New York City roads, which were not in the best conditions.

Moreover, the battery compartment was made bigger and redesigned in order to make space for larger batteries but also to help with the ventilation of fumes and to isolate corrosive acid from leaking to components, which was a very important issue.

Public response to the electric cab was mixed.

Critics did not perceive any difference from the hansom cab: the service offered, the fees paid as well as the design of the cab were the same as horse-driven hansoms.

Probably the strategy was to show as little difference as possible and introduce the horseless carriage as smoothly as possible, in order to increase acceptance.

Others even believed that such a carriage would not have a future and it was just a fad. "… in its present form it gives the occupant a hopeless sensation of being perpetually shot through a chute, with the pleasing possibility of being utilized as a battering ram in a collision with a car or a runaway team".[33]

Still others did appreciate this new transport system, especially during the winter season. Typically, temperatures would have been prohibitive for traditional horse-drawn carriages. On the other hand, the electric wagon, rode around the streets of Boston full of snow and mud. This was possible thanks to pneumatic tires bounded with chains or rope, in order to prevent any possible slipping.[34]

Also, more and more hotels started to request an electric transportation for their customers, as it was seen as a new fashionable way of moving.

[33] A Chappie and a Horseman Try the New Horseless Carriage, The Horseless Age, March 1897

[34] Snow and Mud Pictures, The Horseless Age, December 1898

In 1899, the EVC announced its expansion placing order for two hundred more cabs. More specifically:

"…twenty-five of ordinary coupe pattern, seventy-five hansom cabs, fifty full extension broughams seating four persons each and fifty three-quarter extension broughams accommodating three persons each and last two being new styles of vehicles"[35].

As it is possible to see, there was not a standardized cab, but instead EVC decided to have multiple cabs suitable for different situations and needs.

In spring of 1899, EVC, along with its assets and the Motor Carriage Division of the Pope Manufacturing Company, created a massive holding company controlled by William C. Whitney, a New Yorker who controlled major shares of the horse-car franchises in Manhattan, the Metropolitan Street Railway (MSR). The Columbia and Electric Vehicle Company was then founded, with the intent to supply electric vehicles to other companies working in the nearby metropolis, in exchange for twenty percent of capital stock and two and half percent of gross revenues.

The vehicles would have been produced in Pope's manufacturers' stations in Hartford, Connecticut, and the batteries would have been bought directly from the Electric Storage Battery Company twenty percent above cost.

Some months after, the operating branch of the EVC in New York, was taken over and renamed the New York Electric Vehicle Transportation Company. Similar entities, in total seventeen, were created in other regions of the US, like for example the New England Electric Vehicle Transportation Company in Boston or the Illinois Electric Vehicle Transportation Company in Chicago.[36]

In the meantime, in Europe, the electric cab industry showed some signs of weakness.

In August 1899, the Automobile Club of France published its experiments with new types of batteries. The results showed that of the twenty-three testes, many did short circuit.

[35] More Electric Cabs for New York, The Horseless Age, February 1899

[36] Kirsch, D. A. and Mom, G. P. A. (2002) "Visions of Transportation: The EVC and the Transition from Service- to Product-Based Mobility," *Business History Review*. Cambridge University Press, 76(1), pp. 75–110. doi: 10.2307/4127752.

Electric Vehicle Companies for Every State and Territory, The Horseless Age, May 24th, 1899

More specifically, four did four times, two did three times, one did twice, and another did once.[37]

Such outcomes arrived in the U.S., and sparked some criticism among car enthusiasts, which saw the first difficulties in the development of the technology.

Magazines like The Horseless Age, started to take a more critical stance toward electric vehicle, highlighting its limitations.

"No modern invention has enlisted so large and expenditure of time and money with so little result as the electric storage battery. Fortunes have been wasted in fruitless efforts to overcome by some mechanical means the inherent weaknesses of the storage cell".[38]

Batteries had the big inconvenience of the weight. A heavier battery is a more powerful one, but at the end total weight of the vehicle increases. This often offset the benefit of such a battery because of the power required to carry a heavier vehicle. Moreover, a heavier battery is more susceptible to the vibrations that occur while driving, which could ultimately affect its efficiency.

On the other hand, a lighter battery will have lower lifespan and capacity, thus increasing the costs of maintenance and replacing it more frequently.

The cost of an EV was another big obstacle, especially for private consumption, so that only big companies, like EVC had enough capital to sustain such expenses.

Finally, one of the objections that was more often moved against electric carriages was the milage. "This objection is of little import in certain classes of urban service, where the distances covered are not over ten or twelve miles, but where the distance exceeds the latter figure, the electric vehicle can hardly be counted on for reliable and continuous service.", argued the writer in the Horseless Age magazine. Such limitation prevented the EV to spread country-wide in commercial uses, especially because cities became larger and larger, thus requiring higher mileage.

Gasoline, kerosene or steam vehicles were more suitable for longer distances, since they generated more power and are cheaper to buy and maintain.

The niche that was more suitable for it was the luxury uses. The simplicity of use, control and aesthetic features rendered it perfect for rich men and ladies.

[37] Automobile Club's Storage Battery Tests, The Horseless Age, August 1899

[38] Electric Vehicle and their Limitations, The Horseless Age, September 1899

After such problems, the industry started to suffer.

First, The Illinois Electric Vehicle Transportation Company was closed, then it was the turn of the subsidiary in Chicago. As it is possible to read from the Electric World and Engineer magazine, the local cab company was restricted by heavy costs of operation, especially due to the cost of maintenance of the rubber tires, damaged by bad conditions of the streets. Furthermore, the tariffs charged were relatively low, so that costs could not be recuperated with income coming from operations.[39]

The New England Electrical Vehicle & Transportation company was dissolved as well on April 29th, 1901. Boston and any other similar cities were simply too large, thus unsuitable for the relatively limited mile range the EV could offer.

In 1901, the New York Electric Vehicle Transportation Company was reincorporated as the New York Transportation Company and continued its business.[40]

Thanks to the compact dimension of Manhattan, cabs did not need to travel as much as other locations. This allowed the branch to experience a growth and even better profits.[41] Moreover, many rich New Yorkers enjoyed leasing EV monthly or even for a season, so the place turned out to be favorable for the company.

In early October, an important strike among cab drivers hit the company, resulting in big losses and destruction of cabs.[42] The troubles were not finished: a fire deeply damaged the central station at the beginning of 1907 and a financial crisis hit the whole country, jeopardizing the operations of the company.

Richard W. Meade, who became general manager of the surviving company, the New York Transportation Company in 1904, imported ICE cabs from overseas.[43] In fact, at the time, Europe was more advanced in the manufacturing of such vehicles, when compared with the US, even though this lead was short-lived. In 1909, almost half of the one thousand eight hundred taxicabs running in New York was produced domestically showing that US manufacturers managed to learn from their European counterparts.[44]

[39] Automobiles in Chicago, Electrical World and Engineer, March 16th, 1901
[40] New York Transportation, Electrical World, December 28th, 1901
[41] New York Transportation, Electrical World and Engineer, April 18th, 1903
[42] Motor Cab Drivers' Strike, Motor Wagon, December 1906
[43] Taxicab Development in New York City, The Horseless Age, May 13th, 1908
[44] The Taxicab Business in New York City, The Horseless Age, July 21st, 1909

Meade understood a very valuable lesson, which previous top management did not grasp: the importance of a standardized fleet. “with the exception of good management, there is probably no factor of greater importance in contributing to successful taxicab operation than a standardized equipment”, also “in the repair shops the difficulties of operating a diversified equipment become acute”.[45] Since ICE technology was still new, the standardization process allowed mechanists to specialize on a specific type of machine and thus reduced maintenance costs.

Furthermore, the gasoline cabs imported had no frills and were not luxury, thus enabling to perform activities in the most economical way possible.

In 1910, following the words above cited, decided to start a process of standardization using DeDion-Bouton gasoline vehicles and start closing down the electric cab service. This decision was not driven by an absolute technological superiority, but it was more linked to the need for a standardized vehicle and to the flexibility ICE allowed. In fact, it allowed both city driving and field touring without the fear of the battery failing before finding a charging station. Since ICE vehicles were lighter, due to the lack of battery, they were easier to control so that, fewer damages and accidents happened and thus they were cheaper to maintain overall. From that moment on, the EV’s popularity declined more and more, until ICE technology became dominant.

Company’s main branch in New York City continued its operations until 1912, the year in which the heir to the EVC declared bankruptcy.

1.3 – The beginning of the ICE era

After the fall of the EV, ICE technology started developing more and more, thus getting increasing traction as well as its share of the automobile market.

During the first decade of the 20th century, the automobile underwent many important improvements. Such advancements, allowed the vehicle to become central to the life of many Americans, increasing every year its popularity.

[45] Influence of Standardization on Taxicab Operation, The Horseless Age, July 27th, 1910

Automobile shows, associations, races and fairs got more and more well-known and spread across the country. Shows were held in Los Angeles, Buffalo, Pittsburgh, New York, Chicago and many other cities.[46]

These were great opportunity for people to get to know self-propelled carriages, but also for manufacturers, since they could make partnerships and alliances.

From the turn of the century, American producers started to take a divergent path, compared to the European counterparts. They started designing automobiles for the American market, powered by four, six and sometimes even eight-cylinder engines and changing the place of the steering wheel from the right to the left side of the car.

In 1912 an extremely important improvement was added to the gasoline car: the electric starter.[47] Before, the hand cranking starting system represented a big disadvantage, common to all ICE cars. Injuries and sometimes even casualties were not uncommon since the crank handle would often kick back and hurt drivers.

In 1903, David Dunbar Buick founded the Buick Motor Company, whose control later passed to an industrialist, William Crapo Durant, a year later.[48]

Eventually, Durant managed to bring the company to success, becoming one of the Big Four together with Ford, Reo (company of R. E. Olds) and Maxwell-Briscoe.

Durant readily showed his entrepreneurial skills as he formed General Motors company in 1908, merging together Buick, Cadillac, Oldsmobile, Pontiac and other smaller manufacturers.[49]

The main problem with the GM holding was that it was merely an agglomeration of different entities who sometimes even competed with each other.

Moreover, Buick, who was the best-performing brand under the GM umbrella, often provided profits that Durant would then redistribute to the other companies that often operated at a loss, in order to keep them running.

Durant's skills resided in sales as finance, not in management and in 1910 Wall Street helped him with a loan of $12,000,000. That same year, he was laid off.

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[46] The Horseless Age, October 25th, 1905
The Buffalo Show, The Horseless Age, March 15th, 1905

[47] The Cole Standardization Convention, The Horseless Age, July 30th ,1913

[48] New Incorporations, The Horseless Age, June 3rd, 1903

[49] William Crapo Durant, The Horseless Age, November 1st ,1916
The General Motors Company Launched, December 30th, 1908

The acquisitions made by GM, drove the holding to the brink of bankruptcy, but it was saved by James J. Storrow of Lee, Higginson and Company, who became president of the holding. Furthermore, new members were added to the top management team: Charles W. Nash and Walter P. Chrysler (who in the 1920 will build his own automotive company, the Chrysler company).[50] They would then respectively become president of GM in 1912 and president of Buick Motor Car Company. Eventually, the new board managed to enrich the company and make it successful. In 1912, the company produced 43,000 cars in total.[51]

As mentioned above in the previous sections, roads conditions were not satisfactory and represented a big obstacle in the development of the automotive industry. Asphalt and concrete were not used yet, so that the best material used was either gravel or asphalt. Most of the roads at that time were simply made of dirt, which became impractical with bad weather.

The call for safer roads took on a national significance when the affordable and mass-produced Model T gave rise to an astronomical growth in automobile ownership.

During the first decade of the 1900, Good Roads organizations sprung up all over the nation.

The federal Road Aid Act of 1916 was fundamental in order to overcome financial and legal issues. This law allowed the federal government to help states upgrade their road networks, mostly in order to foster farm-to-market contact.[52]

In 1921, the federal government passed the Federal highway Act of 1921, providing $75 million of funds to the states for highway building.

There are a variety of reasons why, in comparison to Europe, the motor car expanded so quickly in the United States. To begin with, early in our modern era, mass

[50] New Officers for General Motors, The Horseless Age, November 30th, 1910
For James J. Storrow of Lee: General Motors Bond Issue Placed – New Directors Elected, The Horseless Age, November 16th, 1910

[51] General Motors Co. Made 43,000 Cars in 1912, The Horseless Age, August 28th, 1912

[52] Richard F. Weingroff, "Public Roads - Federal Aid Road Act of 1916: Building the Foundation , Summer 1996 -," www.fhwa.dot.gov, 1996, https://www.fhwa.dot.gov/publications/publicroads/96summer/p96su2.cfm.

manufacturing of standardized goods was already well known and used in other industries.

Standardization of goods mainly necessitate of a surplus of natural resources for low raw material prices, a higher per capita income, more egalitarian income distribution, as well as the mechanization of manufacturing processes. These characteristics were inherent in the United States, unlike Europe.

Furthermore, the absence of any tariff barriers between states facilitated sales over a large geographic region. As a result, the European model of small-scale, individualized car manufacturing had little chance of being a hallmark of the American automobile industry.

Olds Motor was the first to successfully design a low-priced car, creating a curved-dash buggy, making it the leading company in the country. The results were outstanding, and sales increased each year. Production in 1901 was 600 cars, which increased to 5000 in 1904. The buggy still was not a car for the masses unfortunately, because it was too light, small and not powerful enough to be an all-purpose family car, nonetheless the results achieved by Olds are remarkable for the time.

The company achieve such goal by carefully controlling the whole supply chain, division of labor and elimination of any delays. Such principles would later be fundamental for Henry Ford's success.

In 1903 Henry Ford tried to become an established automaker by founding his third company, the Ford Motor Company. It started producing car models identified by capital letters, like the Model A, B, C, F etcetera.

In 1908 the Ford Motor Company unveiled its Model T at a price of $850. Since then, the company was able to reduce the price of the car year by year.

Henry Ford wanted to design a car directed to the mass market, a product that could perform well in every situation. It was primarily a touring car with the body of a turnabout and had four-cylinder engine.

Moreover, it was engineered to be durable, easy to drive, control and repair so that owners themselves could do maintenance work. From those starting pillars, Ford and his team, found a way to make it as cheap as possible.

At that time, mass production was still not employed, and cars were still built in small batches of various models. Henry Ford even said: "The way to make automobiles is to make one automobile like another automobile, to make them all alike, to make them come from the factory just alike-just like one pin is like another pin when it comes from a pin factory".[53]

The car was so successful that the year later, Ford gave up all the other models to focus just on the so called, Tin Lizzie.

The Model T represented the perfect example of standardization; simple, small, strong, containing only the minimum number of parts, and for these reasons, durable.

Success was also possible thanks to the Ford Highland Park plant, inaugurated in January 1910.[54] Mass production techniques pioneered at Highland Park, especially the moving-belt assembly line in 1913-14, helped make mass automobile ownership a reality.

The most critical demands put on the assembly line worker were to adhere to the machine's speed, be punctual, and be able to tolerate the monotony of repetitive tasks for long periods of time.

Selling great number of cars was needed in order for the assembly line to be successful, James S. Couzens' contribution should not be ignored. Couzens ran Ford Motor Company's corporate affairs and carefully chose a specific set of dealers, over 7,000 in 1913, who went out and marketed Model Ts. It is possible to say that Couzens created the conditions for the Model T to prosper and actually created a market for it.

It is remarkable that each year, sales increased, and price dropped.

For example, in 1909, the price rose to $950, but still sales increased more than 100% in sales, from 5986 sold in 1908 to 12292 in 1909. In 1916, the price dropped to $360, and sales rose steeply to 577036.[55]

From 1915, automobile registrations skyrocketed, especially thanks to the Model T. Total vehicle registrations in 1915 were 2,309,670. Just five year later, they were 8,225,860.

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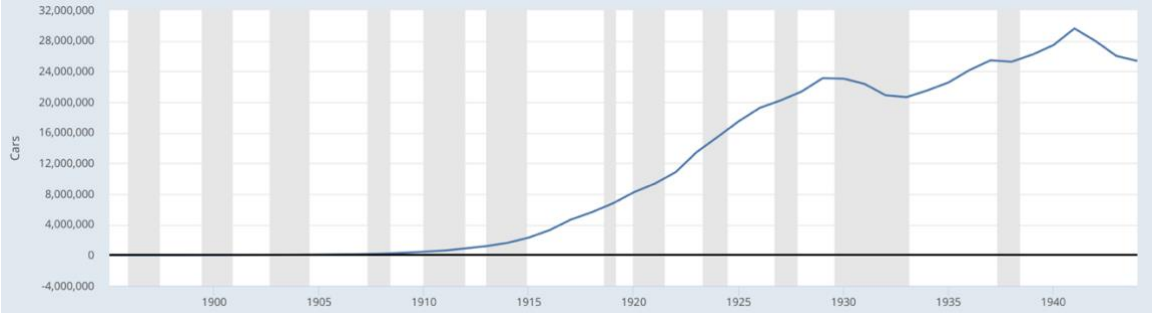
[53] John B. Rae, "*The American Automobile : A Brief History.*" (Chicago & London: Univ. Of Chicago Press, 1967): 59

[54] Ford Opening New Plant, The Horseless Age, October 5th, 1910

[55] John B. Rae, "*The American Automobile : A Brief History.*" (Chicago & London: Univ. Of Chicago Press, 1967): 61

Tin Lizzie had the low-priced field (below $600) all to itself, becoming the best-selling car of the time.

The number of automobiles produced in the United States more than tripled between 1914 and 1917, from 573,000 to nearly 1,900,000.



Automobile Registrations from 1895 to 1944[56]

As the automobile industry needed ever-increasing supplies and components for the engines, frames, and other metal fixtures of the vehicles, the steel industry and machine tool makers prospered. A battery, headlights, interior upholstery, and paint were all needed in addition to these essentials.

Ad companies, print and broadcast newspapers, and ad agencies all made money from nationwide car ad campaigns. Automobile servicing and repair became a big industry. The petroleum industry, which sold gasoline for the ever-increasing number of vehicles, was one of the biggest winners of all.

In 1914, Henry Ford instituted the five-dollar, eight-hour day for workers who had worked for him for six months and provided adequate service, recognizing that mass production necessitated mass consumption and that labor was more than a commodity. It was an extreme increase in wage, since the great majority of those employees' wage was about $2.34 per nine hours.[57]

[56] National Bureau of Economic Research, "Automobile Registrations, Passenger Cars, Total for United States," FRED, Federal Reserve Bank of St. Louis, January 1, 1895, https://fred.stlouisfed.org/series/A01108USA258NNBR.

[57] Daniel M. G. Raff, "Wage Determination Theory and the Five-Dollar Day at Ford," *The Journal of Economic History* 48, no. 2 (1988): 387- 393

This announcement also brought international attention to Ford, as well as causing concern among many business leaders. Thousands of job seekers descended on Detroit, around the Highland Park plant soon after the new policy was implemented.

Profit-sharing plans were not only implemented in the U.S., but also in Europe, especially in Tafford Park in Manchester, England.[58]

Higher efficiency, which represented a twenty to thirty percent increase, meant that cars were produced at a much higher rate than expected. This, on the other hand, had the effect that many men were to be laid off. 2000 workmen left the company in the summer of 1914[59].

The idea behind such increase in wages and welfare was not only generosity, but mostly economic driven. His aim was to reduce the high turnover of employees, increase efficiency, retain the best workers.

The organization was having some issues with employee retention. In the calendar year 1913, the company's employee turnover rate was 370 percent, and it hit 412 percent in a 12-month period.

Year	Average Force	Number Leaving	Turnover rate (%)
1913	13623	50448	370
1914	12115	6508	54
1915	18028	2931	16
1916	32888	7512	23

Effects of the increase in wages and reduction of work hours[60]

Moreover, absenteeism was drastically reduced. Before the adoption of the profit-sharing scheme, daily absence was about 10.5 percent, while in 1914 it was reduced to 0.4 percent.[61]

[58] Ford Extends his Profit-Sharing Plan to England, The Horseless Age, April 22nd, 1914
[59] Ford Declares Profit-Sharing Plan a Success, The Horseless Age, June 24th, 1914
[60] Sumner H. Slichter, "*Implications of the Shorter Hour Movement*," *Proceedings of the Academy of Political Science* 30, no. 3 (1971): 89–100, https://doi.org/10.2307/1173287
[61] Boris Emmet, "*Bureau of labor statistics profit sharing in the united states*", (December 1916), https://fraser.stlouisfed.org/files/docs/publications/bls/bls_0208_1917.pdf.

Since the increased wages' costs were offset by increase in production and sales, it is clear that it was a rather successful move from Ford's part.

Ford controlled half of the car industry in the United States at the end of World War I. GM, despite having two of the best-selling models in Buick and Chevrolet, only had a quarter of the market share, with the rest split among a slew of other manufacturers.

The assembly line had far-reaching implications. The Model T became a familiar sight around the world thanks to Ford's subsidiaries in every major country, despite the fact that the car was heavy and strong by European standards.

In terms of manufacturing methods, there was no competition from abroad. The assembly line did not appear in European car production until after World War I.

In 1914 the First World War broke out and three years later the U.S. joined the conflict. This was the first time that cars and self-propelling carriages were used in a conflict, mainly for the movements of troops or supplies and ambulance services.

Domestic automotive market remained mostly unaffected by the conflict, especially because it was fought in Europe and the fact that for the United States, the conflict only lasted one year. Manufacturers kept their car production but also helped with military production. They were asked to automate gun production, design aircraft engines, build warships, and so on, in addition to providing staff cars, armored vehicles, and supply trucks.

The War Industries Board (WIB) was established in July, 1917, as an agency to coordinate procurement of supplies needed for war, set production quotas, and allocate raw materials (primarily coal, rubber, and steel). This was mainly due to shortages of raw materials which were of strategic importance for the army.

A month later, on August 6, 1917, the National Automobile Chamber of Commerce met in Detroit and voluntarily agreed to slash passenger car production by half starting August 1, 1918.[62]

At the end of the war, horses and electric vehicles represented an extremely small market, while ICE technology became more and more widespread. The war simply

[62] The Whole Automobile Industry Back of the Government, December 15th, 1917, The Horseless Age

accelerated the process of technological selection, since EVs were not able to satisfy completely the needs of their customers.
For the first time at the National Automobile Show in 1914, there was not a single electric or steam model on display.

Moreover, after that period, the industry faced some important changes. Unlike in the early years, new companies faced a tough time trying to break into the market.
The difficulties faced by newcomers were so great that they were unsurmountable.
Companies needed not only large investment in manufacturing facilities, but also a complex and widespread distributor network, and even if these were established, consumers were becoming increasingly hesitant to buy unknown brands. So, even if some did attempt to break into the market during the 1920's none of the managed to stay and compete with other established brands.
The most significant shift occurred at the top, when General Motors dethroned Ford as the industry's leader.
As the years went by, the industry started to resemble more and more an oligopoly, formed generally speaking by Ford, GM and Chrysler.
The benefits of scale spread to marketing as well as manufacturing, and by the 1920s, sale had supplanted production as the industry's main issue.
Selling became too important in the eyes of manufacturers, thus taking control of this activity was vital. They were also able to spend larger amount of capital in advertising in mass media, something that smaller dealers could not afford.
It became evident that in order to stay in business in this industry, size mattered almost more than anything else.

1.4 – The establishment of ICE

After the war, the dominance of ICE vehicles over other technologies became extremely evident, leaving steam and electric with negligeable market shares.
A very important figure in the automotive industry of the first few decades of the 20th century is Alfred Sloan. At a very young age, he showed his managerial capabilities and became president of Hyatt Roller Bearing Company at the age of 24.

When William Durant regained control of GM in 1916, and succeeded to Charles W. Nash, he initiated a series of mergers and acquisitions, which were later incorporated into a new entity: United Motors. [63] One of the companies that he did acquire was Hyatt Roller Bearing. As part of the payment, Sloan, required both cash and stocks of United Motors, turning him into president of the corporation.[64]

In 1918, Durant merged GM with United Motors and Sloan became vice president of the former. Due to a series of troubles and financial failures, Durant was laid off in 1920.

Three years later, Sloan became president of the company, which was on the brink of bankruptcy, because of Durant's poor managerial decisions and the economic recession of 1920-1921.

During those years, the automotive market experienced a deep crisis, new cars sales declined, just like prices. In order to fight back against the recession, Sloan and Pierre Du Pont, who previously purchased large number of stocks of GM, reorganized the company and assembled a new team of managers. An early version of the so called "multidivisional structure" was created, in order to sustain the coordination requirements. Under Sloan's new direction, GM developed new marketing practices that reshaped the whole industry.

GM was able to recognize the end of an era and the beginning of a new one. During the first few decades of the 20th century, Ford almost saturated the market with the Model T, a standardized car which was sold only in black paint, since it was the color that dried the fastest. Ford also relied on just one model, which did not really change since its introduction, as he felt that the only thing people needed was basic transportation. This was true at the very beginnings of the industry, but as time passed, consumer tastes changed, meaning that they wanted something more.

On the other hand, Sloan made sure that GM could offer a car for every price level, from low-priced entry to truly luxury. Sloan recognized the importance of differentiation, "the car for every purse and purpose".

[63] Durant Succeeds Nash as GM Head, The Horseless Age, June 15th, 1916

[64] Parts and Accessory Concerns Merge, The Horseless Age, June 1st, 1916

Year	Chrysler	Ford	GM
1911	N/A	40	35
1917	N/A	741	196
1925	134	1495	746
1929	375	1436	1482
1933	499	326	652
1937	996	837	1637

Market share in thousands of units of the American automobile market[65]

From the table above, it is possible to see that from 1929, Ford was not the leader of the automotive industry anymore, but GM was.

Every September, a set of new GM cars would make their debut, initiating the so called "planned-obsolescence". The company also made effective use of its products' strong status hierarchy. Customers could start their automotive careers with Chevrolets, but as their financial fortunes grew, they might upgrade to an Oldsmobile, a Buick, or even a Cadillac.

This strategy required high level of commitment from everyone, coordination and great managerial skills, but in the end, it was one of the factors of success for GM.

Furthermore, dealers had to be prepared each year with a new model to illustrate to customers.

While Ford built cars that could last forever, GM focused on giving customers each year a reason to buy the new model, making the previous obsolete.

Ford's company was too structured and centralized to bring a new model to the market with such frequency. What at the beginning was a strength, was now a weakness, impeding him to keep up with the changes in the market.

The crisis hit dealerships as well. Since Sloan recognized their importance and the need to keep good relations. He spent a lot of time on the road, not only attending dealer meetings but also visiting individual dealers, often four or five in a day. Furthermore, he offered financing for new dealers as well as loans for established ones.

[65] McCraw, Thomas K., and Rowena Olegario. "*Henry Ford, Alfred Sloan, and the Three Phases of Marketing TN*." Harvard Business School Teaching Note 797-037, August 1996. (Revised January 1998.): 284

As a result, the General Motors distribution organization was enhanced by an improved coordination and mutual aid between the company and its distributors.

On the other hand, Henry Ford reacted very differently to such situation and exploited them. He forced dealers to purchase 90,000 new cars cash, even though the demand could not match such supply. In this way, Ford was able to overcome the 1920-21 recession with enough capital.

GM focused also on advertising, something that Ford did not di directly and was totally in control of dealerships. In 1923, GM became the biggest magazine advertiser. This allowed the company to portray the image they desired, shaping people's views and opinions about the company.

In 1927, seeing sales declining, Ford decided to stop producing the Model T and presented to the public the new Model A. Even though the model was new, the whole business model and methods of production did not change, it was still based on standardization and extreme control of the production process.

Five years later, Ford decided it was time to adapt to the current industry trends so that the company converted to the annual model changes and introduced new branches at different price points in order to compete with GM.

Chrysler was another important manufacturer that managed to emerge and become part of the so called "Big Three".

It was founded in 1925, by Walter Chrysler, former president of the Buick Motor Company. The company did not have enough financial resources to exploit economies of scale and enter the market in the low-price range, so it had to take another route.

When the Dodge Brothers Manufacturing Company was placed on the market in 1918, the issue was solved. After John and Horace Dodge passed away because of the influenza outbreak that followed World War I, their heirs chose to exit the car market. Dodge was absorbed by Chrysler, thus acquiring the manufacturing plant, all the facilities, an established place in the medium-priced market and a strong dealer network.

With such resources, Chrysler was able to launch the Plymouth in 1928, a move that was ideally timed to capitalize on Henry Ford's temporary absence from the mass market.

During these first 30-40 years, the automobile changed dramatically. In 1919, the average new passenger vehicle was a closed car, and unlike previous years, it was fueled by gasoline, EV and steam engines were almost nonexistent. Radios and heaters were becoming more popular, and engines were mostly six cylinders, with a growing trend toward eights. The vehicle's center of gravity was lowered. With this move, the cars could make even harder turns without the risk of turning over.

It was no longer needed to build a car to was able to drive over hazards and poorly maintained dirt roads, because roads were improving more and more.

Clearly, the automobile introduced significant societal changes, and some of these were becoming apparent as car ownership became more prevalent in the 1920s.

Cars allowed people to reach destination with such an ease that was never experienced before. Sunday drivers were becoming increasingly popular. They were essentially people who rode down the highway, in no hurry because they weren't going anywhere in particular and the aim of the ride, was the ride itself.

Long-distance journey started to be more and more common, also thanks to the development of good highways and streets, even though it should be noted that such net was often focused on the north-east part of the country.

With long-distance highway traffic, service infrastructure, economic and social change followed. Filling stations, garages, restaurants and other hospitality-based activities inevitably sprung up everywhere there was a fair amount of car traffic.

Car ownership became an integral part of the life of almost all citizens across different social and income levels.

Congestion and parking issues arose as the amount of motor vehicle traffic on city streets increased. This was especially because roads were not able to develop at the same pace as cars were produced and bought. Also, it is also true that at the time, cities' design was still based on horse-drawn carriages, so that there was a misalignment between cities' growth rates, increasing use of cars and poor street development and management.

Of course, the advent of the car was not embraced positively by everyone. Some residents shared fear that people were wasting their Sundays going around places, instead of going to church. Also, some viewed the car as potentially harming family life Others feared that crime rates may rise since having a car gave the option to flee the

crime scene much more rapidly. Moreover, the rate of highway fatalities skyrocketed. Safety devices like seat belt, which now is considered normal, were not a thing, drivers often drove recklessly, without respecting driving laws and signals, that were not often employed. In fact, there were no warning signs, traffic police, driver's education was still lacking, street lighting was poor, as well as many others that we all now consider normality.

In 1910, 3580 deaths caused from car accidents were recorder. Twenty years later, the number was 31204.[66]

Public transport was another sector that changed a lot in these decades. As cities' boundaries grew more and more, the need of buses that could go even outside the city center increased.

Unfortunately for the public transportation in 1923, almost half of the people entering and exiting the central business district did so in automobiles, a rate that by 1931 had risen to 62 percent.

Public transport ridership rose significantly after World War II, but only for a brief period. This was mainly due to rationing of fuel and rubber, as well as a halt on car production. However, the boom in demand was not accompanied by adequate and efficient supply. Passengers in Detroit and other industrial areas crammed into overcrowded transit buses, causing unpleasant riding conditions and even racial tensions.

Following the war, the longer-term pattern of dropping numbers resumed. In the early postwar period, various transportation corporations faced financial collapse, leading to municipal ownership. In other smaller cities, public transportation stopped completely. The rise of automobile-dependent suburbs, increased car ownership, as well as huge investments in road constructions represent big obstacles for the public transit system.

[66] FHWA, "MOTOR VEHICLE TRAFFIC FATALITIES, 1900 -2007" https://www.fhwa.dot.gov/policyinformation/statistics/2007/pdf/fi200.pdf.

When the Great Depression occurred, the automobile industry was hit hard. Sales of new vehicles dropped by 75% from 1929 to 1932, resulting in a combined loss of $191 million for car firms in 1932.[67]

The luxury market almost vanished. On the other hand, the lower-priced category rose from 40% of sales in 1929 to 80% in 1933 and stayed at 60% during the recovery and beyond.

Such crisis accelerated the process toward the formation of an actual oligopoly in the industry, because such period of financial trouble hit smaller companies the hardest

Big players in the industry, on the other hand were hit but managed to keep their place. For example, GM started to cut costs by quickly scaling back production in its middle-market and high-end products and laying-off workers. It also offered great discounts to customers by dropping prices on expensive cars. Just like at the beginning of Sloan's era, GM was able to listen to the market and act accordingly. By moving production from high-end brands to the more mass market, namely the brand Chevrolet, GM actively established itself in the low-priced car market.

The 1929 crisis was also the period in which Chrysler became a giant in the industry. During that period, it cut costs rapidly, laid off employees, reduced administrative expenses and dramatically improved efficiency. Moreover, it pushed in advertising and marketing support for the Plymouth, its discount brand, knowing that profits in a serious recession were more likely to come from a budget car.

Ford was in the midst of a decline and the crisis did not help. The highly centralized company was too inflexible to respond to changes. This caused the fall from to third most important auto manufacturer. Of course, it survived the Great Depression, but it took years to recoup some of the losses it incurred during those years.

The years of the Great Depression left many unemployed and those who managed to keep their position saw their wages deeply reduced.

Labor unrest and unionization were very common, especially in the automobile industry.

[67] David Rhodes and Daniel Stelter, "*How Automakers Accelerated out of the Great Depression*," Italy - IT, January 8, 2021, https://www.bcg.com/it-it/publications/2010/growth-automakers-accelerated-out-great-depression.

Reaching unionization was a long journey. Corporate resistance, rivalries among different unions and the inability to categorize auto workers were the main obstacles.
Those workers, due to their extreme specialization in few tasks could not be neither considered craftsmen, nor unskilled manual laborer. They were actually skilled, but at the same time they were not true artisans, as they did not follow the whole production process.
In order to remedy, the American Federation of Labor (AFL), set up a network of local unions, under its general guidance, which could be joined by whomever did not find a fitting place in the other unions.
Strikes and general labor unrest were extremely common, and they often required the intervention of the National Guard. In 1937 some turmoil stopped, since both GM and Chrysler accepted the United Automobile Workers as a bargaining agent. Finally, Ford too had to negotiate.

With the election of Franklin D. Roosevelt, the New Deal was passed. It consisted in a series of program to foster economic growth in order to return to pre-crisis level. The Work Project Administration (WPA) coordinated the efforts.
One of the projects contained was an extensive road-building plan. More specifically, construction or improvements of highways and streets, which received the most part of the funds, airports, public facilities and many others. Many were farm-to-market roads, which increased their opportunity to sell goods, but also it was a possibility to rural citizens to take advantage of the opportunities of the city. About 572,000 miles of rural roads were constructed during an 8-year period. In order to increase street safety, guardrails and guard walls were built as well.[68]
When WWII broke out in Europe, automobile manufacturers kept their business usual. As it became evident that the U.S. was about to enter the war, car manufacturers helped by shifting part of the civil production to military equipment, like for example jeeps, tanks, or airplane engines. This changed required some time to adjust to such new products, and knowledge and know-how had to be tailored to specific requirements.

[68] Final report of the WPA Program, Library of Congress, 1947

In June 1940, Chrysler was contacted for tank production, which started in September. Even though Chrysler remained the most important car manufacturer producing tanks, the U.S. government reached out to others as well.

Ford on the other hand, was occupied working on aircraft engines for the Royal Air Force. The task will then evolve and embrace not only engines, but also other parts of aircrafts.

As the Japanese bombarded Pearl Harbor, the automotive industry faced important restrictions. This was because the USA was about to enter the war and now, resources like rubber, oil, steel and other became of national security importance. In 1942, car production was suspended in order to save steel and other essential resources for wartime purposes. The U.S. used to import rubber heavily, but when the Japanese started occupying exporting countries like Malaya, supplies of the material started to be scarcer and scarcer. Rubber was an integral aspect of keeping American civilian life running smoothly. In fact, it took around 250,000 tons of crude rubber to sustain the country's 27,000,000 private cars going for a year during peacetime.

However, figures from the fall of 1942 showed, the US would face a 211,000-ton crude rubber shortfall by the beginning of 1944 due to military requirements.

Bus-based public transportation services were also reliant on rubble to run, and many rapid transit systems had only changed their streetcar lines to bus lines at the outbreak of World War II. As a result, from the beginnings of the United States' military participation in World War II, rubber shortages were a huge military concern with far-reaching ramifications for civilian transportation as well.

In May 1942, in an effort to save rubber and oil, the government established a nationwide speed limit of sixty-five km per hour, which was later decreased. Fuel rationing was introduced six months later, which at the peak, allowed for around 7 liters each week, to which some other could be added depending on necessities.

During the four years of war, Americans greatly limited personal travel, shared wherever possible, walked and bicycled more, and used rail transportation more often. During that time, fuel use for private and commercial usage dropped by 32%.[69]

[69] Flamm and Bradley, "*Putting the Brakes on 'Non-Essential'* Travel: 1940s Wartime Mobility, Prosperity, and the US Office of Defense. - Free Online Library," www.thefreelibrary.com, 2006

The Office War Information (OWI), which was responsible for US's war propaganda, deeply stressed the need to car share, portraying it as patriotic. It also went so far as to portray the good man as a driver, weakening public transportation. The OWI aimed to discourage drivers from using public transportation, since it carried 53 percent more passengers on average during the war than in 1941 and it had insufficient equipment to handle such considerable increase in ridership rates. The OWI claimed in a 1943 press release that a man who takes public transportation when he is able to use his own vehicle is doing his country a disservice.[70]

Moreover, in cities like Detroit which were centers for war production and attracted many workers, especially black and white migrants, public transportation grew more crowded, and African Americans made up a larger number of passengers. At the time, racial tensions were common and such issue was exacerbated by the war. Some letters were sent to the Mayor of Detroit, Mr. Jeffries, basically stating that white folks were not comfortable sitting with beside Afro-American citizens. One example was from a white 59-year-old lady living in Detroit: "One gets in a [street]car- a coloured man or coloured woman in every seat. […] We 'd rather stand then sit with them, not only we folk but plenty more. I have lived in Detroit 38 years in my home 34 and the last few years we have seen this sort of thing grown worse and worse. […] Folk that have their own car don't have to contend with this sort of thing ".[71]

Wartime events further increased the racial divisions, making public transportation for black people and private transportation for whites.

Unsurprisingly, after WWII, millions of Americans abandoned public transportation in favour of cars as their main mode of transportation. The period of unnecessary speeding gave way to an era of gradual reduction in public transport use and an increase in auto-centric urban planning. General increase in wealth led to more people purchasing cars, moreover the urban sprawl accompanied this trend and was helped by the spread of vehicles. Moreover, public funding for the public transport sector became scarcer and

[70] Sarah Frohardt-Lane, "*Promoting a Culture of Driving: Rationing, Car Sharing, and Propaganda in World War II*," *Journal of American Studies* 46, no. 2 (2012): 337–55

[71] Frohardt-Lane K. Sarah, "*Race, Public Transit, and Automobility in World War II Detroit*," Illinois Digital Environment for Access to Learning and Scholarship, May 25, 2011: 1

scarcer, with a detrimental effect on efficiency. After the war, ridership rates began a general negative trend.

During WWII, car production fell dramatically as manufacturers almost completely switched their production to war-related products. For this reason, they needed time to return to pre-war production levels.

Even though quotas were lifted, material shortages and labor unrest restricted the feasible amount of production. Since economies of scale could not be reached in such small quantities, prices had to be higher than before. In order to constrain the growth of inflation, President Truman established price limits for goods. For example, the maximum price Ford could charge was $780, even though production costs were well above that.

In 1947, the price control ended, and production was able to increase, but still companies did not return to quantities achieved before the war. Prices of car could reach even double the amount in the late 40's.

Labor unrest and strikes were another problem car manufacturers and the administration had to face. This was due to wages not rising in conjunction with general pries. Turbulences became very common, so that so that companies had to negotiate salary increases and other benefits.

Agreements were fostered by the fact that car makers were on the verge to achieve once again economies of scale, and any delay caused by labor strikes could impede such target.

In 1949 total car output reached to more than 5 million, surpassing the previous record of 1929. The year later it was 8 million.

Changes in the car engines as well as design were introduced in the last couple decades. Most cars in the 1950s had an eight-cylinder engine rated at about 100 horsepower. They had smoother lines, longer and with a lower center of gravity, had sealed-beam headlights, and heaters and radios were starting to become a standard.

In 1948, Cadillac introduced a feature which became iconic in the decade: the tail fin. It was embraced by almost every car manufacturer and each tried to make the car with the longest fins.

Moreover, this was the true era of customization. The customer could choose the accessories, body styles, colors (for exterior and interior) and engines. The competition shifted from price to technical features like style, comfort and safety. Car manufacturers simply did not want to engage in any type of price war, which would be detrimental for all players involved.

With years passing, the industry did resemble more than ever an oligopoly, in which historical independent car makers were struggling to keep up with leaders, and many did not make it.

After that the US started to develop an effective national network of roads designed primarily to promote the movement of high-speed vehicle traffic. Although there was one major issue, money. Ordinary resources allocated were not enough, so there was the need to look somewhere else. One idea was the institution of tollroads, which allowed to raise revenue without increasing taxes or the price of gas.

Of course, the revenue did vary depending on the traffic, but still even for those areas with limited traffic, revenues were enough to break even. Tollroads accomplished the goal of providing improved and widespread highways without dramatically increasing taxes to citizens.

When WWII concluded, there were 25,500,000 private vehicle registrations in the United States. Since then, car sales skyrocketed. Ten years after, the number multiplied. By 1960, the great majority of American families had at least one vehicle.

The car solved many problems, starting with the previous isolation of rural cities, improved education since children could attend school much more easily, as well as public health, since medical care in remote areas was much more feasible.

Farms benefited too, since new market opportunities were open.

In the mid to end of the 1950's cars became bigger and bigger, with more and more frills. This increased the cost to produced them, and of course, the price too. Sales of small overseas cars was still low, about one percent of the total domestic market in 1955, but the imports increased each year, especially with the 1957-58 recession.

In 1950, U.S. imports of new passenger automobiles were 21,287. Ten years after, the figure arrived at 444,666.

Year	U.S. Imports
1947	1,453
1950	21,287
1955	57,115
1960	444,622
1965	563,673
1970	2,013,420
1975	2,074,653

New Passenger automobile, Quantity in units, U.S. International Trade Commission[72]

The domestic market was not protected with any kind of tariffs or quotas because many of the big companies had overseas interests. GM and Ford both had been European producers. For example, Vauxhall, the British auto maker company, was acquired in 1925 by General Motors. In June 1957, GM announced that it intended to import the automobiles made by the overseas subsidiaries.

Chrysler was directly involved in the French SIMCA company and in the British Rootes. It started imports from 1958.

The trend of the more compact, European-style cars did not last very long, because at the end, Americans' preference was still toward bigger, faster and louder cars. Moreover, such vehicles' was not low enough to become such a decisive factor.

Nonetheless, a new segment, although smaller, was created in the automobile market, showing that it was not a single monolith with homogenous tastes, but actually people required diversity.

During the 60's and the 70's another major issues became relevant: the pollution and its effects of the environment, which sparked consumers' interest over less consuming vehicles.

Some initial evidence of the correlation between car usage and pollution already came in the 40's and even the 20's, even though the public opinion took the issue seriously especially in the beginning of the 70's.

[72] U.S. International Trade Commission, "*Consumption, suggested retail prices, and trade balances with selected countries for motor vehicles, 1964-81*" (December 1982), https://www.usitc.gov/publications/332/pub1329.pdf.

The pioneering work of chemistry researcher A.J. A.J.Haägen-Smit was fundamental. He showed that photochemical reaction between hydrocarbons produced by cars and nitrogen oxides, produced pollutants that reduce visibility and can cause eye and nose irritation. This experiment was conducted in the Los Angeles area, but it could be easily extended in other major U.S. cities.[73]

Paul Ackerman, former chairman of the American Manufacturers Association (AMA), admitted in 1959 that tires and other rubber products were deteriorating in the Los Angeles area, causing air pollution. Moreover, hydrocarbon compounds produced by cars were found to react with oxides of nitrogen, resulting in smog.[74]

Despite the fact that the signs of a potential pollution crisis were evident, the industry did not conduct research to establish mitigation measures that would prevent photochemical smog from being more serious.

It was estimated in 1966 that motor vehicle emissions contributed 86 million tons of the 146 million tons of contaminants released into the atmosphere, and by the mid-1960s, there was widespread agreement that this was a major social issue and a potential public hazard.[75]

Various federal, state, and municipal agencies became more interested in the topic, and during the 1950s and 1960s. Stricter air quality rules and emissions requirements for the cars were the result, like for example the Clean Air Act passed in California, which became the state with the most stringent anti-pollution regulations.

Even though there was strong initial resistance from car manufacturers, as they aimed to maintain the status quo and keep exploiting economies of scale, ultimately, they had to adapt to such requirements and produce less polluting cars

[73] Ralph Nader, *Unsafe at Any Speed : The Designed-in Dangers of the American Automobile* (New York: Bantam Books, 1973): 118-121

[74] Ralph Nader, *Unsafe at Any Speed : The Designed-in Dangers of the American Automobile* (New York: Bantam Books, 1973): 118-127

[75] James J. Flink, "Three Stages of American Automobile Consciousness," *American Quarterly* 24, no. 4 (October 1972): 451, https://doi.org/10.2307/2711684

1.5 – Initial signs of inadequacy

The beginning of the 70's represents a stage in which the current model of fully-owned internal combustion engine cars shows some initial weaknesses. Safety and environmental impacts became evident to everyone, moreover two oil crises hit the world, showing the dangers of dependence of the Western countries on OPEC oil.

In the 70's, following President Nixon's request to financially help Israel in the Yom Kippur War, the OPEC instituted an oil embargo on the United States. The price of fuel rose four-fold in 1974, passing from $2.90 a barrel to $11.65.[76]

Domestic production was unable to meet American demand, moreover, non-OPEC oil producers had declined their own oil exports, with the ultimate result of increasing OPEC countries' importance. The USA found itself more dependent on foreign oil than ever before. In order to save resources, the government implemented again speed limits were and fuel restrictions.

The price of oil had risen dramatically, putting a strain on customers and the economy as a whole. Since the embargo coincided with a dollar depreciation, a global recession seemed to be on the horizon.

Moreover, with such dependence on oil, Americans' preference for cars changed.

Before the crisis, American cars were very powerful and not always fuel-efficient. After the embargo, regulations were made so that cars were able to afford more miles travelled per gallon.

For example, a Chevrolet Impala could not achieve more than fifteen miles per gallon.

The crisis shaped demand for smaller and more efficient cars. Japanese automakers were already established in the American market, but their market share was still relatively small. With the crisis, overseas car manufacturers, began to take a larger portion of the domestic car market, thanks to their superior quality and reliability.

By 1980, the United States had imported 1.8 million Japanese vehicles, accounting for about 20% of all cars sold that year.

[76] Michael Corbett, "*Oil Shock of 1973–74 | Federal Reserve History*," www.federalreservehistory.org, 2013, https://www.federalreservehistory.org/essays/oil-shock-of-1973-74.

In order to respond, the Big Three had to adapt and tap into the smaller and more compact segment. Ford unveiled the Fiesta, Chevrolet presented the Chevelle and Chrysler the Plymouth. Gas mileage became an attribute as important as any other and it was pushed hard in advertisements.

In 1975, Congress passed the first of a series of Corporate Average Fuel Economy (CAFE) laws, establishing fuel utilization standards. CAFE's goal was to reduce energy consumption by improving the fuel efficiency of automobiles and light trucks. More specifically, it mandated car makers to build products that on average, could run 27.5 miles per gallon, by 1985.[77]

By 1980, the landscape completely changed, and Japan became the leading producer of cars, taking over the throne which was American since 1908. Toyota, Nissan and Honda captured more than sixteen percent of American market share. Ten years later, the combined share of the three Japanese automakers, increased to twenty-two percent.

Ford and Chrysler were suffering deep financial crisis and the latter was on the verge of bankruptcy, while on the other hand, GM kept its first place, with forty-six percent of the total domestic market share.

During this period, the debate around EV returned, especially after the oil crisis.

Still, one representative of the EPA thought it was still premature to show off to the public new EVs, since it was a technology that basically did not receive any attention for almost fifty years, so that it was lagging behind ICE performance. If it was shown, the public may take it the wrong way and only focus on the fact that it was still an immature technology that could not compete with cars of the time. It needed more time to develop more powerful.[78]

Even though the failure of the EVC happened more than sixty years prior, the actual reasons for the decline of this technology were still not fully understood.

The debate was still centered around constructing better batteries, instead of seeing it as a part of a different transportation system that needed infrastructure to back it up.

[77] Paul Ingrassia, "*Crash Course : The American Automobile Industry's Road to Bankruptcy and Bailout ... And Beyond*" (New York: Random House, 2011): 64

[78] David A Kirsch, "*The Electric Vehicle and the Burden of History* "(New Brunswick, N.J.: Rutgers University Press, 2000): 204

In this chapter the whole journey of the automobile in the United Sates, from the beginnings to the 1980's, has been analyzed.

It has been highlighted how in the beginning the three main sources of power, gas, electric and steam competed in order to be the dominant, until the former actually became the chosen one. Furthermore, it has been shown the rise and fall of the electric vehicles, with the example of the Electric Vehicle Company, as well as the main causes. It is worthwhile remembering the fact that at the end, gasoline did not prevail because it was considered to be technologically superior, but actually, it is fundamental to consider different factors when analyzing its history.

It has been decomposed the evolution of the of ICE automobiles, how they have changed overtime, both in terms of style, design as well as mechanically. Moreover, it should be noted how external factors facilitated the rise of ICE cars, resulting in a sort of vicious cycle, which is hard to interrupt. For example, as it was discussed above, as cars became cheaper and cheaper, it was not something for the rich only, so that the middle class was able to afford them. Automobile allowed to live even further from the city center, thus the development of the suburbs, which public transportation often was not able to serve properly. In this case, having a car was not an option, but a necessity, thus creating a reinforcing cycle.

Finally, in the last decades, the model of car ownership, especially gasoline-fueled cars, has shown some weaknesses and critics of this model became more and more prominent. Current prediction show that such standard may not be sustainable in the long-term, thus we all may need to find suitable alternatives.

Chapter 2

The growth of the model: ICE and Ownership

In this chapter, it will be discussed how today's automobility paradigm, based on gasoline power and ownership of the car, became the predominant one.

The car structure, according to Sheller and Urry, involves numerous components. More specifically, it is made of businesses each having a role in its economic development, like for example automakers, oil companies, as well as a variety of others designed around it. In order to understand its evolution, it is important to grasp the role of each of them and the relationships among each.

First off, the system, according to Urry, is made up of privately owned 'steel-and-petroleum' cars which first appeared in the last decade of the nineteenth century, and quickly surpassed all of other competing technologies.[79]

As discussed in detail in the chapter above, the path of the automobile was not linear or unidirectional.

Initially, electric vehicles, thanks to the expansion of the EVC and other taxi companies in Europe, seemed to have an edge over other technologies, but this initial lead did not translate into real market dominance in the long run.

It is possible to say that the unrealized project of the EVC was the first big hit for electric technology. Even though the source of failure was not the technology itself, it had many repercussions on the perception people had of the electric power. It was not a simple matter of technical superiority; the reasons were many more, as it will be illustrated in the next pages.

The paradigm of the EV can be seen as composed of different elements, namely: the vehicle, manufacturers, the battery, central stations and the final consumer. Each component needs to provide a positive contribution to the model in order to achieve success. Unfortunately for the EV industry, complete cohesiveness and coordination was never achieved.

Also, what the New York Transportation Company and others were not able to achieve is the integration with other public transport services, like street railway or coaches. For

[79] Urry, J. (2004) '*The 'System' of Automobility'*, *Theory, Culture & Society*, 21(4–5), pp. 27–31. doi: 10.1177/0263276404046059.

example, if there was a gap in transportation between the train station and the city center, no taxi services were available, so that people were simply forced to walk. This was because the great majority concentrated in the central district part of the city, and due to minimal mile range, going beyond may not have been a wise choice.

Also, taxicab transportation was a service that only wealthy people could afford, thus restricting it to a very small niche. All the other social classes preferred walking from place to place or using coaches and railways, which represented cheaper alternatives.

Moreover, there was also issue of standardization.

Charging plugs and battery boxes should have been the same for every EV, but this did not happen. Some used lead-acid while others used iron-nickel batteries, which required different voltages. It was unlikely that all stations had charging facilities at a broad range of voltages, given the high cost of doing so.

EVs also needed standardization in terms of repair. Customers had to feel that they could go freely anywhere without the fear of not finding a repair shop that was able to fix some issues with their own car model.

Speed represented another problem. Every year, car manufacturers aimed to produce faster cars, since it was a feature that salesman found very easy to build their proposition on, as it was a very interesting factor for buyers. Unfortunately, excessive speed greatly impacted energy consumption, as well as tire wear, thus reducing total mileage and increasing the need of related infrastructures and maintenance costs. The appeal of a high-speed vehicle proved to be a determining factor and ICE vehicles were faster than their electric counterparts, thus constituting another reason to buy them instead of EVs.

Finally, the major issue was the mile range. Without a widespread net of battery change or exchange stations, EVs' potential was extremely limited. At peak development, one hundred km was the maximum distance guaranteed, even though lower numbers were much more common. On the other hand, ICE vehicles could offer almost double that amount.

Moreover, it was much easier to develop an extensive system of gas pumps, which required less capital, than battery stations. Charging speed was not fast by any means and providing an exchange option required expensive tools, like for example cranes that could take out the battery, lift the new one and put it back into the car.

Faced with such restriction, developing ICE vehicles seemed much more feasible, cost advantageous and more importantly, scalable, which became the most important feature for the success of the car.

The kind of standardization EV needed was achieved by Henry Ford with his Model T. This is one of the most important turning points in the automobile history.

As seen in the sections above, the Ford Motor Company managed to design a single vehicle that was suitable for different kinds of usages, from touring to city travel. Most importantly, it was able to do so at extremely low prices. The quality, durability and of course, the price, made the Model T the best-selling car for many decades.

Ford's popularity allowed the notion of car ownership to spread. Rather than being a privilege for rich people, every American citizen could buy one.

It is important to highlight the fact that by late 1920s, automaking became the most important industry in the country. Each year, it was responsible for the acquisition of ninety percent of petroleum supplies, eighty percent of rubber, seventy-five percent of glass, and close to twenty percent of steel.

Car-related business greatly prospered. Gas stations, repair shops, accommodations and many others became highly demanded.[80]

As stated above, ICE increasing popularity pushed related economic sectors to innovate and expand. One example is the petroleum industry which completely changed. Prior to 1900, just about a tenth of all petroleum refined was converted into gasoline. This was because, gasoline was widely treated as an unusable waste product and thus discarded. The invention of the gasoline car was helped greatly by a rapid rise in crude oil supply, especially thanks to the discovery of new oil fields as well as improved methods for treating gasoline.

Starting with the Spindletop field in East Texas in 1901, new fields sprung up in rapid succession, raising crude-oil supply.

Across the country, buses started to use internal combustion engines too, and led to the replacement of streetcar lines, which were powered by electricity.

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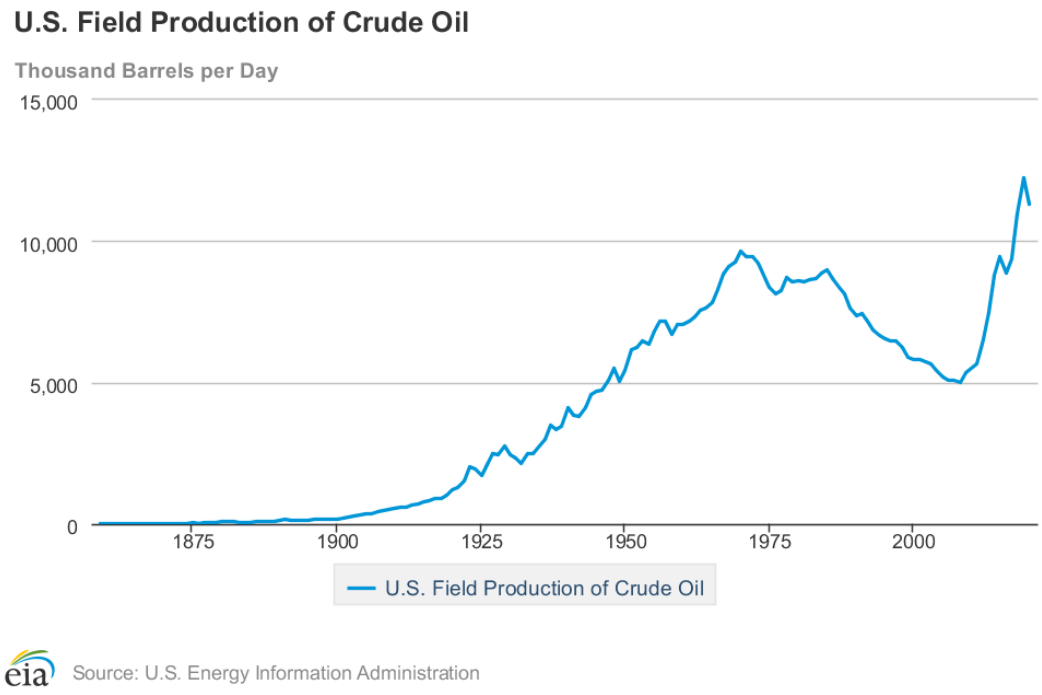
[80] Martin W Sandler, "*Driving around the USA : Automobiles in American Life*" (Oxford ; New York: Oxford University Press, 2003): 35



U.S. field production of crude oil, U.S Energy Information Administration[81]

The choice of ICE, rather than EV or steam, as stated above, was not purely based on technical judgements. The arguments discussed in the previous paragraphs represent the real reasons for the preference.

From such evidence it is clear that Henry Ford provided a product that was affordable and around it, many other businesses flourished, thus creating a virtuous cycle where each element overall strengthened and reinforced the model. Furthermore, culture and the creation of suitable infrastructures simply secured and reinforced the system.

This is a clear case of path dependence: the advantage created by Henry Ford, generated a snowballing effect in which industries simply conformed and embraced such technology by supplying the products needed.

It can be argued that the shift from a service-based system of automobility, in which cabs were the main element, to the current one, based on private ownership of vehicles initiated around the first few decades of the 20th century and with time, became more and more consolidated. A defining factor that favored the shift was the urban sprawl.

[81] U.S. Energy Information Administration, "U.S. Field Production of Crude Oil (Thousand Barrels per Day)," https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=M.

By the mid-century, one-fifth of the population of the United States lived in suburbs.

In the years after the WWII, the U.S. housing market was going through a supply crisis, which started back in the Depression years. In order to solve this problem, the U.S. government decided to provide the necessary stimuli to house creation through the institution of agencies like the Federal Housing Administration (FHA) and the Veterans' Administration (VA).[82]

At the core of the former, there was a policy that minimized costs and risks of owning a home, through long-term and low-interest mortgages. The FHA also offered protection for lenders against losses from mortgages defaults. Thus, if a borrower did default, the agency would pay back the lender the specific amount left. In addition, the FHA provided builders with low-interest construction loans.

The latter, the VA, offered advantageous conditions for home-owning to veterans coming back from war.

These two programs combined resulted in a boom in construction, bringing the price of houses down, in order to meet actual demand.

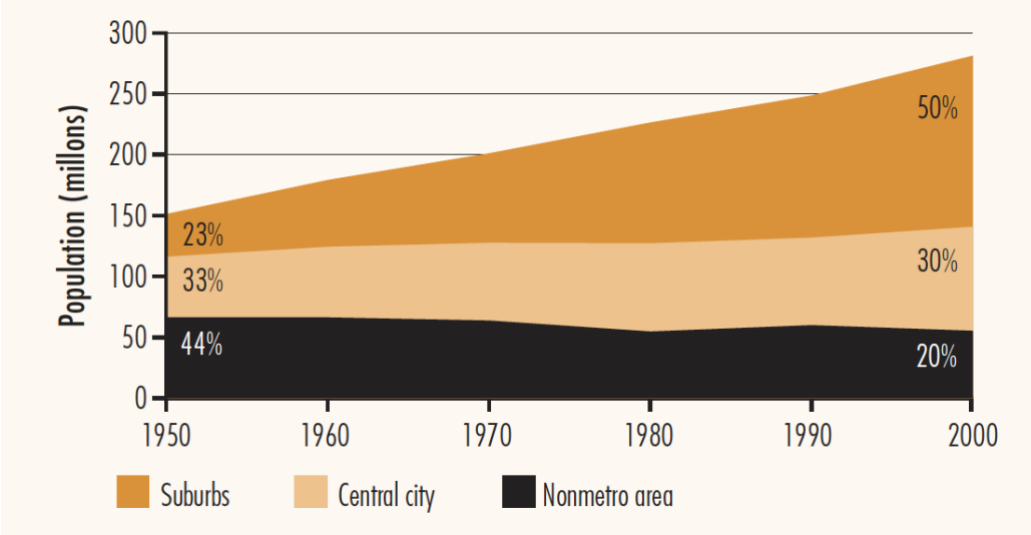
Moreover, new real estate investment trusts, banks and pension funds invested heavily on the housing market, introducing additional resources for its development.

One great example of the boom of construction is Levittown. Levitt and Sons, a construction company, took the work of Henry Ford as example and tried to embrace the same philosophy of assembly line production, but in the housing market. In 1947 the company purchased an area in Long Island, New York and built 17,000 houses in less than a decade. Thanks to the cost-saving measures, Levitt was able to sell its houses for less than $8,000 each.[83]

Cities like Levittown sprung up all over the country, contributing to the so called "urban sprawl", where more and more people decided to escape the city and live in the suburbs.

[82] Julia Kagan, "Federal Housing Administration (FHA)," Investopedia, 2019, https://www.investopedia.com/terms/f/federal-housing-administration.asp.

[83] Colin Marshall, "Levittown, the Prototypical American Suburb – a History of Cities in 50 Buildings, Day 25," the Guardian (The Guardian, April 28, 2015), https://www.theguardian.com/cities/2015/apr/28/levittown-america-prototypical-suburb-history-cities.

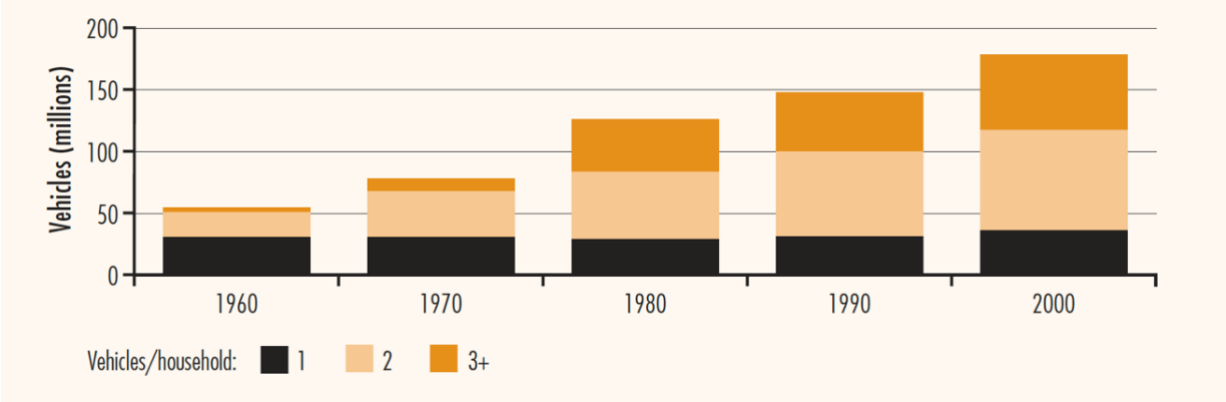


Population distribution in the United States[84]

The car was another one of the main causes that helped the trend toward suburbanization, as these two concepts go hand in hand and can even be seen as complementary. In order to get around in the suburbs, people needed and most of the time still need a car.

The economic boom allowed an abundance of cars in the market, to the extent that by the end of 1970s, the citizen to car ratio was about 2:1, and some households had more than one car. In the typical family, both parents were likely to work in the city, or at least outside their neighborhood, thus necessitating more than a single car. Furthermore, as children grew older, they often needed a car too, in order to get to school or have some social interaction with their peers.

[84] Alan E. Pisarski, "Commuting in America 2013: The third national report on commuting patterns and trends", (2006): 23-38



Vehicle ownership per households in the United States

This method of transportation was facilitated by the great involvement of the government in projects of highway-building, which became prevalent especially after WWII with the Interstate highway Act in 1956.

Thanks to highways, commuting to work became possible and many decided to escape chaotic city centers and stay in quieter areas. Higher inner-city crime rates, lower-quality schools, and general fiscal pressure within the central business district could all have contributed to the desire to leave the city.

Suburbanization did not only affect the housing market, but there was also an economic decentralization during the mid-20th century. Before that, finance establishments, banking offices, city halls and retail shops were all in the central part of the city. Moreover, factories and distribution centers were mostly located around train stations. The growth of motorization enabled easier and cheaper movement of goods, as well as people. Cheaper rents, lower land costs, more available space and the fact that they were not tied to train stations, pushed businesses to relocate outside of urban areas.

Commercial planners, corporate offices, major supermarkets, as well as corporate headquarters and offices began to relocate to the suburbs by the early 1950s.

The growth of fringed areas was accompanied and sustained by the increasing number of supermarkets, shops and service alike that sprawled around during this period.

However, such expansion had a detrimental effect on public transit.

Since cities' borders grew so much, buses and metros had to offer an increased level of service, supplying larger areas. Government funding was not adequate and so the efficiency of the service plummeted to the point that, after World War Two, the great

majority of American metropolis lost their once very efficient public transportation network.

The city of Los Angeles is an excellent example. The Pacific Electric Railway Company built an extensive tram network that served the city center, some interurban areas, and suburban communities such as Long Beach. Owing to increased population growth, the public service was no longer able to provide an effective service due to high congestion. Pacific Electric Railway raised their fees in order to recuperate some of the losses and increase the quality of the service. Unfortunately, the company, between 1912 and 1941 run a deficit each year, thus contributing to the decline of the public service in the Californian city.[85]

Moreover, newly built cities were simply impossible to serve with public transit, as they were designed with the car in mind, not public transport.

After all, it makes much more economical sense to serve an area with high population density, rather than one which has less inhabitants who also live far away from each other.

The design of the city played a very important role in the decline of the public transport and its replacement with the car. Older cities like New York or Chicago, were built following the classic grid plan, which allowed people to easily walk from neighborhoods to neighborhoods or to the nearest streetcar stop. For this reason, cities alike, still have a more efficient and more used public transport services. Major European cities are evident examples of this.

Since the 30's, new towns and cities did not follow that scheme any longer. Instead, the new design, called "cul-de-sacs" or "dead-end" was chose. It is characterized by low density of houses, which surround a circular drive and have low connectivity between one another. This design was developed originally because it was supposed to be safer, in terms of accidents, speeding and because city developers had the automobile in mind, as the main mode of transportation. They did not have to worry about building houses near streetcar stops or other public transport services, because the car was experiencing

[85] Mees, P. (2009). "Transport for Suburbia: Beyond the Automobile Age" (1st ed.). Routledge. 18-25 https://doi.org/10.4324/9781849774659

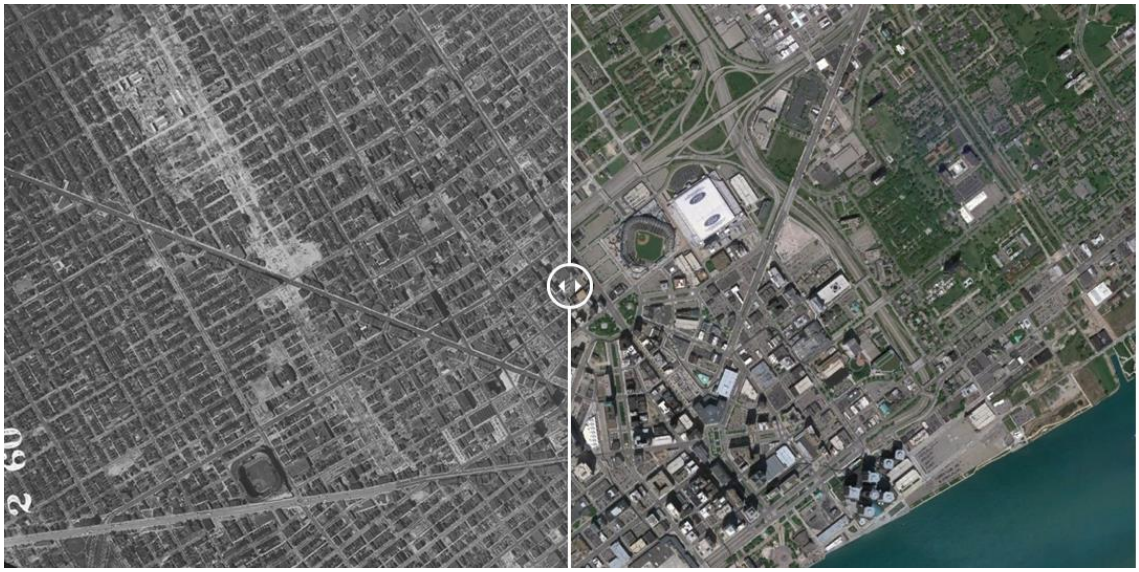
a boom in demand, and it was more and more common for households to have at least one.

U.S. cities' design from 1900 to 1950[86]

The change in urban landscape was also caused by vast improvements and investments in the highway net. As previously mentioned, in the first half of the century, most American cities were built following the grid scheme, which allowed to move easily either on foot or public transit.

The picture presented below represents the city of Detroit, Michigan, before the 50's (left-hand sight) and in 2010 (right-hand sight). It is possible to see that wide parts of the city were starting to be cleared for highway and large-scale redevelopments in 1951. By 2010, the downtown area is fully encircled by highways. With this new scheme, it became almost impossible to walk around and increasingly difficult for the public transport to serve its citizens.

[86] Emily Badger, "Debunking the Cul-De-Sac," *Bloomberg.com*, September 19, 2011, https://www.bloomberg.com/news/articles/2011-09-19/the-problem-with-cul-de-sac-design.



Picture of the city of Detroit, Michigan in the 1951 (left) and 2010 (right).[87]

Reasons for decline ridership of public transport in the United States are not only derived from poor city design, general tendency towards living in the suburbs and widespread car ownership. Ralph Buehler and John Pucher conducted an extensive review of the public transport, with a specific focus on the comparison between the American public transport system and Germany's.

It is important to highlight the fact that such a comparison enables the reader to really isolate the variables responsible for the decline use of public transport in the USA. This is because the two countries are very similar: they are both federal democracies, with significant public intervention in the economy, they are two of the wealthiest countries in the world, enabling them to have extensive highway systems high rates of car ownerships (which is a factor important to each culture) as well as potential great spending power on public transport and finally, especially for Germany, the automotive sector is of critical importance in each national economy.

The fact that the European country has made better progress than the American counterpart should not give the impression that German mobility is based on a totally different paradigm. The comparison is presented in order to understand why personal mobility is more dominant in the American continent than in Europe. Even though

[87] Shane Hampton, "60 Years of Urban Change: Midwest," The Institute for Quality Communities, December 12, 2014, http://iqc.ou.edu/2014/12/12/60yrsmidwest/

Germany offers a more efficient public transport to its citizens, in the European country, the vast majority of personal trips are still made with the car.

The authors found that even though both countries experienced an increased move of people towards outskirt areas of the cities but decline in public transport ridership in the United States was far greater.

It is important to note that in their review, the authors found that out of fourteen countries (all European), the USA ranked last in term of annual public transport trips per capita. Moreover, it is not only Europe that does a better job in this field, but Canada too has a more intensive use of the public transport, further showing that the problem is exacerbated in the USA.

After car use restriction were lifted post-WWII, total ridership dropped from 16.4 billion to 4.7 billion. Since then, per capita trips kept decreasing until the 70's, where the values stayed constant around 2-3 billion up to 2010.

Some of the reasons for this decline have been described above (car ownership, car-oriented suburbs), but it is also important to note that by 1970, a good portion of the service in the United States was poorly managed and coordination between one another was lacking.

Moreover, in most American cities, cars or private buses are used to go to school. Public transport is very rarely used. On the other hand, German students take public transportation much more often, walk or ride bikes. This lack of public transportation awareness among American schoolchildren could prevent them from using it later in life.

In both nations, public transportation accounts for a greater proportion of trips in urbanized cities, major metropolitan areas, and areas with elevated population densities. Thus, it makes only sense that in low-density areas, like suburbs, public transport is almost non-existent.

As stated above, the American public transport system is not as efficient and coordinated as its German counterpart.

In the USA, almost all firms operating in the sector are publicly owned and passenger revenues cover only 33% of the costs, so that the rest has to come from Government's subsidies. Such influx of money deviates such resources from being invested in renovations and improvements. On the other hand, German' passenger revenues cover

up to 77% of the costs. This means that German fares can be lower, since the central government needs to fund a smaller portion of the costs.

Naturally, increased efficiency and reduced prices attract more passengers, making it more appealing.

The German public transport service is far more extensive, there is a high degree of coordination among different services, in terms of routes and schedules so that waiting time is minimized, bus and train stations are often placed close to each other, so that transfer is facilitated, and it also offers discounts for annual or monthly tickets, as well as special prices for students. Such system is hardly found in the U.S.

Furthermore, German cities are designed in such a way that waling or cycling is encouraged, which can ultimately facilitate public transport use. On the other hand, American cities are made to be fully travelled with the use of a car, making cycling often dangerous, since there are no special lanes.

In the USA, the purchase of a car is often (indirectly) encouraged through lower taxes on gasoline (EU excises on gasoline are $1.62 per gallon, while USA charges $0.18 per gallon), sales taxes on new the purchase of new cars and heavy subsidization of roads.[88]

In Germany, there are much more limits on automobile usage, like for example zones where it is prohibited to drive, and parking is harder to be found than in the United States. Not only is the number of roads per capita in German cities lower than in American cities, but motorways are also limited to the suburbs of German cities, with only a few exceptions. In contrast, most American cities have vast high-speed highway networks. Finally, most American cities continue to base their renovation plans on increased availability of low-cost or free parking for cars, while German cities have decreased car parking availability and raised its cost.[89]

From the argumentations presented above it is possible to understand how the current system based on private ownership of mostly ICE cars came to be and how it became the chosen mode of transport.

[88] U.S. Energy Information Administration (EIA), "How Much Tax Do We Pay on a Gallon of Gasoline and on a Gallon of Diesel Fuel? – FAQ" , (2016), https://www.eia.gov/tools/faqs/faq.php?id=10&t=10.

[89] U.S. Energy Information Administration (EIA), "How Much Tax Do We Pay on a Gallon of Gasoline and on a Gallon of Diesel Fuel? - FAQ, (2016), https://www.eia.gov/tools/faqs/faq.php?id=10&t=10.

2.2 The growth of the model: Car and Western Culture

Daniel Miller, in his "Driving Societies", tells an interesting story from which it is possible to understand the relationship between cars and drivers. More specifically, the author imagines how aliens would see our society from above. The author suggests that they would probably observe the world as inhabited by strange creatures called cars, which are served by hosts or slaves who walk on legs and spend their whole life serving them, ensuring that they are well-fed and healing them in case of accidents.

Gordon M. Sayre's opinion is that cars are more like a "prosthetic extension of human bodies", instead of a simple tool or object that we as human exploit to achieve specific tasks.[90]

From the story reported above and Sayre's understanding, it is possible to understand how much the car is deeply engrained in today's culture, the strength of bond and how this product shaped our own society.

What started as a product for the wealthy, quickly became accessible even to the lower-income households, spreading all over the United States, and later, Europe. It was fostered by Henry Ford and the mass production, intensive construction of roads and highways as well as the design of cities which reinforced the relationship car-human beings. The automotive industry has now become a backbone sector in the economy of many different countries, from the USA to Germany and having a strong domestic automotive industry, contributed to patriotic proudness.

From Gartman's "Three Ages of the Automobile", it is possible to understand how cars and their perception evolved with time.

At the very beginning, they were a symbol of wealth, due to their high price and design, result of skilled and craft labor process. Such vehicles were often used for recreative purposes and to show off rather than simple transportation tools. As a result, the car in the American culture, became associated with independence and enjoyment, as well as a sign of wealth.

[90] Gordon M. Sayre, "The Humanity of the Car: Automobility, Agency, and Autonomy," *Cultural Critique* 107, no. 1 (2020): 122–47, doi:10.1353/cul.2020.0017

With growing interest from other classes, manufacturers decided to add cheaper alternatives to their catalogues, in order to expand their market, so the Model T and cars alike were produced. The democratization of automobility started, in which more and more people got to enjoy this new technology. Now, the model of car one owned became much more important than actually owning one.

In the late 1920s, the most important American automakers started to sell a wide range of versions that were similar in terms of quality but differed in style and accessories. This created cars for different markets, so that the era of customization started. Such segmentation followed the idea that at the time, having a car was not a luxury. The true luxury was given by the model of car driven. So, Cadillac owners felt somewhat superior to its Chevrolet counterpart, because the former group knew they could afford more than the latter.

Between 1960 and 1970, American automakers doubled their product ranges and dramatically increased the choices for customer, adding different vehicle models, including compacts, subcompacts, intermediate-sized cars, muscle cars, sports cars, and true luxury cars. So, it is possible to see that at the very beginnings, the car itself was a symbol of wealth, but with time, people were able to express their own identity through the plethora of car types available and the importance shifted to the brand or model of car.[91]

The car has always been attached to a sense of freedom, especially for rural communities that were previously isolated.

Unlike public transport, having a car meant being free and independent and deciding when and where to go. It stressed the character of individuality, rather than having to obey to set timetables and schedules of the public transport. So, automobility triggered the need for a level of versatility that it could be achieved only by the car itself.

Being able to move around and to be mobile shape society. As it will be presented in the next sections, under some conditions, having a car is necessary, thus creating a vicious

[91] Gartman, D. (2004) 'Three Ages of the Automobile: The Cultural Logics of The Car', Theory, Culture & Society, 21(4–5), pp. 169–195. doi: 10.1177/0263276404046066

cycle of dependence and acceptance of the car. Moreover, being restricted in terms of mobility can deeply change one's opportunities to have a better life.

For a large portion of the population, the automobile embodied technological advancement, economic growth opportunities, jobs, and accessibility. The automotive system came to be seen as a precondition for moving on and building economic growth, especially after World War II.

As mentioned above, the car is a status symbol. People express themselves through their cars. This means that the utility of driving a car is influenced not just by its functional meaning, but also by symbolic and affective factors. Often, cars are seen as a symbol of personal achievement, in financial terms for example. Being able to afford and buy a nice car is like portraying to everyone else, one's value. Also, buying the first car represents for many young people a great objective, which almost symbolizes the passage to adulthood.

Buying a car is not always strictly a rational decision, but there are many other factors that play a role, and sometimes are even more critical. It is widely known that people choose cars based on aesthetic, personal interests, personal identity and demographic characteristics, such as social class, gender, age, and even political views. Nowadays, choosing an electric vehicle rather than a pick-up truck, is almost a political statement, from which external viewers can infer a lot about driver's characteristics and values.

In the early days of automobility, when the rivalry between ICE and EV was still present, each technology was seen to be more appropriate to a gender rather than the other and it immediately became a mean of social expression. EV were clean, noiseless, easy to drive and control and not so fast. On the other hand, ICE vehicles often left stains of oil, were noisy due to the engine itself and until 1912, when the electric starter replaced the classic crank, they were hard to start and often dangerous. There perceptions played into the gender roles and reinforced them, so that EVs were seen as more suitable for wealthy ladies, while ICE vehicles represented characteristic typically associated with men. Moreover, thanks to its versatility and speed, gasoline cars did tap into adventure-seeking men that wanted to escape the monotony of the city and looked for dangerous activities.

Thanks to the work of Balkmar and Mellström, it is possible to understand that cars and motor vehicles in general, have long been associated with masculinity by associations with wild, indomitable animals, as well as the car's associations with strength, independence and driving enjoyment.[92]

In order to understand better the relationships between cars and drivers, it is necessary to introduce the concept of "Interpretative Flexibility", developed by Trevor Pinch and Wiebe Bijker.[93] It basically states that each relevant social group, which can be seen as a set of people with common characteristics, give a specific meaning to an artifact which depends on their interests. This will in turn shape how the artifact develops, its design and its path. So, it can be stated that the same characteristics of the gasoline car, that were considered as unpleasant (noise, unreliability, dirt, difficult to start) as well as others that were seen as not relevant (possibility to go off-road, speed) were accepted and embraced by men as important features. As previously stated, those attributes were seen as deeply related to the stereotypical idea of a "real man", so for example, speed and adventure became strong selling points and were pushed in the advertisements of cars.

For instance, when Ford decided to build a high-performance sports car, it chose the name "Mustang", a typical horse found in the western part of the United States. It is an evocative symbol of speed, freedom, power as well as excitement for wide open spaces, which appealed most frequently to a male consumer base. Also, Oldsmobile started to advertise its Starfire with the slogan "High adventure starts right here!" and showing a picture of the car riding up a mountain road.

What started as a way of moving around and connecting different cities evolved into a mode to escape the monotony of the city, experience new places and more generally have fun.

[92] Balkmar, D., and Mellström, U. (2018). Masculinity and Autonomous Vehicles. *Transfers* 8, 1, 44-63, available from: https://doi.org/10.3167/TRANS.2018.080105

[93] Trevor J. Pinch and Wiebe E. Bijker, "The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," *Social Studies of Science* 14, no. 3 (1984): 399–441

Chrysler advertisement, June 1959[94]

Furthermore, there is another important concept which helps grasp why the relation between cars and people is so strong. Anthropomorphism relates to the attribution of typical characteristics human to non-living objects. Clouds are a clear example of this phenomenon. People believe that the shape of clouds remind them of other people or animals. In reality, our brains try to almost decode a figure that otherwise would not be understood. Just like with clouds, the same often happens with cars.

Anthropomorphism has the ability to shape our perception towards those same objects. In a 2012 study, Windhager et al. investigated people's eye movements when comparing the front part of cars to human faces. The study discovered that headlights correspond to the eyes, grilles to the nose, and air intakes to the lips. Such connections would eventually become the face of the car, in the observer's eye, thus stimulating the same part of the brain that is fired up during face recognition.[95]

[94] Heon Stevenson, *American Automobile Advertising, 1930-1980 : An Illustrated History* (Jefferson, N.C.: Mcfarland, 2008): 86

[95] Sonja Windhager et al., "'Cars Have Their Own Faces': Cross-Cultural Ratings of Car Shapes in Biological (Stereotypical) Terms," *Evolution and Human Behavior* 33, no. 2 (March 2012): 113–118, https://doi.org/10.1016/j.evolhumbehav.2011.06.003

People tend to look the most at the “eyes”, so the headlights, even if that region covers a relatively small area of the front of the car. From this portion of the car, people can also infer other human characteristics, like maturity, sex and attitudes. [96]

Such studies could partially explain the why some people feel a strong attachment towards automobiles or because some prefer specific models of cars. Probably consumers infer certain characteristics and thus form an abstract idea of that specific car. People feel like cars are like living objects and the type of “car face” could also play a role during the decision of which car to buy and more generally play a part in the image the driver wants other to perceive of him/herself.

Such idea of anthropomorphism can be easily understood in the movie “Cars”. Each vehicle represented show different personalities, traits, attitudes as well as nationality, depending on the type of car, design, model and other characteristics

The car had a major impact also on women’s lives and changed their traditional role of the mother. It allowed them to be more independent and it became a significant tool in the fight for women's suffrage.

Automobiles were the centerpieces of large-scale rallies. The National American Woman Suffrage Association (NAWSA), for example, used this new method of transport to send delegates around the country in 1913 in order to gather signatures for constitutional suffrage amendment. They used an amazing caravan of motorcars to carry the signed petitions to Congress that summer.

In 1916, two NAWSA-sponsored women set out around the country in a yellow Saxon car called the "Golden Flyer" to give lectures, spread books, and encourage women's voting rights.[97]

In Italy, the presence of the car in the artistic fields helped create and spread the interest towards it. For example, the avant-garde movement “Futurismo”, which developed in

[96] Windhager S, Hutzler F, Carbon CC, Oberzaucher E, Schaefer K, Thorstensen T, Leder H, Grammer K. Laying eyes on headlights: eye movements suggest facial features in cars. Coll Antropol. 2010 Sep;34(3):1075-80. PMID: 20977106.

[97] Saige Jedele, “The Automobile and Women’s Suffrage - Blog - the Henry Ford,” www.thehenryford.org, 2020, https://www.thehenryford.org/explore/blog/the-automobile-and-women-s-suffrage

the first decades of the 20th century, was highly inspired by this new technology. The automobile is seen as a symbol of progress which allows the individual to feel free and independent. Filippo Tommaso Marinetti, one of the most important poets of the movement even stated in the manifesto of the Futurismo, that the car is even more beautiful than the Winged Victory statue of Samothrace.

Moreover, the concept of the speed is one of the pivotal ideas of the movement. "We affirm that the beauty of the world has been enriched by a new form of beauty: the beauty of speed".[98]

As a result, the automobile became more than just a mode of transportation; it became a piece of art and the automotive engineer became an artist.

Giacomo Balla, a Futurist painter, in over a hundred paintings, depicted racing cars. They were symbols of modernity and social evolution.

Such artistic interest spread to Europe and the United States as well. Francis Picabia, a French painter, when arrived in New York, was fascinated by the number of vehicles in the streets and there, he started his series of paintings involving cars and their moving parts.[99]

Speed is a very important concept, as it is related to escapism, risk taking and masculinity. Races are the exact place were cars and speed are celebrated. They are extremely popular around the world and they were born in the first years of automobility. Races greatly helped spreading the interest towards vehicles.

Moreover, races introduced rivalries both between manufacturers and even different countries, thus adding to the proudness of citizens.

Nowadays, the main racing competition get a lot of attentions and viewers. For example, on average, each 2020 Formula 1 Grand Prix is seen by more than 80 million people, while the Rally Monte-Carlo, Rally Sweden and Rally Guanajuato Mexico were watched by more than 242 million people in 2019.[100]

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[98] Filippo Tommaso Marinetti, Futurism Manifesto, 1914

[99] Peter Wollen and Joe Kerr, *Autopia : Cars and Culture* (London: Reaktion Books, 2002).

[100] "Formula 1 Announces TV and Digital Audience Figures for 2020 | Formula 1®," www.formula1.com, February 8, 2021, https://www.formula1.com/en/latest/article.formula-1-announces-tv-and-digital-audience-figures-for-2020.3sbRmZm4u5Jf8pagvPoPUQ.html.

Along with races, many organizations and associations sprung up, both in Europe and USA.

With time, many subcultures linked to a specific car model or car category emerged (the same can be said for motorcycles), like for example or Fiat 500, Ford Mustang fan clubs as well as sportscar clubs. Enthusiasts from different parts of the world gather together to drive, show off their cars. All of them take lot of pride in owning, maintaining and driving their own vehicles. Thanks to a material object, very strong bonds and relationships between members are created, creating a sense of identity and community. Even if it does not pertain to the car world per se, Harley Davidson is a great example for this.

Another artistic form where the car has been highly present and has helped shape our perceptions is cinematography. For example, in the saga “Fast and Furious”, cars represent courage, status, importance and style. Also, they are not simple objects to get from point A to point B, but they allow ordinary people to do extraordinary things when behind the steering wheel. Cars are seen as an extension of the male ego too, as they are flashy, loud and each is perfectly tailored and modified in order to represent the identity of the driver. They are the ultimate solution to every problem. Even though this is a recent example, similar cases can be seen throughout the history of movies.

A less recent example, is the Italian movie “Il Sorpasso”, produced in 1962. It tells the story of a journey of two men, whose personalities are completely the opposite. Bruno, the protagonist, greatly represents the Italian feeling for cars, as well as the stereotypes of Italian people driving really fast. Moreover, it shows how much cars became central in the culture of the peninsula, used to show wealth and status.

Road movie is a very important genre in which the main characters leave their home to go on a trip. Road movies often focus on characters' internal struggles and revelations as they experience new realities on their journey. So that the vehicle can be seen as a tool for personal growth, used to rebel against ordinary life and traditional values, as well as a way towards self-discovery.

2.3 The pressures against the current automobility paradigm – Transport poverty

Transport poverty refers to a specific situation in which households are at serious risk of being cut off from other communities or cities because of a lack of adequate transport system, namely railroads, buses, trams, and others. This may result in social and economic isolation, leaving the community in a state of impoverishment.

The current automobility system, analyzed in the previous pages, has created an extremely strong dependency on car usage, which leaves behind those who cannot afford to buy one. So, for many, public transport is the only viable alternative. Nonetheless, in many areas, it is either not efficient or simply nonexistent.

The absence of adequate public transport and its implications will be analyzed in the next pages.

The suburbanization trend did not affect only the middle or higher-income households, but it is a phenomenon that impacted lower-income people as well.

It has been recorder that almost 60% of all impoverished people in the top 100 US metro areas live in the suburbs.[101]

This is not only a phenomenon recorded in the United States though. As Hunter analyses, in England and Wales, the trend is very similar. Suburbs are home to higher-than-average number of single parents, part-time workers, people with disability and pension recipients as well as 58% of those considered to be workless (people unable to work because of illnesses or disability, students and carers).[102]

In France the situation is very analogous. It is estimated that one-third of those living in the "banlieues" are in the "poverty" category. These neighborhoods also, are marked by high rates of poverty, high rates of unemployment and race and ethnic segregation.[103]

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[101] Elizabeth Kneebone and Jane Williams, "New Census Data Underscore Metro Poverty's Persistence in 2012," Brookings, 2013, https://www.brookings.edu/research/new-census-data-underscore-metro-povertys-persistence-in-2012/.

[102] Paul Hunter, Poverty in Suburbia: A Smith institute study into the growth of poverty in the suburbs of England and Eales, The Smith Institute, 2004

[103] Loïc J D Wacquant, *Urban Outcasts : A Comparative Sociology of Advanced Marginality* (Cambridge: Polity Press, 2010): 141-43

Australia suffers from the same problem. High prices for homes, especially in more central areas led lots of low-income households to move in the outskirts of the city where adequate public transport is not present very often.[104]

As illustrated in the chart below, in the period 1990-2014, the percentage of population in a state of poverty, living in American suburbs rose by 96.3%, outpacing the same growth in urban areas.

	Total Poverty Population (in 1,000s)		Percentage Change (1990-2014)		Mean Poverty Rate	
	1990	2014	Poverty Population	Total Population	1990	2014
Urban tracts	9,544	12,741	33.5%	14.4%	18.7%	23.2%
Suburban tracts	8,616	16,909	96.3%	37.2%	8.3%	12.2%
Mature (pre-1970)	4,185	6,509	55.5%	3.3%	9.3%	13.9%
New (post-1970)	4,431	10,400	134.68%	64.7%	7.7%	11.1%

Changes in Poverty between 1990-2014, US Census 1990; American Community Survey 1990-2014[105]

The expansion of the population living in the suburbs is one of the most important factors behind the increase in the number of marginalized people and poverty rates in suburbs. Even if poverty rates stayed constant, suburban population growth would inevitably lead to an increase in the number of poor people living in there.

In 1999, almost 8 million people who lived in poverty stayed in nonmetropolitan areas. Also, there were 11 million citizens having some kind of disability and 7.8 million people

[104] Sefa Awaworyi Churchill and Russell Smyth, "Transport Poverty and Subjective Wellbeing," *Transportation Research Part A: Policy and Practice* 124, no. C (2019): 40–54, https://ideas.repec.org/a/eee/transa/v124y2019icp40-54.html.

[105] Scott W. Allard and Sarah Charnes Paisner, *The Rise of Suburban Poverty*, *Oxford Handbooks Online* (Oxford University Press, 2016):11, DOI: 10.1093/oxfordhb/9780199935307.013.96

were elderly. All these numbers are greater than those in urban or metropolitan areas.[106]

Investments towards requalification of urban centers strengthen this trend, since houses in the city center becomes more and more expensive, so that less wealthy people are forced to move elsewhere.

Another major factor responsible for the growth of the suburbs is related to job opportunities. As highlighted by Garr and Kneebone, since 1990, more and more employers have relocated toward metropolitan fringes.[107]

However, not all suburbs are created equal, nor they offer equal job opportunities.

In recent decades, higher-income suburbs have seen significantly greater employment growth than low-income suburbs.

Low-wage, low-skill job seekers in suburban areas thus face a major commuting burden due to a spatial mismatch between the location of jobs and job seekers.

Furthermore, public transit in the United States is clustered in a few major metropolitan areas, including New York City, Chicago or San Francisco, leaving both smaller areas and suburbs undersupplied.[108]

As stated above, not all suburbs are alike. In his paper "A Typology of U.S. Suburban Places", Mikelbank, describes different kinds of suburbs, from which appear also the "struggling suburbs". The authors describe them as having low housing value, citizens typically have low incomes and low levels of college attainment, single-parent households represent a very high portion of the total and levels of unemployment are higher than elsewhere. These areas are the ones in which demand for public goods, like for example public transport is the highest. Nonetheless, in general, suburbs often lack adequate investments in public transport. Moreover, as described in the previous chapters, many suburbs were not designed to be served by public transport, but on the other hand, they were built to be car dependent.

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[106] Dennis M. Brown et al., "Public Transportation on the Move in Rural America," *Naldc.nal.usda.gov*, (2006): 7.

[107] Elizabeth Kneebone and Emily Garr, "The Suburbanization of Poverty: Trends in Metropolitan America, 2000 to 2008," Brookings, accessed April 24, 2021, https://www.brookings.edu/research/the-suburbanization-of-poverty-trends-in-metropolitan-america-2000-to-2008/.

[108] Buehler R. Promoting Public Transportation: Comparison of Passengers and Policies in Germany and the United States. *Transportation Research Record*. 2009;2110(1):60-68. doi:10.3141/2110-08

This problem hits more disproportionately low-income areas, creating job opportunity disparities, unemployment, underemployment and thus a vicious cycle from which it is hard to escape.

The suburb-to-suburb connections that have become increasingly necessary in the last decades, since jobs kept on decentralizing, are not provided. Instead, in most cities, the transport service focus only on the portion suburb-downtown.[109]

Adding to these problems is the fact that suburban governments often have less resources and expertise to tackle the issues, when compared to their urban counterparts.[110]

On the other end of the spectrum, there are richer suburban areas, labeled as "suburban successes". Here, higher levels of income make transportation not a problem, and cars are the preferred mode of transport. So, the lack of buses, trams or other do not have a very deep impact in such areas.[111]

It has also been analyzed that spatial segregation based on income, deeply impacts the choice of public transportation service a specific person may be able to utilize. In the USA, rail passengers were recorded having the highest income. On the other hand, those using buses were more likely be poorer, often with incomes equal to a third of the national average. This is because rail services mostly connect higher income while buses, most typically serve lower income parts of the city. [112]

Disadvantaged residents thus are forced to travel long distances in slower buses, in order to reach their destinations.

Another category that is affected by lack of adequate transport are elderly people. Once they are no longer eligible to drive, many find themselves with no other ways to move around and thus need to be dependent on relatives even for basic necessities. Even

[109] Why American public transit is so bad | 2020 Election, Vox, 2020

[110] Elizabeth Kneebone, "The Changing Geography of US Poverty," Brookings (Brookings, February 15, 2017), https://www.brookings.edu/testimonies/the-changing-geography-of-us-poverty/.

[111] Brian A. Mikelbank, "A Typology of U.S. Suburban Places," *Housing Policy Debate* 15, no. 4 (January 2004): 940–57, https://doi.org/10.1080/10511482.2004.9521527.

[112] Ralph Buehler and John Pucher, "Demand for Public Transport in Germany and the USA: An Analysis of Rider Characteristics," *Transport Reviews*32, no. 5 (September 2012): 541–67, https://doi.org/10.1080/01441647.2012.707695

though this category is often neglected, around 80% of them live outside urban areas, thus in those places that rely, almost always, on car usage.[113] Most elderly have lived and bought their house during the housing boom post-WWII, examined in the previous section, and many have stayed there throughout the years, so it only makes sense that once they cannot drive any longer, their mobility options diminish drastically, leaving them isolated.

This issue is exacerbated by the fact that western countries are progressively aging older, thus in the next future this problem will become more and more relevant.[114]

Loneliness and social alienation in the elderly are major public health concerns that impact a large number of individuals, putting them at risk for dementia, more specifically they are 50% more likely to develop this condition, as well as others. From an article published by the Centers for Disease Control and Prevention, it is possible to understand that social isolation increases the risk of premature deaths from all causes, the risk of heart disease and stroke, as well as anxiety, depression and suicide.[115]

Of course, there are transport services specifically dedicated to highly vulnerable people, the paratransit. These are services that operate in conjunction with public transit, offering a shuttle to get them to a bus or subway station.

Unfortunately, many do not qualify. People residing within 8km of a bus line are not allowed to use paratransit. Many that qualify must schedule appointments in advance and set aside an entire day for travel, as shuttles usually arrive within two-hour slots.

Moreover, the same issue is often faced by people with disabilities, which in some cases are forced to use buses. In UK, it is estimated that around 40% of people with mobility impairments do not own a private car.[116] Insufficient public transportation may cause social exclusion, may prevent people from accessing to health facilities, job or other shopping and leisure activities. It should also be noted that with inadequate

[113] "50.05 beyond a Report to the Nation on Livable Communities: Creating Environments for Successful Aging Acknowledgments" (2005), https://assets.aarp.org/rgcenter/il/beyond_50_communities.pdf.
[114] US Census Bureau, "An Aging Nation: The Older Population in the United States," Census.gov, May 30, 2017, https://www.census.gov/library/publications/2014/demo/p25-1140.html
[115] CDC, "Loneliness and Social Isolation Linked to Serious Health Conditions," www.cdc.gov, May 26, 2020, https://www.cdc.gov/aging/publications/features/lonely-older-adults.html.
[116] Karen Lucas et al., "Inequalities in Mobility and Access in the UK Transport System Future of Mobility: Evidence Review Foresight, Government Office for Science" (March 2019): 4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/784685/future_of_mobility_access.pdf.

governmental funding, public transports like buses may not afford specific facilities that allow people with disabilities to easily get on and off, thus representing a further obstacle for them.

Most of the case presented pertains to the United States, since it is the wealthiest nation in the world and it has one of the highest rates of car ownership per capita, thus perfectly exemplifying the current automobility model. Moreover, European countries still have a more “centralized” and concentrated than their American or Canadian counterparts, thus it may be argued that problem of suburbanization and its effect on transport poverty is less accentuated. Nonetheless transport poverty is not only an American problem.

In UK, transportation-related social isolation can be explained, at least in part, by an increase in the need to drive, even though still, a quarter of all households do not have access to a car for a number of reasons.

Increasing prosperity has resulted in a sharp increase in the automobile ownership over the last 50 years. Since 1970, the percentage of households with cars has increased from 52% to 74% in 2001, even though there are still many without one.

As a result, society has become largely organized around the automobile. This allowed more out-of-town retail and housing developments, which were less suited to mass transportation. Furthermore, bus fares increased faster than gasoline prices, making public transportation less competitive. This was compounded by lower overall vehicle costs.

Still, there are some people who rely almost solely on walking and buses.

As average distances to work and key facilities became longer, walking became a less viable means of transportation, thus leaving many with only one option left: public transport.

Around the same time, taking the bus seemed less appealing. Around 1985 and 2000, bus fares increased by 30% in real terms, an increase that was not proportionately accompanied by higher wages.

The Social Exclusion Unit drew a report about transport and social exclusion in the UK. The findings are remarkable, showing that lack of an adequate transport system deeply

impact the lives of people who cannot afford a car, in many different aspects of their lives.

It found that two jobseekers out of five see lack of transport as a barrier to get a job, one in four say that transport related costs are prohibitive even for interviews. Transport costs can quickly wipe out any financial gains made from joining or returning to work.

In the field of healthcare, 31% of people without a car face issues when having to go to the hospital and over 1.4 million people have missed medical help because of transport problems. According to estimates, 10% of hospital outpatient visits are delayed due to transportation issues, placing people's health and well-being at risk and costing taxpayers' money.[117]

Overall, good mobility greatly increases the changes to find and keep a job.

Because of transportation issues, 18% of people without a vehicle find it impossible to visit friends and relatives, compared to 8% of car owners. People without vehicles are also twice as likely to have trouble going to recreation centers (9%) and libraries (9%).

Finally, six percent of teen between 16 and 24 turn down education opportunities because of transport issues. Students' mobility choices in higher education are influenced by the geographical position of universities and schools. Even in cities with extensive public transportation networks, commuting from the surrounding area to colleges and universities can be limited to private cars or trains, both of which are costly options for students and lower income families.

It is clear to see that transport issues cut people out of the job market and have detrimental effects on education and training. As a result, they are unable to break free from the loop of social isolation. Communities are then marginalized and unable to attract proper investment as a consequence of the issues.

The problem is also exacerbated by decreasing government support to public transport. Between 2009/2010 and 2013/2014, mileage service has decreased by 22% in urban areas and 24% in rural areas.[118]

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[117]Brand, Christian, Fiona Raje, John Preston, and Margaret Grieco.. "Transport and Access to Health Care : the Potential of New Information Technology. Final Report." Transport Studies Unit, University of Oxford (2004): 10

[118] Social Exclusion Unit, "Making the Connections: Final Report on Transport and Social Exclusion" (February 2003)
https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_policy/---invest/documents/publication/wcms_asist_8210.pdf.

Just like in the USA, the income is a major predictor of the transport service a person may use: lower-income people use buses more than wealthier people, which on the other hand use more frequently trains or cars. This is often due to accessibility and prices, rather than an actual choice of the consumer, as buses are cheaper than the other two methods and more widespread than trains.

In a report conducted by Sustrans, an agency promoting sustainable transport, it is possible to see that 1.5 million people are at high risk of suffering from transport poverty.[119]

Those at most risk are ethnic minorities, young people not in school, unemployed, women and elderly. Owing to a lack of public transportation and a low density of jobs, schooling, recreation, and other opportunities, rural and small urban areas face most often transportation challenges, thus strengthening the already present inequalities.

From the cases presented, it can be better understood why it is important to talk about transport poverty, since it impacts out society in many different ways: it leads to lower job opportunities, increasing the wealth gap between the lower class and the rest, it creates episodes of social isolation, as well as healthcare issues. The people living in the suburbs, who are not wealthy, most of the time are stuck in such a condition especially because of lower mobility options.

2.4 The pressures against the current automobility paradigm – Environmentalism

During the late 60's and early years of the 70's, a new issue took more and more space in the public discourse: pollution and its effects on the environment. As highlighted in the first chapter, early studies already indicated a strong correlation between air pollution and emissions from cars' exhausts, but in the following decades, such concern spread among the population. This resulted in the formation of various environmental

[119] Sustrans, "Locked Out" (2012), https://www.sustrans.org.uk/media/3706/transport-poverty-england-2012.pdf.

groups which achieved legislations contrasting smog and emissions caused by automobiles.

Public opinion polls showed the increasing public concern. According to one poll, only 1% of those surveyed in May 1969 thought that pollution represented a major national concern, but just one year later, that number had risen to 25%.

Due to increasing awareness was also reflected in the number of interest groups that were founded around this period, like Greenpeace and many others.[120]

Moreover, a very important publication gained increasingly more traction. Ralph Nader published "*Unsafe at Any Speed*" in 1965. In his book, the author publicly criticized the automotive industry for producing something that multiple studies deemed as dangerous for the whole population. One of the chapters in the book, directly debate the environmental issue, stating that the problem with pollution was known for quite some time, but automakers did not really pay attention to that. Later the author became a very important figure in the discussion about the matter. Just one year after the publication of his work, the administration created the National highway Traffic Safety Administration, with the aim to improve road safety.

The issue became more and more pressing so that the automotive industry became involved. Kenneth Hahn, a Los Angeles County supervisor, wrote to Henry Ford II, President of Ford Motor Company, in 1953. In the letter, he expressed his worries about air pollution and smog, the contribution of car exhausts and asked whether or not the company had any plans to tackle this problem. The response stated that cars' emissions would dissipate in the atmosphere, with no adverse effects of public health. Even though scientific research supporting cars' exhausts' dangers became more and more prominent, the automotive industry did not feel the need to intervene in any type of way, covering up the dangers.

Hanh wrote a letter to President Lyndon B. Johnson too, where he admitted that the dialogue with car manufacturers had not been fruitful, as "each of the major companies has been given notice and has refused to comply with his request, it seems to me that Congress must pass a mandatory law requiring the industry to assume its responsibility.

[120] Stan Luger, *Corporate Power, American Democracy, and the Automobile Industry.* (Cambridge: Cambridge University Press, 2005): 78

I have found out that you cannot "cooperate" or urge them "voluntarily" to do the job".[121]

The problem of air pollution was significant especially in big cities, like Los Angeles where the number of vehicles riding around was extremely high.

Smog levels were so high that visibility was sometimes impaired, and it was not uncommon that local administrations closed highways in order to avoid possible incidents.

Moreover, it was found that carbon monoxide could be absorbed in the blood stream, resulting in oxygen deficiencies. It became an actual public hazard, with potential damages to society. The California State Health Department established that carbon monoxide in concentrations of 30 parts per million represents an "adverse" amount. Dr. Haagen-Smit, an expert in the field, measured carbon monoxide concentrations of up to 120 parts per million on highways in the Los Angeles area.[122]

New York City was another city hit by this problem and the dangers were deeply felt in 1953 and 1966. Due to climatic conditions and heat, chemicals and other particulates got trapped in the city, blocking such pollutants from rising up to the atmosphere.

Observations at the New York City Department of Air Pollution Control Laboratory on November 18, 1953, revealed that sulfur dioxide concentrations were significantly higher than the previous day and beyond the level deemed natural for New York City's air. Also, the department's office was inundated with complaints from community people complaining of eye pain and coughing. Later studies attribute the deaths of between 170 and 200 people to the smog and air pollution of those days.[123]

Thirteen years later, during Thanksgiving weekend, a similar smog outbreak occurred, this time resulting in the deaths of around 200 people. Moreover, companies like General Electric and GM were known to dispose their chemical waste in the Hudson, contaminating it.[124]

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[121] Umich.edu. (2021). Hahn to LBJ, 1965 · Give Earth a Chance: Environmental Activism in Michigan. http://michiganintheworld.history.lsa.umich.edu/environmentalism/exhibits/show/main_exhibit/item/633

[122] Ralph Nader, *Unsafe at Any Speed : The Designed-in Dangers of the American Automobile* (New York: Bantam Books, 1973): 121

[123] Greenburg L, Jacobs Mb, Drolette Bm, Field F, Braverman Mm. "Report of an air pollution incident in New York City - November 1953". *Public Health Rep*. 1962;77(1):7-16.

[124] Jim Dwyer, "Remembering a City Where the Smog Could Kill," *The New York Times*, March 1, 2017, https://www.nytimes.com/2017/02/28/nyregion/new-york-city-smog.html.

Because of an increasing awareness of the health effects of air pollution, this incident was widely publicized, prompting people around the country to link these extreme incidents to pollution in their communities. As a result, environmental movement became a more pressing issue.

In 1969, another event that sparked concern about this issue was the Santa Barbara oil spill caused by a Union Oil drilling platform, which at the time was categorized as the largest in U.S. history. Around 12 million liters of crude oil were dumped in the ocean, forming an oil slick 50-km long and killing thousands of animals. The images of the disaster, of the animals covered in oil and the beaches painted black were seen all over the United States and for many it was like a wake-up call and a determinant moment for the formation of environmental movements and the traction they later received.
Following the spill, California's environmental regulatory agencies were strengthened, with fines for industrial polluters, and a ban on new offshore oil drilling platforms was imposed.[125]
This event, combined with the studies investigating the effect of pollution and smog, led to the creating of stricter pollution requirements and regulations forcing car manufacturers to produce more efficient automobiles which polluted less.

The state of California was the first to pass pollution control laws. On June 10, 1947, Governor Earl Warren signed the California Air Pollution Control Act (CAPCA) into law. This legislation allowed for the establishment of Air Pollution Control Districts in any county, with Los Angeles County being the largest and one of the most polluted in the state.
In 1959 it was found that vehicle crankcase pollutants were a significant source of hydrocarbons. At the end of the year, all of the United States' automakers declared that all 1961 model vehicles sold in California would be fitted with crankcase ventilation

[125] Christine Mai-Duc, "1969 Santa Barbara Oil Spill Changed Oil and Gas Exploration Forever," Los Angeles Times (Los Angeles Times, May 21, 2015), https://www.latimes.com/local/lanow/la-me-ln-santa-barbara-oil-spill-1969-20150520-htmlstory.html.

systems (also called blowby) to remove the many of the hydrocarbons from the source.[126]

The first federal regulation related to the environment was the Air Pollution Control Act of 1955, which for the most part provided funds for researching pollution control methods and left to the single states the responsibility to actually set standards related to air quality. Even if it was not legally binding, for the first time, air pollution was officially declared a threat to public health.[127]

The federal government started to take steps after becoming aware of the spread of air pollution. After not-so-subtle threats made by Abraham Ribicoff, former Secretary of Health, Education, and Welfare, in December 1961, car manufacturers agreed to install blowby devices in every vehicle produced in 1963 (nationwide). On different occasions, unfortunately, the industry either delayed or limited the installation of specific devices or technologies to reduce pollution.

For example, in 1964, Ford was accused of installing emission control devices only on those cars destined for the Californian or New Yorker market, so those areas with the most stringent anti-pollution regulations. [128]

In 1965, the Clean Air Act was amended and established for the first time federal vehicle emissions standards for 1968 models. [129]

California was probably most advanced state in this field. California State Department of Public Health convened a hearing in May 1964 to discuss adopting an air quality requirement for nitrogen oxides. The need for some monitoring over this contaminant was questioned by GM and Ford air quality engineers, which on the other hand showed no proof of its harmlessness. Car manufacturers also argued that they were unable to eliminate hydrocarbon leaks from the carburetor and fuel tank.

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[126] P. A. Bennett et al., "Reduction of Air Pollution by Control of Emission from Automotive Crankcases," *SAE Transactions* 68 (1960): 514–36

[127] Diana Clarkson and John T. Middleton, "The California Control Program Fo RMotor Vehicle Created Air Pollution," *Journal of the Air Pollution Control Association* 12, no. 1 (January 1962): 22–28, https://doi.org/10.1080/00022470.1962.10468042

[128] Ralph Nader, *Unsafe at Any Speed : The Designed-in Dangers of the American Automobile* (New York: Bantam Books, 1973): 128

[129] Arthur Holst, "Clean Air Act | History & Effects," in *Encyclopædia Britannica*, 2019, https://www.britannica.com/topic/Clean-Air-Act-United-States-1970.

In order to overcome such resistance, the Los Angeles Air Pollution Control District asked chemical companies to develop automobiles accessories to control the abovementioned emissions. The state's intervention put pressure on carmakers, which announced that starting from 1966, their models would meet California's air quality standards.

One year later the California Air Resources Board (CARB) was established, with the goal of attaining and maintaining stricter air quality rules. It established the nation's first NOx emissions regulations for automobiles and paved the way for the diffusion of the catalytic converter, which revolutionized the ability of automobiles to eliminate smog-forming emissions.

The car industry was asked for a new technological solution, and catalytic exhaust devices were designed to turn nitrogen oxides into harmless by-products. All cars sold in California in 1975 had to have catalytic converters.

CARB introduced guidelines for cleaner-burning oil, as well as preliminary standards for cleaner diesel fuel for trucks and buses, despite the fact that lead had already been removed from gasoline.[130] These two innovations were also adopted nationwide.

The Clean Air Act of 1970 (also known as the 1970 CAA) marked a significant change in the federal government's position in air pollution control. This bill allowed for the development of more robust federal and state regulations to restrict pollution from both industrial and personal sources.[131] By 1975, new vehicle emissions had to be reduced by 90%. President Richard Nixon created the Environmental Protection Agency (EPA), which had extensive authority over motor vehicle emissions regulation. The agency created the National Ambient Air Quality Standards (NAAQS), setting limits on the concentration of pollutants that cause smog and other health hazards. New vehicles had to follow EPA hydrocarbon (HC), carbon monoxide (CO), and nitrogen oxide (NOx) emission requirements (NOx).[132]

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[130] Government of California, "History | California Air Resources Board," Ca.gov, 2012, https://ww2.arb.ca.gov/about/history

[131] US EPA,OAR, "Evolution of the Clean Air Act | US EPA," US EPA, November 21, 2018, https://www.epa.gov/clean-air-act-overview/evolution-clean-air-act.

[132] US EPA, OAR, "Timeline of Major Accomplishments in Transportation, Air Pollution, and Climate Change | US EPA," US EPA, June 27, 2016, https://www.epa.gov/transportation-air-pollution-and-climate-change/timeline-major-accomplishments-transportation-air.

Some acknowledged and worried that the infrastructure required to meet the requirements did not exist yet, and that the deadline was optimistic. Most politician decided, however, that the best way to get the automotive industry to implement the requisite technologies was to force it, giving birth to the idea of technology-forcing requirements.

In the following years, Clean Air Act Amendments became more frequent, establishing more stringent requirements for emissions, so that car manufacturers ultimately had to comply.

As highlighted in this section, the automotive industry had always needed an external push when it comes to innovation in areas that do would not necessarily bring in higher revenues, just like innovation in the case of air pollution. For a long time, American automakers simply disregarded pollution control regulations. Following that, vigorous campaigning was used to fight both state and federal pollution controls.

For example, the Cato Institute, a public policy research foundation, whose funders include the American Petroleum Institute, Exxon, Ford Motor Company and Toyota Motor Sales, clearly tries to support the auto and oil agenda. In 1995, with the publication of “Health and Smog: No Cause for Alarm”, tried to oppose the strengthening of clean air regulations and suggested to rewrite and modify the Clean Air Act. The Competitive Enterprise Institute is a similar organization as Cato and the sum of money the car and oil industries pump into the Institute is reflected in its anti-environmental publications and campaigns. Once again, its funders are Ford Motor Company, GM, Texaco Foundation and the American Petroleum Industry.

Ford and GM are probably the two of the most important and powerful car automakers in the United States and also in the world

The former has been found guilty of multiple environmental regulations, like for example violating the Clean Air Act by unlawfully installing a device in their 1997 Econoline vans that would bypass pollution control systems.

The same could be said for the latter. According to the EPA, General Motors facilities breached the Clean Air Act at least 26 times between 1997 and 1999.[133]

Moreover, many in the automotive industry believed the regulations were too strict. Ford's North American president stated that by 1975, car production might stop because of the Clean Air Act, the vice chairman of GM declared the standards a "a case of overkill". [134]

Nonetheless, even after violations like that, automakers had to adapt to the pollution requirements.

In the next section, it will be analyzed an issue that has a lot in common with environmentalism and brought important changes in the industry.

2.5 The pressures against the current automobility paradigm – Oil crisis and Energy Dependence

The transport sector takes up a major share in energy consumption. In fact, for OECD countries, the share dedicated towards transport is around 25% of total energy consumption, 75% of which is divided between motor gasoline and diesel. Personal automobility fuel consumption accounts for 61% of total consumption of transportation energy, as of 2012, while on the other hand, buses and trains are only responsible for 6% of the total. Estimates forecast an increase in total energy consumption for transportation, especially deriving from non-OECD countries.[135]

Throughout the 20th century, dependency of oil became a global issue in various occasions. Since the great majority of the economies and societies deeply rely on supply of oil, a sharp increase in the price of barrels exported or decrease in supply of crude oil, can have great implications for many countries.

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[133] U.S. PIRG, "Dirty Dollars, Dirty Air: The Auto and Oil Industries' Continuing Campaign against Air Pollution Control" , https://uspirg.org/sites/pirg/files/reports/Dirty_Dollars_Dirty_Air_USPIRG.pdf.

[134] Kaiser, Walter. "CLEAN AIR ACT AND AMERICAN AUTOMOBILE INDUSTRY." *Icon* 9 (2003): 31-43. http://www.jstor.org/stable/23790668

[135] U.S. Energy Information Administration, "International Energy Outlook 2016 – With Projections to 2040, (May 2016): 7-11, https://www.eia.gov/outlooks/ieo/pdf/0484(2016).pdf.

The path of social and economic policies, the rate of inflation, conditions in financial markets, exchange-rate relationships, the restructuring of international monetary structures, as well as many other factors are all influenced by changes in the international oil market.

Moreover, oil prices are often linked to economic recessions and periods of inflation. Even though it has not been established a direct causal relationship between the two, it is possible to see economic downturns and oil shock near in time.

Luckily, so far, the shocks have been rather brief in time, so that long-term damage has been avoided, but in the case of a more substantial turmoil, consequences may be very different, also considering the rising in energy consumption worldwide, which will be further analyzed in the next chapter.

Nonetheless, the issue of energy security and dependence is becoming more and more prominent in the public opinion. Paul Sabin, in his study "*Crisis and Continuity in U.S. Oil Politics, 1965-1980*", highlights the fact that the American government was far more concerned towards reducing imports rather than decreasing total demand of oil. As it will be illustrated in the next pages, such target was not achieved, thus the importance of Middle Eastern oil shortages. Additionally, in the pursue of such policy, the US has sent increasing number of militaries in the Middle East, in order to hold on cheaper supplies of oil. Also, fears about energy dependence allowed for easier to get authorizations for offshore drilling site, as well as creation of the Alaskan pipeline, which before 1973 was often obstructed due to environmental concerns and Alaskan native claims.

Since the 70's, it is hard to see a dramatic difference in the approach towards energy security. [136] Also, more and more tax incentives and tax breaks for oil producers were put in place during the last years by governments.

It is possible to see a similar trend in the EU as well. Around two-thirds of total oil consumption is transport-related and since the 2000 there has been a slight decline in total oil consumption, mostly related to introduction of biofuels, economic downturns and improvements in vehicle efficiency. Despite the decline, oil imports in the EU have

[136] P. Sabin, "Crisis and Continuity in U.S. Oil Politics, 1965-1980", *Journal of American History* 99, no. 1 (May 22, 2012): 177–86, https://doi.org/10.1093/jahist/jas086

actually increased to 88% in 2014, compared to 76% in 2000. The main exporter is Russia, which accounted to around one third of EU imports, while the rest comes from highly politically unstable areas like North Africa, namely Libya and the Middle East. Just like the USA, such high dependence plays a very important role in the geopolitical strategies of the members, especially in the form of relationship with Russia and its government.[137]

Energy exports are used by Russia and other energy-rich states as means of foreign policy leverage. Russia further uses its oil resources to defend and advance its interests in nearby states as well as to expand its geopolitical reach, particularly in Europe.

On the 9th of July 2008, Russian oil supplies to the Czech Republic were cut off. The official justification was technical, according to Moscow. However, several observers, including Czech ones, believed it was linked to the Czech Republic's recent decision to host America's latest anti-missile radar system, which Russia views as potential threat.[138]

It's no coincidence that, in reaction to Russia's invasion of Crimea and interference in eastern Ukraine, EU member states have avoided imposing economic sanctions on the country's gas and oil industries. Despite strained diplomatic ties as a result of its activities in Ukraine, Russia continues to supply its coal to the EU.[139]

Currently, the dominance of oil and related products has not been weakened in the mobility field and growing demands, especially from developing economies, will put even more stress on already limited oil resources.

Electric vehicles still represent the minority. As highlighted by IEA, they accounted for 2.6% of total global car sales in 2019 and in that same year, they represented 1% of global car stock.[140] Moreover, electric energy is mostly generated by fossil fuels, which

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[137] Transport Environment, "Europe Increasingly Dependent on Risky Oil Imports" (July 2016): 2-5 https://www.transportenvironment.org/sites/te/files/publications/2016_07_Briefing_Europe_increasingly_dependent_risky_oil_FINAL_0.pdf.

[138] Andrew E. Kramer, "WORLD BRIEFING | EUROPE; Russia: Czech Oil Supply Will Be Restored," query.nytimes.com, 2008, https://archive.nytimes.com/query.nytimes.com/gst/fullpage-9F04E2DC1F39F931A15754C0A96E9C8B63.html.

[139] European Parliament, "Study Requested by the AFET Committee Policy Department for External Relations Energy as a Tool of Foreign Policy of Authoritarian States, in Particular Russia" (April 2018): 8-20 https://www.europarl.europa.eu/RegData/etudes/STUD/2018/603868/EXPO_STU(2018)603868_EN.pdf

[140] IEA, "Global EV Outlook 2020 – Analysis," IEA, June 2020, https://www.iea.org/reports/global-ev-outlook-2020

are non-renewable and extremely polluting resources. An article published by the Guardian showed how in California, 60 percent of electricity came from burning fossil fuels in 2015, while solar and wind combined accounted for less than 14 percent, while in China, another major market for EVs, coal generates 72% of all electric power. So, as the title of the article suggests "electric cars are only as clean as their power supply".[141] Moreover, renewable energy, even though is on the rise, still supply less than 20% of the global energy mix.

For these reasons, a change in the automobility paradigm is necessary, shifting from individual to a mass transport system could solve the problem of energy security.

Recently the "Peak Oil" theory has got much interest. It basically states that since oil is a finite resource, it is ultimately doomed to end up sometime in the future and the deadline may not be even that far away. Mario King Hubbert, the author of the theory, supposes that global oil extraction will follow a bell-shaped curve, with a peak and a decline. Estimates forecast that even though oil supplies may be enough to last for decades still, there will be a period of production peak and decline. The peak, under IEA estimates may be around 2030. After that peak, there will be a steady decline in supply, with rising prices and thus high damages to the global economy, if alternatives are not found. Moreover, as it will be discussed later, reliance on Middle eastern supplies is very dangerous, as political instability can influence supply of this extremely important resource.[142]

Even though some initial signals of energy dependency and security were already present post-WWII, like for example in 1948-49 or 1951-53 when, due to political instability and conflicts some important oil pipelines were shut, the two major crises happened during the 70'.

Unlike the previous examples, in which the fear of oil shortages was tamed by increase in export by other countries, in 1973-74 and 1979, the supply was sharply decreased by a number of exporting countries, which in the years prior became the most important

[141] "Why Electric Cars Are Only as Clean as Their Power Supply," the Guardian (The Guardian, February 14, 2018), https://www.theguardian.com/environment/2016/dec/08/electric-car-emissions-climate-change

[142] Will Kenton, "Peak Oil," Investopedia, 2019, https://www.investopedia.com/terms/p/peak_oil.asp.

sources of oil, thus affecting the global supply. The aftermath was felt by several Western countries and thus many started to view such dependency as a matter national stability.

Between 1960 and 1970, energy consumption both in Western Europe, Japan and USA rapidly increased, due to boom economic conditions post war. World's consumption rose 10.6% each year between 1969 and 1973, so in order to keep up with the demand, imports had to grow dramatically, and that is what happened. In the meantime, oil progressively replaced coal as major power fuel of the world. In 1955, coal accounted for three-quarters of West Europe's energy consumption; by 1972, coal accounted for less than a quarter of its energy consumption. The demand for petroleum products grew in tandem with the rise of road and air transportation.

Since Europe does not have major oil resources, it was forced to rely on external partners. The EEC's reliance on imported oil had increased to around 60% of overall energy demand by the time of the 1973 embargo, with peaks reaching even 79%, in the case of Italy.

Oil imports into the United States, which had previously been a small percentage of total demand, started to increase exponentially, reaching 25% in 1971 and 35% in 1973. Furthermore, oil producers in the United States considered it more lucrative to spend overseas, growing their reliance on foreign sources.[143]

Fears about external energy dependency was already spread. The Eisenhower administration implemented import quotas. Nonetheless, they were hardly respected since the demand was so high that it could not be met by relying mainly on internal oil resources. President Nixon abolished those quotas in April 1973 and replaced them with simple tariffs.

Another state that deeply relied on oil imports was Japan. In 1973, It purchased around 99% of of its oil supplies, 40% of which came from members of the OAPEC group, an organization of Arabic oil exporters.

In mid-September 1960, Iran, Iraq, Kuwait, Saudi Arabia and Venezuela, few of the biggest oil producers on a global scale, decided to join forces and create the

[143] Issawi, Charles. "The 1973 Oil Crisis and After." *Journal of Post Keynesian Economics* 1, no. 2 (1978): 3-26.
http://www.jstor.org/stable/4537467

intergovernmental Organization of Petroleum Exporting Countries (OPEC). As of 2021, the organization is composed of Algeria, Angola, Ecuador, UAE, Gabon, Libya and Nigeria, as well as the founding countries. Its main objective is to coordinate petroleum policies among its member countries in order to stabilize prices.

The so-called "oil crisis" of October 1973 was the culminating event of a series of occurrences in the prior years and months.

Organization of Petroleum Exporting Countries (OPEC) unilaterally decided to take control of oil markets and determine demand and price levels.

Producers from the Persian Gulf met in Kuwait and agreed to set the price of Arabian light crude at 5.12 dollars, up from the previous price of 3.01 dollars.

The long-standing Arab–Israeli conflict, which had culminated in 1967 in a brief battle was another important event. It ended with Israel increasing its territory in the Sinai Peninsula, the West Bank, and the Gaza Strip, significantly expanding its control area.[144] Responding on such expansion, Arab oil-producing nations, united by the Organization of Arab Petroleum Exporting Countries (OAPEC), voted to enact an oil embargo, as well as output cuts, on countries perceived as sympathetic to Israel, in an effort to convince the Western world, especially the United States, to moderate their support for the Jewish state.

Moreover, the increasing energy demand was fostered by a steady economic growth of the Western countries, that found it more advantageous to shift from coal to oil as main source of energy, as noted above.

In October 1973, the conflict between Israel and Arab countries escalated rapidly when, in an effort to reclaim land captured by Israeli forces, Egypt and Syria, launched an assault on Israeli troops on the Golan Heights and the Sinai Peninsula. Oil was rapidly used as a weapon to dissuade any country to help Israel in the war.

Although the United States produced a third of the world's oil in 1970, they reduced their share to a quarter by 1973. Saudi Arabia and Iran had already surpassed Venezuela as the world's top oil exporter by 1970.

[144] U.S. Office of the Historian, “Milestones: 1961–1968 - Office of the Historian,” State.gov, 2019, https://history.state.gov/milestones/1961-1968/arab-israeli-war-1967.

On 17th October 1973, the OAPEC decided to cut production of oil by 5% each month until Israel abandoned the territory previously occupied in 1967. Kuwait, Libya, Qatar, Saudi Arabia Egypt, Syria, the UAE, Bahrain, and Algeria all supported the policy.

Three days later, Saudi Arabia announced a total embargo to the United States.

The Arab OPEC states decreased their production by 4.5 million barrels per day (mbd) in November compared to September, despite increases in production by other members, bringing the total decline to just 4.2 mbd. Nonetheless, this accounted for 13% of OPEC's total production in September.

Reductions did not stop. Except for those countries that broke diplomatic relations with Israel or supported Arab countries, the rest, even those neutral, saw a deep decrease in oil imports.

Prior to October 1973, the United States was importing 1.2 million barrels of Arab oil a day, but after it had to just 18,000 barrels a day five months later, while the Netherlands pulled over 70% of its oil from Arab sources.

By the end of 1973 the crisis was mostly over, with the effect of deep oil reduction and fourfold rise in the price of oil in just three months.

Even if the boycott's ultimately disastrous repercussions were avoided, it showed unequivocally that oil imports to the West were no longer solely a matter of economics but actually they were entwined with politics.

In December 1973, the OPEC decided on a new price of over 11 dollars per barrel. The official embargo was ended in March 1974.[145]

This is probably the most important oil crisis in recent history, even though, there were many others throughout the years. Moreover, a turmoil in the oil market has deep implications in the economies of the countries. For example, it is possible to point out that the embargo played a role in the 1973-75 economic recession, as increased oil prices intensified inflation.

Oil prices have a direct impact on the prices of commodities because during the production process, petroleum products are often involved. Indirect effects on costs such as shipping, packaging, and heating should be considered too. Ultimately, since people need to use their cars, a higher portion of income was directed to transportation,

[145] Fiona Venn, *Oil Crisis.*, Routledge, May 30th, 2002

decreasing the remaining amount for other needs. The decrease in consumption is not only decreased due to more spending dedicated to transport, but also because of increasing price of other goods and services. Moreover, in times of crisis people tend to increase their savings, because of fears about the future.

Increases in energy prices affects the production and demand for products other than oil. As a result, high oil prices will shift up the supply curve for products and services that use oil as a source, with the result of higher prices and lower quantities.[146]

In the years of crisis, drivers were often forced to wait in queues that wrapped around the road. Many, in order to avoid such queues, got up early or waited until sunset. Gas stations displayed color-coded signs: green for accessible gas, yellow for rationed gas, and red for gas that had run out.

Odd-even rationing was implemented in some states, allowing drivers with license plates ending with odd numbers to get petrol on odd-numbered days. To save petrol, the national speed limit was lowered to 55 miles per hour. For 1974 and 1975, Nixon made daylight savings time permanent.

After several years of relative stability, prices soared sharply again in 1979. The second oil crisis began in late 1978, when Iranian supply was disrupted due to domestic political unrest. Saudi Arabia's short-term production reduction in January 1979 helped decrease world output on a scale close to 1973, and prices rose quickly as before. Early in 1979, spot market prices soared from $ 19 per barrel to $31 per barrel.

The result was that crude oil prices rose by more than 500 percent in seven years, even adjusted for inflation.

The rise of oil prices compounded with other factors and resulted in the so called “stagflation” and an economic crisis in 1973-75. This was a period characterized by high inflation, unemployment, recession, and of course, high oil prices. For five quarters, between 1973 and 1975, the GDP decreased, with a peak in Q1 1975 of -4.8%, which rebounded fairly quickly.[147]

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[146] Keith Sill, “The Macroeconomics of Oil Shocks,” *Business Review*, no. Q1 (2007): 21–31, https://EconPapers.repec.org/RePEc:fip:fedpbr:y:2007:i:q1:p:21-31.

[147] Kimberly Amadeo, “Stagflation and Its Causes,” The Balance (The Balance, January 9, 2008), https://www.thebalance.com/what-is-stagflation-3305964.

Oil does not only raise economic issues, but it has also social and political implications between oil exporting countries and oil importing countries (even though the same argument could be made for other sources of energy, like natural gas). As it is possible to read from "The First oil War", a paper published by the Oxford institute for Energy Studies, Iraqi's invasion of Kuwait in 1990 was, for the most part, oil-driven, just like USA's reaction which aimed at protecting one of the most important oil supplies globally.

Iraq accused both Kuwait and UAE to produce more oil than they were supposed to, (following OPEC quotas) and thus damaging its economy. This was actually true, as Kuwait was pursuing a low oil price policy (thus increasing the production) in order to keep up with growing global demand. Furthermore, lowering the prices also meant that there would be lower need to invest in alternative energy sources, something from which OPEC could only benefit in the long run.

Moreover, Iraq believed also that Kuwait had stolen Iraqi oil in an oilfield along the border.

Of course, the causes and the development of the conflict are not only related to petroleum, but it is possible to speculate that if only Kuwait did not possess that amount of resources, Western response may have been much different.[148]

Once again, the conflict was accompanied by a rapid increase in oil price and a short recession which lasted about eight months. American unemployment peaked to 7.8% in 1992, interest rates rose and GDP in Q4 1990 and Q1 1991 were respectively -3.6% and -1.9%.[149]

From the chart below, it is possible to see the spot oil price per barrel, in relation to American's recession periods (highlighted in gray), accounting for inflation. Before the 1973, the West Texas Intermediate, often used as a benchmark in order to grasp oil price fluctuations, experienced a period of stability. With the Yom Kippur War and the Iranian

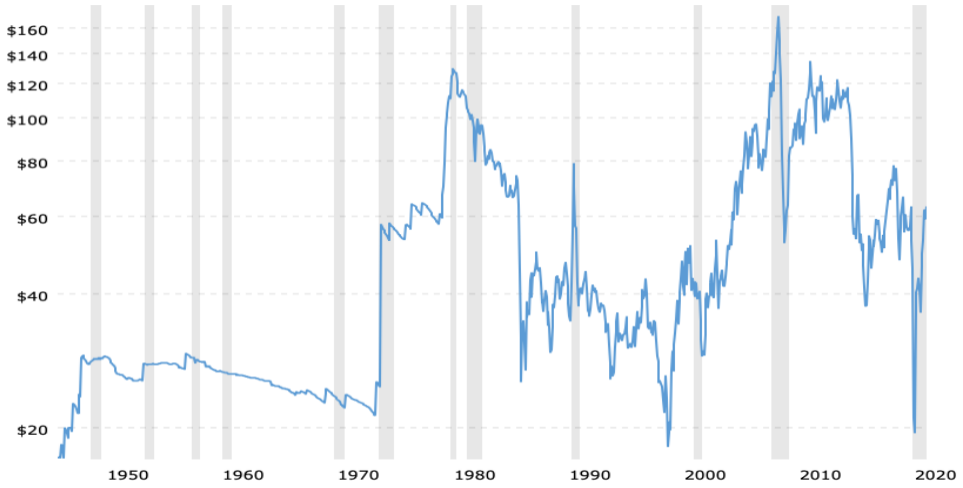
[148] L. Archer et al., "The First Oil War: Implications of the Gulf Crisis in the Oil Market" Oxford Institute for Energy Studies, (1990), https://www.oxfordenergy.org/wpcms/wp-content/uploads/2010/11/SP1-TheFirstOil-WarImplicationsoftheGulfCrisisintheOilMarket-LArcheretal-1990.pdf.

[149] Kimberly Amadeo ,"17 Recessions in U.S. History,", The Balance, 2009, https://www.thebalance.com/the-history-of-recessions-in-the-united-states-3306011.

Revolution, two big increases have been recorded and since then, prices have been generally increasing.

More recently, it is possible to note a relationship between the financial crisis of 2008 and sharp increase in oil price.

As noted above, oil price and economic downturns do not have a perfect degree of correlation, but the majority of American recessions were anticipated by increases in prices of oil.



Crude oil price in dollars per year, adjusted with inflation in relation with economic recessions.[150]

In this section, it has been analyzed the different implications of the high dependence of oil, which is especially used for mobility purposes. Considering that in the last century, the demand for oil increased dramatically, and forecasts estimate it will to in the next decades, it is important to raise awareness on the dangers and ramifications of such dependence. Economic recessions, social and political distress are all linked to the production and purchase of oil, as it was illustrated by the examples provided above.

Moreover, since most oil supplies are controlled but few countries, and many of them are part of a cartel, the OPEC and OAPEC, it is important find alternative resources and gradually achieve energy independence.

[150] Macrotrends, "Crude Oil Prices - 70 Year Historical Chart," Macrotrends.net, 2001, https://www.macrotrends.net/1369/crude-oil-price-history-chart.

During the late 70's and early 80's, mainly due to environmental concerns and the oil crisis, which made oil prices skyrocket, important changes happened in the automotive industry. As described in the first chapter, in 1975 the U.S. government introduced regulations on energy consumption. The Corporate Average Fuel Economy (CAFE) governs the average fuel economy of new cars sold in the United States. CAFE standards operate by setting a minimum fuel economy (in miles per gallon) for the entire fleet of new vehicles, with different specifications for passenger cars and light trucks.

From 1973 to 1988, the norm managed to double fuel economy of US vehicles, from 14.2 mpg to 28.6 mpg on average. In 1985, GM and Ford tried to lobby the administration in order to lower fuel requirements, stating that oil prices would decrease and that consumers wanted bigger vehicles (thus less efficient), so that producing smaller cars would not have been economically advantageous. Standards were not lowered, and the two manufacturers had to comply. On the other hand, Chrysler always seemed to be one step ahead the other two, and by that time it had already invested $4.4 billion in smaller, more efficient car segment, while recording profits.[151]

These improvements in fuel economy were made possible thanks to different technical advancements like weight reductions, achieved through technological optimization, the expanded use of plastics and other lightweight metal parts, as well as removal of accessories like air conditioning, which were major sources of energy consumption. Another choice was to adapt and upgrade existing fuel-saving technology, which included engine, transmission, aerodynamics, and rolling resistance improvements. Also, in order to achieve conformity with fuel-efficiency standards, automakers had to make technical trade-offs, such as lowering engine capacity and vehicle weight to increase mpg. This last option and the spread of lighter cars were the most used methods. From a study conducted by Yiwei Wang and Qing Miao, it is possible to observe that starting from 1975, horsepower and weight declined substantially. Nonetheless, after a sharp rise, from 1985 to 2010, the average miles per gallon (mpg) remained

[151]Daniel J. Evans and John Heinz, "Opinion | REJECT the PLEA from FORD, G. M.," *The New York Times*, April 20, 1985, sec. Opinion, https://www.nytimes.com/1985/04/20/opinion/reject-the-plea-from-ford-g-m.html.

constant, while horsepower and weight steadily increased sine 1985.[152] So, it is possible to observe that initially, weight and engine power reductions were used in order to comply with regulations, but with time, other fuel-saving technologies were put in place, aided also by the fact that miles per gallon requirements were not heightened substantially, unlike what happened in the early days.

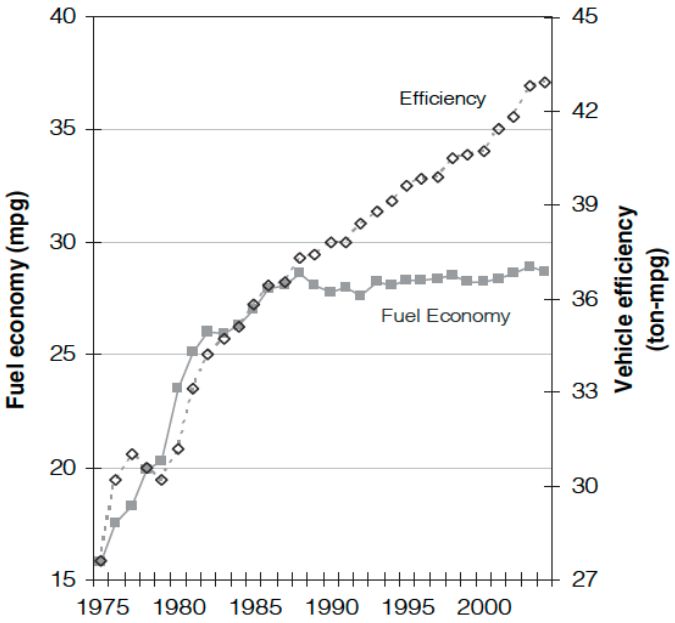
Klier and Linn suggest that most of the advancement in order to obtain higher mpg, was done by reducing horsepower and weight, rather than actually investing and innovating in the field of R&D. Moreover, the authors distinguish energy efficiency and fuel economy. The former relates to how efficiently a vehicle uses fuel. Using EPA's metric, it is calculated as total weight multiplied by miles traveled and divided by gallons of gasoline consumed.[153] It is possible to note a general increase in efficiency, which tapered off over the years. Between 1975 and 1987, the increase was 2-3% per year, after that, it decreased to only 1% per year. The latter relates to the number of miles travelled per gallon of oil used.

Klier and Linn observe that for over two decades, advances in fuel efficiency have not been translated into increased fuel economy. One of the reasons could be the increase in popularity of SUVs and larger vehicles, which impedes higher efficiency to increase fuel economy. From the mid-1980s to today, advances in aerodynamics, rolling resistance, engine, and drivetrain reliability have amounted to about 1% a year in average energy performance—equivalent to gains of about 0.2 mpg per year in new passenger vehicles.

Vehicle efficiency started to diverge from fuel economy in 1987, while efficiency improved, fuel economy did not.

[152] Yiwei Wang and Qing Miao, "The Impact of the Corporate Average Fuel Economy Standards on Technological Changes in Automobile Fuel Efficiency," *Resource and Energy Economics* 63 (February 2021): 101211, https://doi.org/10.1016/j.reseneeco.2020.101211

[153] Hearst Autos Research, "Fuel Efficiency: Everything You Need to Know," Car and Driver, June 11, 2020, https://www.caranddriver.com/research/a32780283/fuel-efficiency/.



Fuel economy and vehicle efficiency in the period 1975-2000[154]

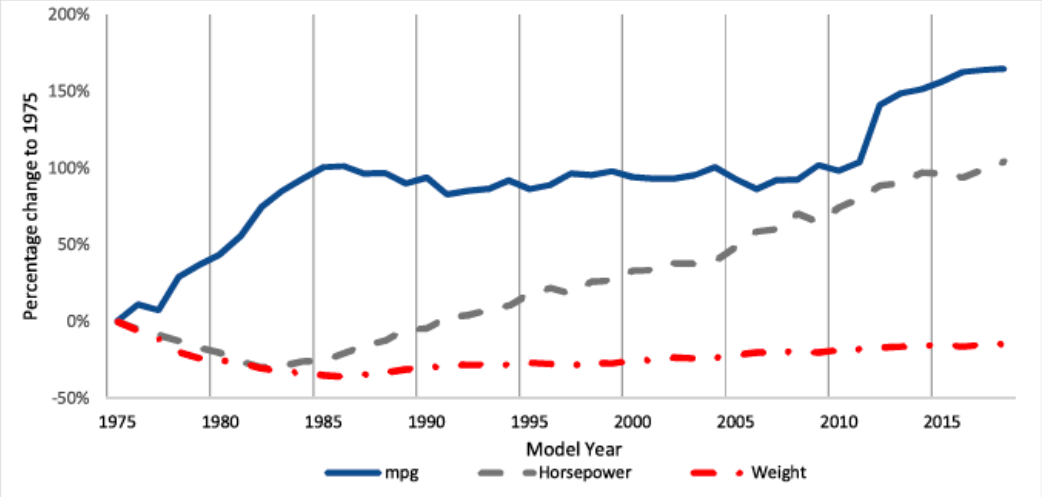
During the first years of the regulation, for the categories of light-duty vehicle and passenger cars there was a sharp decrease in the number of larger and bigger models sold. More specifically, for the latter party. On the other hand, the number of mid-sized vehicles rose dramatically with a peak in 1987, when, this category achieved a share of almost 80%, while the share of larger ones decreased. After that period, the trend reversed and both small and mid-sized vehicles started to decline in popularity and large cars increased their share in the market. Klier and Linn further showed that in the United States, the benefits of technical advances have been most often used to meet private interests (power, size, and luxuries) rather than the public interest (reduced GHG emissions and oil imports) since the mid-1980s. In this case, increased efficiency did not positively influence fuel economy, as seen in the graph presented above.

Typically, heavier vehicles offer more space for passengers, have more accessories and electronics and need higher towing capacity. With these things considered, generally larger vehicles have lower fuel economy.[155]

[154] Thomas Klier and Joshua Linn, "New-Vehicle Characteristics and the Cost of the Corporate Average Fuel Economy Standard," *The RAND Journal of Economics* 43, no. 1 (March 2012): 186–213, https://doi.org/10.1111/j.1756-2171.2012.00162.x

[155] Thomas Klier and Joshua Linn, "New-Vehicle Characteristics and the Cost of the Corporate Average Fuel Economy Standard," *The RAND Journal of Economics* 43, no. 1 (March 2012): 186–213, https://doi.org/10.1111/j.1756-2171.2012.00162.x

CAFE guidelines were revised in 2007 and again in 2009, more than 30 years since they were first introduced. As CAFE standards became ever more stringent, car makers were, once again, forced to comply. From that point on, it is possible to note a sharp rise in mpg (graph below) and very slight change in weight and horsepower. Thus, it may be speculated that in the recent years, developments and innovation in the car industry have allowed to produce more fuel-efficient products. New technologies such as hybridized electric–internal combustion engine vehicles, regenerative braking, continuously variable transmissions, engine on-off controls, and the continued replacement of large hydraulic and mechanical equipment with electrical systems all contribute to significant energy efficiency gains. Moreover, the increased use of diesel engine, especially for trucks, significantly rose the mpg, compared its gasoline counterpart.



Change in mpg, horsepower and weight for passenger cars between 1975 and 2015.[156]

CAFE regulations also resulted in a push in overseas car imports, especially Japanese cars which achieved more and more a higher share of the market. This was mainly due to the fact that car makers like Honda, Toyota or Suzuki were able to offer to consumers more compact cars which were achieving higher mpg that their American counterparts. Moreover, such cars often exceeded CAFE requirements and were the most efficient in the market. Honda, for example, created a fleet that averaged 3.96 miles per gallon

[156] Yiwei Wang and Qing Miao, "The Impact of the Corporate Average Fuel Economy Standards on Technological Changes in Automobile Fuel Efficiency," *Resource and Energy Economics* 63 (February 2021): 5, https://doi.org/10.1016/j.reseneeco.2020.101211

above the CAFE benchmark between 1990 and 2001. On the other hand, Ford, GM, and Chrysler all registered less than 0.2 miles per gallon above the national average.[157]
All of the 25 models offered in 1980 with EPA gas mileage levels of more than 30 miles per gallon were imports. Moreover, they Japanese cars focused on the lower-price market, so that they were cheaper to buy and cheaper to run overall. Just 12 of the 37 models priced between $4,000 and $5,000 were domestics, while 25 were imports.
While the American auto industry struggled to adapt to significant structural changes, international automakers, especially those from Japan, were setting sales, production, and profit records. Imported car sales in the United States hit new peaks in 1979 and 1980, both in terms of number of units delivered and market share. Imports accounted for respectively 21% and 27%. Of the imports, about 80% were from Japan. [158]

At the same time, thanks to soaring gas prices and the search for alternative sources of fuel, the EVs start to get more traction, which unfortunately for this technology won't last long. Many big and small car automakers start to invest into electrics and presented their solutions to the public. In 1973, GM unveiled a prototype urban electric car, which due to its extremely strange design, limited range and performance issues, resulted into a total failure.
The Sebring-Vanguard Citicar represented another attempt, but once again, since the technology did not improve much in the last fifty years, the range problem persisted (the battery could last for about 65 km). Also, the odd design did not help with popularity.
Moreover, in 1976, the U.S. Congress gave birth to the "Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976". This was a program directly aimed at increasing funding into EVs and hybrid technologies in order to show their commercial feasibility. The plan was to produce two generations of such vehicles before 1986, a goal which was not achieved, as the technology needed more time to be

[157] Mark R Jacobsen, "Evaluating US Fuel Economy Standards in a Model with Producer and Household Heterogeneity," *American Economic Journal: Economic Policy* 5, no. 2 (May 2013): 148–87, DOI: 10.1257/pol.5.2.148
[158] Dick N. Nanto and Craig Elwell, "Imported Automobiles in the United States: Their Rising Market Share and the Macroeconomic Impact of a Proposed Import Restriction," www.everycrsreport.com, September 15, 1980, https://www.everycrsreport.com/reports/80-157.html.

properly developed.[159] Also, it still did not consider the EVs as a different automobility system, that needed special attention and high levels of integration. Furthermore, as explained in the last pages of the first chapter, many argued that the technology was not ready yet, and promoting that could backfire and have negative effect on the public perception of EVs.

From the discussion above, it is possible to understand that the automotive industry is not always the most innovative when it comes to pollution. Actually, there have been episodes where big automobile manufacturers tried to use their power in order to maintain the status quo a delay regulation as much as possible. Nonetheless, thanks to public awareness of environmental issues and change in needs, as well as external pressures (i.e., oil price), they are forced to change and adapt to new scenarios.

[159] V. J. Esposito, "The U.S. promotes electric vehicles: An energy department program is designed to encourage research and support experiments," in *IEEE Spectrum*, vol. 14, no. 11, pp. 69-70, Nov. 1977, doi: 10.1109/MSPEC.1977.6501656.

Chapter 3 – 1980-2000

The pressures against the current automobility paradigm - The problem with congestion

As car ownership became more and more common, another issue started arising, which is congestion. Street and urban development were not able to keep up with the increasing number of cars on roads and highways, so that it became common to be stuck in traffic, even for a long time.

Between 1982 and 1999, the total percentage of daily traffic in seventy-five American metropolitan areas nearly doubled, increasing from 17% in 1982 to 33% in 1999.[160]

In big cities like Los Angeles, people can be jammed in traffic even for hours, although highways often have six lanes or more. Of course, the problem is much more prominent in big cities, especially in the central business district. From the study conducted by Sorensen et al. it is possible to observe a map of the whole city of Los Angeles alongside its most jammed highways. Many links of the freeway system which are close to downtown can take up even more than four hours to be fully travelled and average speed may be less than 50 km per hour. Furthermore, between 1983 and 2000, the average travel time increased by 40%.[161] Nonetheless, this is not exclusively a problem for metro cities, as smaller cities experienced increased traffic as well over the years. This problem relates to lack of adequate substitution to the car, which is still the preferred mode of transport thanks to its flexibility, speed, convenience and comfort. As smaller cities are the ones that are most often left without efficient and widespread public transport, people simply do not have other chance to move around if not cars.

In the period between 1980 and 2000, U.S. population grew by 24%, while total vehicle miles traveled increased by 80%. This means that as the number of citizens grow, more cars are bought and thus, more miles are travelled in general. Still, the increase in travel is not directly proportionate to the increase in population. It is estimated that miles

[160] Anthony Downs, "Traffic: Why It's Getting Worse, What Government Can Do," Brookings (Brookings, 2004), https://www.brookings.edu/research/traffic-why-its-getting-worse-what-government-can-do/.

[161] Sorensen, P., Wachs, M., Min, E., Kofner, A., Ecola, L., Hanson, M., . . . Griffin, J.,. Characterizing Congestion in Los Angeles. In *Moving Los Angeles: Short-Term Policy Options for Improving Transportation* (2008):35-5.

driven would have increased by 47% even if population stagnated.[162] Considering that total global population is estimated to keep growing, the problem will only become bigger and bigger, requiring different tactics than the ones that have been employed in the past.

Traffic is not simply an issue with city design and the mode of transport people decide to use, but it also relates to the different activities people need to perform (commute to work, take the children to school etc.) that happen around the same time of the day, thus forming so called peak periods or rush hours. These are typically between 7 to 9 a.m. and 5 to 7 p.m.

Following a summary document drawn up by the OECD, the causes of congestion are multiple, and their importance varies among countries. For example, in the United States, the most important factor is labeled as recurring congestion, which refers to trips that happen regularly like commuting trips. The second major element is accidents. Others are work zones, weather and poor signaling.[163]

This increased time wasted have many implications. For example, in downtown Manhattan, where most of the economic and social activity of the city is concentrated, congestion could cost up to $20 billion each year. This sum consists of increased costs of vehicle maintenance and fuel burnt, industry revenue loss and increased operating costs for companies.[164]

Another major problem is environmental. As more people wait in long lines of cars, with their engines turned on, more CO2 and other gases are released into the atmosphere, contributing to global warming and air pollution.

Moreover, due to more time spent behind the wheel, people could have less free time to dedicate to themselves or staying with the family, thus increasing stress and potentially decreasing the quality of life.

Some cities, like London tried to tackle the problem by charging drivers a fee when they enter a specific part of the city, during rush hours. This discourages people to use their

[162] Anthony Downs, "Traffic: Why It's Getting Worse, What Government Can Do," Brookings (Brookings, 2004), https://www.brookings.edu/research/traffic-why-its-getting-worse-what-government-can-do/.
[163] OECD, *Managing Urban Traffic Congestion* (OECD Publishing, 2007), https://doi.org/10.1787/9789282101506-en
[164] "$100 Billion Cost of Traffic Congestion in Metro New York" (January 2018), http://pfnyc.org/wp-content/uploads/2018/01/2018-01-Congestion-Pricing.pdf.

car and, if aided by efficient public transport services, can increase people using buses or metros and even bikes. Thanks to such policy, intermodal travel can be pushed, thus becoming a real opportunity, instead of relying to just one, the car. This policy has been a success as people driving in central London did decrease by 25%, bike rides soared by 66% and bus wait time decreased by 25%.[165]

The same policy was enacted in Stockholm, managing to decrease the number of vehicles entering the charging zone. Initially introduced on trial in 2006, a referendum confirmed that policy, which became permanent in the first months of 2007. The law allows for some exemptions, like emergency vehicles, buses, vehicles driven by people with disability and less polluting cars, like fully-electrics and hybrid. Congestion pricing in the Swedish capital resulted in 20% less traffic, 15% of alternative-fuel vehicles increase and reduction in emissions.[166]

Such policy has encountered much resistance in the United States, both by the public as well as many politicians. The main reasons against it, is that tolls like that would indirectly hit more disproportionately less wealthy households. This is because many of the live in parts where public transport is not easily available, so many have no other option to go to work or reach other destinations. Also, since the car culture is so much engrained into the Western culture, it may be seen as a direct attack to a way of living that has been sustained for the last century. Moreover, people would find extremely strange to pay for something that was before free of charge and people generally see taxes in a very negative way. The revenues from congestion pricing could be invested into more efficient public transport, but people may not trust the Government in this regard, since public transport inefficiencies have been known for a very long time.

Unfortunately, other cities, especially in the North American continent have responded by building new roads and highways, even though, historically, did not seem to be an adequate solution to the problem. In Houston, Texas, more lanes were built and

[165] Nicole Badstuber, "London's Congestion Charge Is Showing Its Age," *Bloomberg.com*, April 11, 2018, https://www.bloomberg.com/news/articles/2018-04-11/london-s-congestion-charge-is-showing-its-age.

[166] Jonas Eliasson, "The Stockholm Congestion Charges: An Overview" (July 2014): 1-7 https://transportportal.se/swopec/cts2014-7.pdf.

investments towards highways were put in place. Nonetheless, traffic data shows that travel time did not decrease, but actually it got worse.[167]

The main reason why this attempt does not work is explained in an article written by Adam Mann, where the author introduces the concept of induced demand. This idea basically shows that as more supply of a certain good is offered, like roads, related demand will actually increase, incurring into a sort of vicious cycle from which it is hard to breakthrough. More interestingly, the relationship between supply and demand is actually one-to-one, so that if supply increases by 20%, drivers will increase by the same amount, as Matthew Turner and Gilles Duranton explained in their study. As the two scholars argue, new roads create new drivers. So, expanding the highway net represents and incentive to drivers to use more often their car than they otherwise would. Moreover, data show taking lanes away do not increase congestion, as drivers adapt to new conditions without increased levels of traffic, as probably some decide to take up public transport or travel through less congested roads.

A clear example is Paris, which decided to deal with this issue by decreasing the number of highways and lanes alongside with increased level of public transport, as well as more space for people to either walk or ride bikes. Results show that some of the problem has been alleviated, even though not solved yet.[168]

As said above, the common American answer to congestion is building more roads and highways. As shown in a report by Transportation for America, between 1993 and 2017, roads have increased at a faster rate than population growth. 30,511 new freeway lane-miles of roads have been built between that period, representing an increase of 42%, against the 32% of population growth of the respective cities. From the same report, it is possible to grasp the nature of the investment needed. The Federal Highway Administration estimates that just one new lane-mile could cost between $4.2 million to $15.4 million, excluding the costs of maintenance. The report further acknowledges that the strategy "has utterly failed to solve congestion". Even in areas like Detroit, where population dropped, delays and congestion have increased. Furthermore, San

[167] Joe Cortright, "City Observatory - Reducing Congestion: Katy Didn't," City Observatory, December 16, 2015, https://cityobservatory.org/reducing-congestion-katy-didnt/.

[168] Gilles Duranton and Matthew Turner, "The Fundamental Law of Road Congestion: Evidence from US Cities," September 2009, DOI: 10.3386/w15376

Diego, California and Nashville, Tennessee, both saw increases in population as well as highway. Nonetheless, traffic grew respectively by 175% and 329%, a rate that is not match up with population growth. A Brookings article shows how even if the American Government decided to increase highways' capacity by three times, transit travel would increase as well by 11%.[169]

Urban sprawl and the new design of cities, which have been analyzed in the previous sections, deeply affect how much people have to drive, thus impacting congestion and traffic. People will have to travel less if their destination is closer to their house, so if urban development is clustered together, instead of extremely sparse. Moreover, walking or biking become more accessible. When construction is distributed around a highway, however, it results in longer trips and more cars turning on and off the corridor to reach destinations scattered along it, resulting in increased traffic on local roads as well as the area's freeways. [170]

The Texas A&M Transport Institute shows that basically every parameter for measuring congestion and traffic have steadily increased since 1982, from annual traffic cost, to delay per commuter to annual hours of delay. The same trend can be seen in other major metropolis of the country. One of the most important indicators of traffic is the travel time index (TTI), which is the ratio between the amount of time required to arrive at a specific destination with traffic, divided by the same route, but without traffic. In Los Angeles, the TTI in 1982 was 1.27, while in 2000 was 1.4.[171]

From the data show above, it is clear that in order to solve this problem, it is necessary to take a more holistic approach. Looking at urban planning and development, as well as public transport is necessary, along with nudging companies, facilities and stores to build their facilities in areas that are easy to access. It is important to incentivize the use of alternative modes of transport and disincentivize the role of the car.

An article written by Anthony Downs for Brookings, suggests some possible solutions for the problem. The first one is an idea close to congestion pricing, with the difference that

[169] DOWNS, ANTHONY. *Still Stuck in Traffic: Coping with Peak-Hour Traffic Congestion*. Washington, D.C.: Brookings Institution Press, (2004)

[170] Transportation for America, "How More Lanes and More Money Equals More Traffic Congestion" (March 2020), https://t4america.org/wp-content/uploads/2020/03/Congestion-Report-2020-FINAL.pdf

[171] Texas A&M Traffic Institute, "Congestion Data for Your City – Urban Mobility Report — Urban Mobility Information," Tamu.edu, 2019, https://mobility.tamu.edu/umr/congestion-data/.

it would be applied only to so called “High Occupancy Toll lanes”. This would require new lane building or convert existing underused lanes. Nonetheless, this may simply direct more traffic to other highways, worsening the problem. Moreover, following the concept of induced demand, the results may not be guaranteed.

Car accidents are another problem with congestion, and the author suggests that prompt intervention would reduce delays. Even though this could be beneficial, data from the National Highway Traffic Safety Administration show that since 1994, the absolute number of car crashes actually decreased, so it could be argued that accidents do not play a determinant role in congestion.[172]

An interesting solution would be to implement Intelligent Transportation Systems (ITS) devices which allows for increased efficiency of the existing highways and thus reducing congestion. It coordinates traffic supply and demand, allowing drivers to be more informed and make better decisions. The work of Cheng, Pang and Pavlou show that ITS could decrease congestion, contribute to annual savings of about $4.7 billion, decrease travel times, save fuel and reduce emissions.[173]

Another option would be to restrict the development of low-density areas and trying to reverse the trend towards suburbanization which have been the dominant one for the past 50 or 60 years. Also, Transit Oriented Development may be extremely beneficial. The main idea behind it is to cluster residential areas around public transport stops, so that people can more easily access buses, metros and other facilities.

A third option would be to follow the example of London or Stockholm and thus implement a congestion charge, or Paris, which reduced the number of lanes in the city center.

Finally, and probably most importantly, since the success of many of the policies described above depend on it, it is necessary to invest in improving public transport services by expanding their routes, making rides much more frequent, coordinate

[172] U.S. national Highway Traffic Safety Administration, “FARS Encyclopedia,”, https://www-fars.nhtsa.dot.gov/Main/index.aspx.

[173] Zhi, Cheng, Min-Seok Pang, and Paul A. Pavlou, “Mitigating Traffic Congestion: The Role of Intelligent Transportation Systems,” *Information Systems Research*, (May 21, 2020): 1https://doi.org/10.1287/isre.2019.0894

different transport services and overall transform the city away from the car-centric idea.[174]

3.1 The pressures against the current automobility paradigm – The social costs

Road transportation, since the beginning, has been linked to different issues connected to health and safety. As highlighted in the previous chapter, cars' emissions have been associated with air pollution, which can cause many different problems to humans' well-being. Sometimes its effects can also lead to premature death caused by various diseases. Both short and long-term adverse effects are possible, like for example cardiovascular diseases, respiratory issues, neurological complications, as well as respiratory infections in children or chronic bronchitis in adults.[175] Furthermore, the dangers are not only limited to the area where the emissions are produced, but they can travel even cross-continents.

More specifically, the transport sector, even though on average takes up a relatively small percentage of our time in the day (around 6%), is responsible for around a quarter of the total exposure air pollution. This data will definitely be higher for those that are forced to commute regularly and thus may be stuck in traffic for a good portion of the trip duration. During such times, they are forced to breath some of the other cars' exhaustions and emissions. Exposure has been found to be higher during peak-hours traffic than off-peak hours.[176]

Thanks to research on this topic, it is possible to state that cars' emissions represent one of the major contributions to total air pollution and exposure that can occur both inside the vehicles themselves, as well as outside for cyclists, pedestrians and residents.[177]

Unfortunately, unlike road causalities, it is hard to estimate precisely the portion of premature deaths or disease that are directly linked to air pollution, since it is the

[174] Anthony Downs, "Traffic: Why It's Getting Worse, What Government Can Do," Brookings (Brookings, 2004), https://www.brookings.edu/research/traffic-why-its-getting-worse-what-government-can-do/.
[175] Marilena Kampa and Elias Castanas, "Human Health Effects of Air Pollution," *Environmental Pollution* 151, no. 2 (January 2008): 362–67, https://doi.org/10.1016/j.envpol.2007.06.012
[176] Evi Dons et al., "Personal Exposure to Black Carbon in Transport Microenvironments," *Atmospheric Environment* 55 (August 2012): 392–98, https://doi.org/10.1016/j.atmosenv.2012.03.020
[177] Christer Johansson et al., "Impacts on Air Pollution and Health by Changing Commuting from Car to Bicycle," *Science of the Total Environment*584–585 (April 2017): 55–63, https://doi.org/10.1016/j.scitotenv.2017.01.145

cumulative effect of exposure that can lead to such problems and issues can appear after many years of prolonged contact with pollutants. Nonetheless, as shown in the previous pages, with the reported cases of New York in 1953 and 1966, the effects of heavy air pollution are evident.

Even though air quality has improved since the 70's, a lot still needs to be done and problems have not been permanently solved. Europe represents one clear example of work against air pollution, as new and more stringent standards for pollution were put in place since the early 2000s. For example, the categorization of Euro 2, 3, 4 etc. can be easily used to verify cars' emissions, the introduction of catalytic converter and the prohibition of selling petrol with lead. This metal was still present until 1996, and then forbidden due to multiple health risks. It can affect the nervous, immune, reproductive, cardiovascular systems, kidneys' health and decrease the capacity of oxygen transport of blood. Moreover, when children were exposed to it, behavioral problems, learning deficits and lower IQ levels were often observed. Moreover, lead residues can still persist in the environment for a long time, so that risks do not end with its ban from gasoline.[178]

Still, air pollution remains a public concern, which in the last few decades have received more and more attention both by the public, governments as well as scientists. More importantly, air pollution is pervasive and everywhere, thus affecting the whole population, not simply those that actually emit the emissions.

Hedley et al. estimated that 12 months after the establishment of specific policies against air pollution in Hong Kong, cardiovascular diseases were reduced by 2%, respiratory problem by 3.9% and all cause mortality by 2.1%.[179]

From the work of Kampa and Castanas, it is possible to understand all the major implications of air pollution. First off, the respiratory system can be harmed both due to long- and short-term exposure to pollutants. Symptoms can range from light, nose and throat irritation, to severe, like lung infections and cancers. The cardiovascular system is hit as well, since CO2 can bind with blood cells and reduce the transport of oxygen,

[178] US EPA,OAR, "Basic Information about Lead Air Pollution | US EPA," US EPA, March 17, 2016, https://www.epa.gov/lead-air-pollution/basic-information-about-lead-air-pollution.

[179] Anthony Johnson Hedley et al., "Cardiorespiratory and All-Cause Mortality after Restrictions on Sulphur Content of Fuel in Hong Kong: An Intervention Study," *The Lancet* 360, no. 9346 (November 2002): 1646–52, https://doi.org/10.1016/S0140-6736(02)11612-6

worsening the whole respiratory system. This can affect different organs, cause blood clotting, obstruct blood vessels. Many epidemiologists have also found an increase in mortality caused by ischemic heart diseases. Then, the nervous system can be adversely affected as well. This is especially true with lead, as state above, which can lead to impaired memory functions, blurred vision and affect children brain development. Other organs and systems can be affected too: urinary system, because of kidney damage or stone formation, digestive system, with gastrointestinal and liver cancer and reproduction apparatus, related with spontaneous abortion, reduce fetal gowth or congenital malformations.[180]

Another key factor to keep in mind is that in the last few decades, greenhouse gases levels have become extremely high, primarily because of human's use of fossil fuels, and this have a big impact on air pollution. The transport sector account for about 28% of total U.S. GHG emissions, making it the most prominent factor in the mix. Of that portion, 59% comes from light-duty vehicles, so personal automobiles.[181] The problem with greenhouse gases is that they trap heat and pollutants in our atmosphere, ultimately contributing to smog and air pollution.[182] So ultimately, the increase use of fossil fuel has the potential to increase the problems related to air pollution described above.

Moreover, the constant increasing use of cars, instead of other modes of mobility, contributes to a sedentary lifestyle, which has many implications for our health and well-being. Yan Yu and C. Mary Schooling, found that in 1970, the percentage of obese people (with a body mass index > 30), was 15.7%, which more than doubled in 2012 to 38.8% (even though some variability exists between ethnicity and gender). More interestingly, the study found that the incidence of obesity was greater among lower educational

[180] Marilena Kampa and Elias Castanas, "Human Health Effects of Air Pollution," *Environmental Pollution* 151, no. 2 (January 2008): 362–67, https://doi.org/10.1016/j.envpol.2007.06.012

[181] US EPA,OAR,OTAQ, "Carbon Pollution from Transportation | US EPA," US EPA, June 8, 2018, https://www.epa.gov/transportation-air-pollution-and-climate-change/carbon-pollution-transportation

[182]Christina Nunez, "Carbon Dioxide in the Atmosphere Is at a Record High. Here's What You Need to Know.," Environment, (May 13th, 2019) https://www.nationalgeographic.com/environment/article/greenhouse-gases

attaining individuals, which are often associated with lower wealth.[183] The CDC shows that in 2017, obesity rates reached 42.4%.[184] This proves that over the last decades average bodyweights of American citizens increased dramatically. The reasons for this are multiple and range from behaviors and genetics to lifestyle, dietary patterns and general physical inactivity. Even though car usage is not the only factor playing a role in this problem, it is definitely a very prominent one, since it encourages a more sedentary lifestyle. Obese people have higher risks of different diseases and problems, like all-cause mortality, diabetes, stroke, low quality of life, mental illness or hypertension. Moreover, obesity is not only a risk for the individual him or herself, but it poses also costs on the whole society as well, like for example higher costs of the health care system or lower productivity. It is estimated that in 2008, the medical care costs for obesity-related treatments were $147 billion dollars, while productivity costs ranged between $3.38 and $6.38 billion dollars.[185]

Car usage is not only linked to direct damages to the population, but it also has adverse effects on the environment. Problems like global warming, which cars' emissions represent one of the most important factors, can (indirectly) harm human beings as well, so it is important to highlight the risks and the potential damages. For example, severe weather events are becoming more and more common, and the main reason is due to higher global temperatures.

Another great risk related to the increased use of cars are accidents and crashes, which can result injuries as well as casualties. Worldwide, around 1.35 million people die because of road crashes and 20-50 million suffer injuries resulting from incidents, some of the resulting in long-term disabilities.[186] In the USA, 38,000 people die each year because of this issue, making it one of the leading causes of nonnatural deaths in the

[183] Yan Yu, "Four Decades of Obesity Trends among Non-Hispanic Whites and Blacks in the United States: Analyzing the Influences of Educational Inequalities in Obesity and Population Improvements in Education," ed. C. Mary Schooling, *PLOS ONE* 11, no. 11 (November 28, 2016): 1-12 https://doi.org/10.1371/journal.pone.0167193

[185] Centers for Disease Control and Prevention, "Adult Obesity Causes & Consequences," Centers for Disease control and prevention, 2018, https://www.cdc.gov/obesity/adult/causes.html.

[186] CDC, "Road Traffic Injuries & Deaths: A Global Problem," Centers for Disease Control and Prevention, November 14, 2019, https://www.cdc.gov/injury/features/global-road-safety/index.html.

country and around 4.4 million are injured.[187] Impaired driving caused by drugs and alcohol exacerbate the problem and increases the risk of car crashes and related incidents. Luckily, the trend has decreased since the 80's, but still, it is very dangerous. Alcohol-related car crashes that resulted in casualties, decreased from 53% in 1982 to 34% in 1997, which is the year with the lowest incidence. After that, it stayed relatively constant through the beginning of the 21st century. Throughout the decades, various legislations were passed, for example laws related to blood alcohol concentration and programs were funded in order to prevent such events, all of which helped decrease the incidence of the problem.[188]

Alongside with the dramatic loss of lives, road crashes pose a cost on society too. In 2018, for example, the cost of medical bills related to injuries due to road crashes amounted to $55 billion dollars.[189] More generally, the whole economic cost of crashes, in 2010, amounted to $242 billion dollars, including medical bill, loss in productivity, legal costs and emergency service costs, insurance costs and others.[190]

One of the biggest and most important revolution in preventing deaths and injuries during car crashes is the introduction of the seatbelt, and later on, its mandatory use. In 2010, it prevented 12,500 deaths and more than 300,000 injuries. The three-point seatbelt, as we all know it today, was first introduced in 1958, by a Swedish engineer named Nils Bohlin, which was hired by Volvo. Initially, U.S. automakers offered it as an optional, but in 1966, the U.S. Government made it mandatory to install seatbelt in every car model, even though it did not require people to use them.[191] For this reason, the National Highway Traffic Safety Administration (NHTSA), tried and later managed to pass

[187] Road Safety Facts — Association for Safe International Road Travel, Association for Safe International Road Travel, 2018 https://www.asirt.org/safe-travel/road-safety-facts/

[188] Chuck Kahane, "Statistical Analysis of Alcohol-Related Driving Trends, 1982-2005," (May 2008), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/810942.

[189] Centers for Disease Control and Prevention, "State-Specific Costs of Motor Vehicle Crash Deaths | Motor Vehicle Safety | CDC Injury Center," www.cdc.gov, (November 6, 2020) https://www.cdc.gov/transportationsafety/statecosts/index.html.

[190] Lawrence Blincoe et al., "The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised)," *Trid.trb.org*, 2015, https://trid.trb.org/view/1311862.

[191] Defensive Driving, "A History of Seat Belts - Defensive Driving," Defensivedriving.com, 2016, https://www.defensivedriving.com/blog/a-history-of-seat-belts/.

regulations aiming at installing devices that would put some kind of restraints to drivers when seatbelts were not latched, like for example buzzing sounds that warned.[192]
Another major safety device that helped save thousands of lives are airbags. The Intermodal Surface Efficiency Act of 1991, aimed at funding safety on the roads and required the instalment of airbags (which was ultimately postponed six years, so that automakers could have the time to comply). The invention was developed by John Hetrick in 1953, which proposed it to GM and Ford, which did not respond. At the time, the technology still had some flaws and imperfections, for example it could be dangerous for children which could actually be hit very hard, causing injuries and even death in some cases.[193] With time, airbags evolved and in 1967, Allen Breed added the sensor, making them much more reliable than before.
In the following years, safety became more and more a central issue, both for consumers and regulators, so that such devices became increasingly important factor in the purchasing decision.

In these pages, different social costs that the car imposes to our society have been alayzed. Our own health is affected in many different ways by vehicles, from smog and pollution that can cause several diseases and health problems as well as environmental issues, to increased sedentary lifestyle which enhances the obesity problem, to the deaths and injuries caused by car crashes.

3.2 The pressures against the current automobility paradigm – The push for a more sustainable model

As highlighted in the chapters regarding the oil crisis of 1973-74 and the rise of environmentalism during the 70's, the American market experienced a renewed interest for electric vehicles. Some attempts were made by car manufacturers, but unfortunately, the technology was not ready yet, so that there was not much

[192] Dave Roos, "When Americans Resisted Seat Belt Laws - HISTORY,"History.com (August 31st 2020), https://www.history.com/news/seat-belt-laws-resistance.
[193] History.com Editors, "Federal Legislation Makes Airbags Mandatory," HISTORY, November 13, 2009, https://www.history.com/this-day-in-history/federal-legislation-makes-airbags-mandatory.

competition with ICE vehicles. They had been the chosen technology various decades, since the 30's, while EVs were kept on the back burner for a long time. Issues with mileage, charging spots and speed were still unsolved.

Nonetheless, during the 90's it is possible to see a rise in popularity of the electric technology, pushed mainly by public interests on the environment, as more and more people came to understand the dangers of oil as well as government regulations like CAFEs and Clean Air Acts.

One of the pioneering states was California. In an article published by the New York times in 1989, the state announced a plan to reduce as much as two-third cars' emissions by the year of 2007, as well as aim to have one-quarter of all cars operating on clearer fuel by the year od 1997. From that year on, the portion of clean cars would have to increase, reaching the goal of 2007. Once again, automakers asked for the plan to be postponed, as such technologies would cost a lot more to produce.[194]

The Zero-Emission Vehicle (ZEV) program, put forward by the state of California in 1990, intended to push towards the 2007 goal. It required each car manufacturer to produce a certain number of full-electric, hydrogen fuel cell or plug-in hybrid vehicles, depending on the of cars sold in the state every year.[195] More specifically, the top seven car producers had to make at least 2% of their fleet emission free by 1998, a percentage that increased each year, up to 10% in 2003. Such requirements were often considered unattainable by car manufacturers. Nonetheless, they pushed carmakers to innovate. One of the first example of modern full electric vehicle was the EV1, produced by GM in 1996. It was not only revolutionary in the sense of power source, but also in more financial terms. This is because it could be purchased only on a lease program and became relatively popular during that time, even though the project died after few years. The public greeted nicely the introduction of the EV1, and many celebrities like Tom Hanks as well as Danny DeVito both went on national television to support the project.[196]

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[194] California Limits Sought for Smog, New York Times, December 15th, 1989

[195] California Air Resources Board, "Zero-Emission Vehicle Program | California Air Resources Board," https://ww2.arb.ca.gov/our-work/programs/zero-emission-vehicle-program/about.

[196] A. B. C. News, "Reporter's Notebook: Revenge of the Electric Car," ABC News, October 21, 2011, https://abcnews.go.com/Technology/reporters-notebook-revenge-electric-car/story?id=14787143.

As mentioned previously, the problem with mileage was still present. EV1's range was between 110 and 140 km on a full charge, which could take up to 15 hours, so that charging during the day may have been very impractical.[197]

Moreover, in an article which appeared in the New York Times in 1996, GM executives admitted that lead-acid batteries (which were used by EV1), were not adequate to store enough energy and guarantee longer ranges. While other companies tried to innovate with other type of batteries, like nickel, none of them were capable to be mass produced.[198] The EV1 lasted until 2003, when the producer decided to reclaim all the cars, since they were leased and destroy them. The main reason behind the failure were low-profit margins, niche market and higher than average production costs. Furthermore, along with other car manufacturers, GM tried to lobby the administration to postpone the ZEVs law, deemed unrealistic. Automakers spent lots of money in advertising campaigns in order to get other groups, like consumers and business, on their side.[199]

Moreover, the automaker, once even the state of New York, Massachusetts and Vermont threatened to adopt similar laws as ZEVs, decided to sue the state of California. GM's chief environmental officer said such revolution on a multi-state scale would cost the company hundreds of millions of dollars each year.[200] Once California backed off the mandate, the EV1 had not real economic reason to exist, at the eyes of GM.[201] The ZEV

[197] Aaron Brown, "Here's the Story behind GM's Revolutionary Electric Car from the 90s That Disappeared," Business Insider, March 16, 2016, https://www.businessinsider.com/gm-ev1-history-2016-3?IR=T#when-gm-began-recollecting-ev1s-for-demolishing-many-enthusiasts-came-together-to-give-their-piece-of-mind-and-attempt-to-put-a-stop-to-the-crushing-of-their-beloved-electric-cars-12

[198] Lawrence M. Fisher, "G.M., in a First, Will Sell a Car Designed for Electric Power ThisFall," timesmachine.nytimes.com, January 5, 1996, https://timesmachine.nytimes.com/timesmachine/1996/01/05/045497.html?pageNumber=10.

[199] Donald W. Nauss, "Big Three Escalate Attack on Electric Car : Pollution: Auto Makers Hope Anti-Regulatory Mood Aids New Fight against Zero-Emission Mandate.," Los Angeles Times, March 24, 1995, https://www.latimes.com/archives/la-xpm-1995-03-24-fi-46611-story.html

[200] John O'Dell, "GM Sues to Overturn State's Zero Emission Vehicle Mandate," Los Angeles Times, February 24, 2001, https://www.latimes.com/archives/la-xpm-2001-feb-24-fi-29699-story.html.

[201] Corey Singleton, "The Fascinating History of Tesla and the General Motors EV1," Medium, March 7, 2019, https://medium.com/pushtostart/the-fascinating-history-of-tesla-and-the-general-motors-ev1-f00e4af62f78.

was changed, giving more time to producers to adapt to the changing environment and manufacture no emission and lower emission vehicles.[202]

It should also be noted that the late 1990's and early 2000's was a time where vehicles like Hummer were extremely popular, which were not exactly environmental-friendly, as it was only capable of making 8km per liter of gasoline. So, GM recognized that EVs were costly, but more importantly it identified the SUV market as much more profitable, so that resources were simply shift from one project to another, following simple economic theory.

Nonetheless, the push for EVs did not stop with GM. Toyota in 1997 started producing the Prius, which was the first mass produced hybrid vehicle, capable of reaching 24 km per liter. Since that, Toyota kept innovating and transforming the Prius, making it more and more economical and efficient and increasing its sales year after year. The Japanese car maker was able to grow its share and in 2012 it peaked Prius sales with more than 236,000. Even though it was not fully electric, it still represents a big step forward for the time, also changing the perception of the electric power and challenging the stability of ICE cars.[203] Toyota and the Prius opened up a range of opportunities for other car manufacturers, proving that EVs and hybrids are viable alternatives. Subsequently, more and more companies decided to invest in this technology, and the options for hybrid and full-electric cars increase each year.

Another company that contributed to the popularity of electrics is Tesla. One year after its foundation, in 2003, it received a big investment by the entrepreneur Elon Musk, which then became CEO. Tesla not only managed to transform the EV into a luxury car, with the Model S or Model X, but managed also to get into the mass market with the Model 3. Moreover, thanks to its extremely fast charging technology, which widespread across the United States, it enables drivers to have up to 120km within 5 minutes, thus solving a problem that was present since the fast 1890's.[204]

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[202] Danny Hakim, "California Regulators Modify Auto Emissions Mandate," *The New York Times*, April 25, 2003, sec. U.S., https://www.nytimes.com/2003/04/25/us/california-regulators-modify-auto-emissions-mandate.html.

[203] Joe Clifford, "History of the Toyota Prius," Toyota UK Magazine, February 10, 2015, https://mag.toyota.co.uk/history-toyota-prius/

[204] Tesla Team, "Introducing v3 Supercharging," www.tesla.com, March 6, 2019, https://www.tesla.com/it_IT/blog/introducing-v3-supercharging?redirect=no

In the last decade, EV technology has improved significantly, guaranteeing greater mileage, faster charging and expanding the charging station network. Sales have increased exponentially. From 2013 and 2017, sales grew by 575%, as prices of such vehicles keep falling, since the main cost driver, batteries, have become cheaper.[205] IEA forecasts that EVs will reach the 125 million mark by 2030.[206]

Unfortunately, there are some important issues with electric vehicles. Nowadays, the great majority of manufacturers use lithium-ion batteries, which comes at a great cost. Both lithium and cobalt are key elements in the functioning of the batteries and since they are extremely rare, and often concentrated in few states, the mining process have deep consequences, both on the environmental, social and economic level. Moreover, such elements have been deemed of extreme importance in terms of national and economic security by the American administration, adding geopolitical risks to the issues above mentioned.[207] This is because China, even though do not have important lithium or cobalt resources within its borders, actually refine and produce the highest amount of the two materials worldwide, thanks to its investments in countries where mines are abundant.[208] Currently, China controls about 80% of the cobalt refining sector and Chinese Tainqi Lithium owns about 51% of the world largest lithium reserve, which is located in Australia. Moreover, the country is currently aiming at owning more and more stocks in those mines.[209] It is estimated that eight of the fourteen largest cobalt mines in the Democratic Republic of Congo (DRC) are actually owned by the Chinese

[205] David Coffin and Jeff Horowitz, "The Supply Chain for Electric Vehicle Batteries" United States International Trade Commission, (December 2018), https://www.usitc.gov/publications/332/journals/the_supply_chain_for_electric_vehicle_batteries.pdf

[206] IEA, Global EV Outlook 2018 – Analysis - IEA, "Global EV Outlook 2018 – Analysis - IEA," 2018, https://www.iea.org/reports/global-ev-outlook-2018

[207] Department of the Interior Office of the Secretary, "Final List of Critical Minerals 2018," Federal Register, (May 18, 2018) https://www.federalregister.gov/documents/2018/05/18/2018-10667/final-list-of-critical-minerals-2018

[208] Abby R. Goldman, Frank S. Rotondo, and Jessica G. Swallow, "The Electric Vehicle Battery Supply Chain" (2019), https://www.jstor.org/stable/resrep22804.5?seq=1#metadata_info_tab_contents.

[209] John Xie, "How China Dominates Global Battery Supply Chain | Voice of America - English," www.voanews.com, (September 1, 2020) https://www.voanews.com/silicon-valley-technology/how-china-dominates-global-battery-supply-chain.

government.[210] Lithium is primarily extracted in Australia, Chile, Argentina, as well as smaller portion in Democratic Republic of Congo (DRC). On the other hand, around 60% of cobalt can be found beneath the soil of the DRC.[211]

Following the work of Al Barazi et al., it is possible to see that cobalt is becoming an extremely important resource. In the years between 2010 and 2015, global demand went from 65,000 tons to 90,000 tons. Moreover, it is expected that in 2025, it will grow to more than 155,000. Due to the demand, as well as political instability in the DRC, the price is extremely volatile, which affects the well-being of workers and citizens of mining areas. For example, between 2010 and 2015 the price fell below $23 per kg, while less than two years after, it grew to $44 per kg, representing an increase of more than 90%.[212]

Sovacool et al. studied the impact of mining such critical earth materials in the African country, highlighting the various implications, as well as the debate around e-waste.

Lithium, cobalt and other important metals are used for almost any kind of batteries, so that it is not only a problem related with EVs, even though its growth only makes it worse. The amount of batteries the world needs create an enormous amount of e-waste, which increases by eight million tons every year. Of that amount, only 20% is actually recycled, while the rest is just put in landfill, often in developing countries, where toxic agents can leak and get into the environment. Such phenomenon creates an interesting contrast where the highest demand of batteries comes from industrialized countries, which then dump the waste in developing states. Thus, some may argue that these "green" technologies are not as green as most people think.

The authors distinguish between large-scale industrial mining (LSM), which accounts for about 80% of the total production and small-scale mining in the country (ASM). The former type, often made possible by direct foreign investments by China for example, allow for better extraction techniques, higher degree of mechanization and automation.

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[210] OECD, "Interconnected Supply Chains: A Comprehensive Look at Due Diligence Challenges and Opportunities Sourcing Cobalt and Copper from the Democratic Republic of the Congo" (2019), https://mneguidelines.oecd.org/Interconnected-supply-chains-a-comprehensive-look-at-due-diligence-challenges-and-opportunities-sourcing-cobalt-and-copper-from-the-DRC.pdf

[211] Christian Thies et al., "Assessment of Social Sustainability Hotspots in the Supply Chain of Lithium-Ion Batteries," *Procedia CIRP* 80 (2019): 292–97, https://doi.org/10.1016/j.procir.2018.12.009

[212] Al Barazi, Siyamend, Näher, Uwe, Vetter, Sebastian, Schütte, Philip, Liedtke, Maren, Baier, Matthias, Franken, Gudrun, "Cobalt from the DRC – Potential, Risks and Significance for the Global Cobalt Market", vol. 53, (July 2017)

The latter, on the other hand, employ up to 98% of the total workforce, since investments in dedicated machinery is not possible, thus requiring higher number of workers than the other type. This comes at a risk, since it is dangerous and more labor-intensive to work in ASM. For example, Amnesty International has estimated that accidents are extremely common, like for example tunnels that collapse and bury workers alive. This is because cobalt mining unlike diamonds or other gems that can be individually extracted from rocks, require to remove entire blocks of matter at a time, increasing the risk of collapsing and falling onto workers. Moreover, when mining, people could often get exposed to dangerous metals like uranium, which could also contaminate the water people use for drinking or bathing. Frequent exposure to cobalt can cause lung problems, often called "hard metal lung diseases", respiratory issues, pulmonary diseases and many other health issues.[213] Other potential risks relate to deforestation in order to make space for mines, loss of biodiversity (linked to deforestation and water contamination), air pollution, soil erosion, land instability and ground subsidence, due to the tunnels digging. Furthermore, since the mine sector represent such an important part of the total GDP of the country, it offers lots of job opportunities to people, which may actually build new cities and communities close to the mines. Such communities have to live day after day in close proximity with these hazardous materials. The study stresses the condition of women too, since they are often forbidden to mine, so that job opportunities that could enrich them, are prohibited. Nonetheless, they perform other tasks, like for example cleaning, processing, trading as well as prostitution. Lack of hygiene and promiscuity can serve as a perfect method to spread diseases and infections too.[214] This risk is exacerbated by the fact that the country has one of the highest rates of malaria and HIV infections of the continent.[215]

[213] Amnesty International, "This Is What We Die For, Human Rights Abuses In The Democratic Republic Of The Congo Power The Global Trade In Cobalt", (2016)
[214] Benjamin K. Sovacool, "The Precarious Political Economy of Cobalt: Balancing Prosperity, Poverty, and Brutality in Artisanal and Industrial Mining in the Democratic Republic of the Congo," *The Extractive Industries and Society* 6, no. 3 (July 2019): 915–39, https://doi.org/10.1016/j.exis.2019.05.018
[215] KPMG Global Mining Institute, "Democratic Republic of Congo - Country Mining Guide" (2013)

The problem with exploitation of child labor is known in developing countries, but in the case of such jobs, the risks are much higher, especially because nearby schools are not always present.

Toxic metals that are the result of mining could impair and endanger the physical and mental development of children, which are also often employed in mines. Working in mines expose children to multiple abuses and violence, force them to use dangerous tools and carry heavy loads, all of this while working long hours. In a survey of 150 mines all based in the Katanga region, it has been calculated that 23% of children living there, work in the mining sector, putting them at risk of death or serious injuries.[216]

Another issue underlined by the paper relates to ethnic, racial and status class inequalities, which are worsened. Because of the richness of the soil, and the weakness of the central government, civil wars and conflicts that aim to control such mines are not uncommon. This exacerbates poverty, inequalities and creates lead many to become refugees in the close countries. A publication by International Alert and founded by the European Union, described the current commerce of such materials as oligopolistic, from which only a small group of people, typically government officials and army officers, benefit. Moreover, these elites have been deemed violent and criminal.[217]

This is mainly because such resource represents one of the most important in the whole country, thus the control of mines is a very desired. Furthermore, the presence of multiple armed militant groups and the high rate of corruption, does not help keeping political stability.

Certain ethnic groups, like pygmies are not employed in mines, as well as other groups, which mining bosses refuse to hire.[218]

Adding to these problems, there is the environmental issue. For example, the extraction process consumes large amount of water. The lithium extraction needs about 500,000 gallons of water per metric ton of lithium. In the region of Salar de Atacama in Chile,

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[216] Benjamin Faber et al., "Artisanal Mining, Livelihoods, and Child Labor in the Cobalt Supply Chain of the Democratic Republic of Congo Center for Effective Global Action Policy Report" (2017), http://cega.berkeley.edu/assets/cega_research_projects/179/CEGA_Report_v2.pdf

[217] International Alert, "The Role Of The Exploitation Of Natural Resources In Fuelling And Prolonging Crises In The Eastern DRC", (January 2010)

[218] Benjamin K. Sovacool et al., "The Decarbonisation Divide: Contextualizing Landscapes of Low-Carbon Exploitation and Toxicity in Africa," *Global Environmental Change* 60 (January 2020): 1-16, https://doi.org/10.1016/j.gloenvcha.2019.102028

mines consume more than half of the regional water supply, leaving local agricultural activities undersupplied and endangering jobs and food security. Considering that the area is particularly dry, the issue become even more prominent. As stated above, toxic agents can leak into the water and the soil, leading to their contamination, which ultimately hit livestock and local people.[219]

A report by the UNCTAD, explored the effects of mining. Cobalt mines can expose the environment to the process of acid mine drainage, which takes place when sulfuric acid gets in contact with air and water. This phenomenon can destroy rivers and lakes alongside with their wildlife. The use of explosive is also very common, which has the drawback of creating and pushing dust into the atmosphere, which could cause health problems to local communities.[220]

Another very important document helps explain the dangers of mining exploitation in developing countries. Faber et al. analyzed the conditions of people working in cobalt mines in DRC. The authors found that even though the sector offers job opportunities to a large portion of the population, many times the earnings almost equal households' spending, keeping people in a state of poverty. Workers are able to keep a very small share of the revenues generated by their work. With a mean monthly household income of about 22 USD and mean monthly expenses of about 20 USD. Researchers found that households have only about two months' worth of savings cash. Moreover, since the working team are typically relatively small, opportunity for labor organizations and higher bargaining power is almost non-existent, impeding them to have better working conditions. As said before, due to poverty, families have to rely on children to work as well, keeping them away from schools, which could better their education, hoping for a better future. Furthermore, the study suggests that cutting children off working in mines could endanger the economic situation of families, leading to a vicious cycle which becomes harder and harder to break.[221] This is because even though the work is

[219] Amit Katwala, "The Spiralling Environmental Cost of Our Lithium Battery Addiction," WIRED UK (August 5, 2018), https://www.wired.co.uk/article/lithium-batteries-environment-impact

[220] UNCTAD, "Developing Countries Pay Environmental Cost of Electric Car Batteries | UNCTAD," unctad.org, July 22, 2020, https://unctad.org/news/developing-countries-pay-environmental-cost-electric-car-batteries

[221] Benjamin Faber et al., "Artisanal Mining, Livelihoods, and Child Labor in the Cobalt Supply Chain of the Democratic Republic of Congo Center for Effective Global Action Policy Report" (2017), http://cega.berkeley.edu/assets/cega_research_projects/179/CEGA_Report_v2.pdf

extremely dangerous and the wages are not very high, mines represent a job opportunity for a very large portion of the population, that otherwise may be unemployed. Moreover, in those sites where LSM exist, general living conditions are improved. This is because in order to function properly, additional infrastructure is needed, like for example roads, shops, housing, bridges and others. Also, schools, public health services, drilling wells and other facilities important for the population are built. These improvements provide positive spillovers in other areas, namely economic opportunities, better healthcare, education and others.[222] Unfortunately, as described above, the great majority of the workforce in employed in ASM, not LSM.

Finally, another very important factor to consider is that not all electricity produced to charge cars come from renewable resources.[223] Even though their portion keeps increasing, the majority of electricity is produced using fossil fuels, contributing to the various problems highlighted in the previous section, like in the chapter of the oil crisis of 1973-74.

It is clear that with all things considered, the current EVs have some limitations too and may not be the solution to all mobility problems.

3.3 The resistance supporting the current automobility model

The automotive industry is an economic sector that produces large amount of wealth for countries, contributes for a large portion of national GDPs and give jobs to hundreds of thousands of people. The German automaker sector accounts for around 5% of the GDP of the European country. This is not only the case for Germany, but other great examples are France, USA, Japan, Italy or South Korea, all of which have important auto manufacturers.[224]

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[222] Benjamin K. Sovacool, "The Precarious Political Economy of Cobalt: Balancing Prosperity, Poverty, and Brutality in Artisanal and Industrial Mining in the Democratic Republic of the Congo," *The Extractive Industries and Society* 6, no. 3 (July 2019): 915–39, https://doi.org/10.1016/j.exis.2019.05.018

[223] Center for Climate and Energy Solutions, "Renewable Energy | Center for Climate and Energy Solutions," Center for Climate and Energy Solutions, November 2017, https://www.c2es.org/content/renewable-energy/.

[224] Joe Miller, "Why Germany Should Be Wary of a Catch-All Car Industry Bailout," Financial Times, (September 17, 2020), https://www.ft.com/content/a2c76c43-0f20-4aa3-a710-c135957d5e2a

Moreover, the whole supply chain is extremely long and complex, thus having deep ramifications in other industries, like for example steel, glass and oil, which could lose a big portion of their revenues. It has been analyzed in the first chapter how much the development of the car industry had positive spillovers in other industries. This is valid today as well, and probably such impact has become more prominent. Furthermore, the whole business model builds on economies of scale, so that extremely high car production number and sales are necessary in order to make the sector prosper. This is because in order to achieve certain price levels, high efficiency, coordination and more importantly numbers need to be achieved.

Thus, it is clear that a revolution in the sector is very difficult to happen and oppositions are present. Car sales data do not show any important downturns, but actually it is a growing sector, also thanks to electrification trends.

A review by the AAPC "State of U.S. Automotive Industry", drawn in 2020, helps giving the idea of the importance of the sector for the United States, even though some of the notions presented could be extended to other similar countries too.

First off, it is the largest manufacturing sector in the country, contributing to about 3% of the total GDP. It is also the largest exporting industry, considering that one every five cars produced goes overseas. It is one of the most important drivers of R&D efforts, thanks to its very high spending on the matter, thus pushing innovations, which could be helpful in other fields as well. For example, growing interest in new power sources has increased investments in EVs, making the battery better. Such innovations have potential applications for all devices using a battery. In 2018, car companies and their suppliers spent $23 billion dollars in research and development.

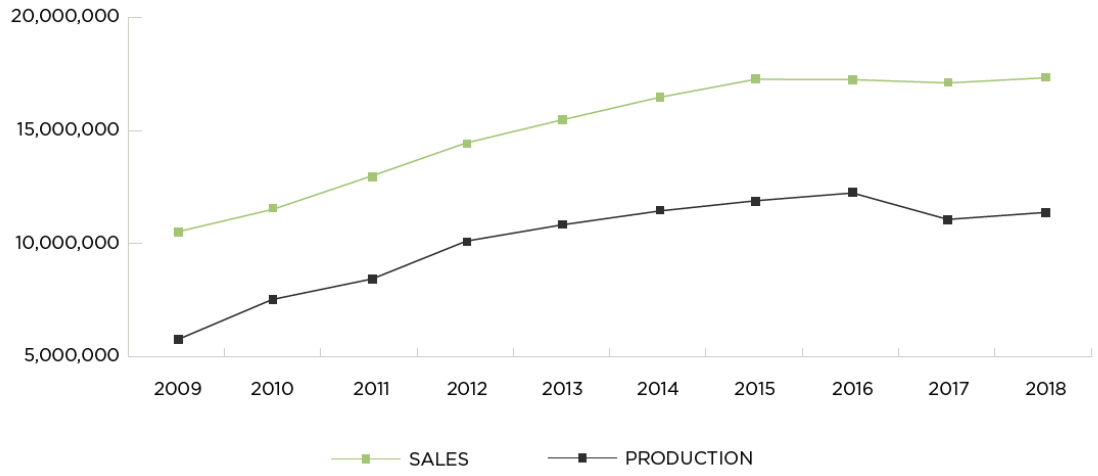
As stated above, the sector help hundreds of thousand people finding a job. Considering both automakers and suppliers, between 2011 and 2018 almost 130,000 jobs have been created across the country, representing a 50% increase in eight years. This is possible thanks to the extremely long supply chain of such products, that involves many different kinds of companies and stretches between various industries. Overall automakers, suppliers, dealerships and other related business represent more than 7.25 million jobs in the American job market, 64% of which are held by FCA, Ford and GM, increasing the importance (and the power) such enterprises have. The importance of the sector can also be seen in terms of the resources used as bailouts in periods of crisis. In the wake

of the 2008 financial crisis, the Bush administration announced loans for more than $17 billion for GM and Chrysler alone.[225]

More resources were added in the period between 2008 and 2014, for a grand total of $80.7 billion for the whole automotive industry.[226]

The industry has also been financially helped by tax breaks, infrastructure development and other kinds of incentives and investments, that have reached $17 billion since 1976.[227] In recent years, similar requests have become more common, claiming that such incentives are necessary in order to produce mass quantities of electric cars, especially after the COVID-19 pandemic.[228]

The demand for cars does not seem to decline. Since 2009, sales have increased substantially (+66%), reaching 17.5 million in 2018. Even though similar growth won't probably happen again the next future, estimates show that there won't be a decline in sales or production figures.[229]



[225] Mike Allen and David Rogers, "Bush Announces $17.4 Billion Auto Bailout," POLITICO, (December 19, 2008), https://www.politico.com/story/2008/12/bush-announces-174-billion-auto-bailout-016740.
[226] Kimberly Amadeo, ed., "Was the Big 3 Auto Bailout Worth It?," The Balance, (2019), https://www.thebalance.com/auto-industry-bailout-gm-ford-chrysler-3305670
[227] Reuters Staff, "Factbox: U.S. States Woo Automakers with $17 Billion in Subsidies since 1976," *Reuters*, (August 4, 2017), https://www.reuters.com/article/us-toyota-mazda-jobs-factbox-idUSKBN1AK2BI
[228] Reuters Staff, "Factbox: U.S. States Woo Automakers with $17 Billion in Subsidies since 1976," *Reuters*, (August 4, 2017), https://www.reuters.com/article/us-toyota-mazda-jobs-factbox-idUSKBN1AK2BI.
[229] American Automakers AAPC, "US Economic Contributions," US Economic Contributions | AAPC, (2020), https://www.americanautomakers.org/us-economic-contributions

Car sales and production data from 2009 to 2019.

Moreover, one market that is expected to grow substantially in the future is the alternative fuel vehicles, like pure electric, hybrid or plug-in. Following a report drawn up by PwC, total market share will grow up to 8.5% in 2022, due to increasing global emissions, oil prices and consumers increasingly more interested in such vehicles.[230]

This is particularly true for developing countries. One clear example is China. The country has experienced unmatched growth since the last couple of decades and the automotive section does not make exception.[231] In 2005, sales reached 5.7 million, while in 2017, the number reached a peak, with 27.5 million sales.[232] Between 2005 and 2011, the Chinese automotive sector grew at a compounding average 24%, following a report drawn by the consulting company McKinsey. Moreover, a considerable portion of the consumers, already purchased their entry-level car, so that many are considering upgrading to higher-price cars.[233] A very interesting trend in the country relates to electrification and new-energy vehicles. China in this moment, represents the biggest and most promising market in the world for such cars. Reuters wrote that sales of full-electric and hybrid cars are expected to rise to 20% by 2025, and 50% by 2035, from just 5% of 2020. More importantly, 95% of that would be electric, and the rest hybrid. For this reason, Chinese investments in lithium and cobalt mines are so important.[234]

One of the main reasons for the expanding market of new energy vehicles, relates to many state's incentives and subsidies, both for producers and consumers as well as carbon emission restrictions that helped the growth of this market sector.

Another country where car sales keep increasing is India. Even though the growth is not the same as China, it is still remarkable. In 2005, 1.4 million cars were sold, and the peak

[230] PwC, "Global Industry Trends & China Market Update" (December 2016), https://www.pwccn.com/zh/automotive/promising-industry-1.pdf.
[231] Trading Economies, "China Total Vehicle Sales 1997-2021 Data,", TRADING ECONOMICS, (November 11, 2019), https://tradingeconomics.com/china/total-vehicle-sales.
[232] Country and Bart Demandt, "China Car Sales Data," carsalesbase.com, (January 29, 2017), https://carsalesbase.com/china-car-sales-data-market/.
[233] Arthur Wang, Wenkan Liao, and Arnt-Philipp Hein, "Bigger, Better, Broader: A Perspective on China's Auto Market in 2020" https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/automotive%20and%20assembly/pdfs/mckinsey%20%20perspective%20on%20chinas%20auto%20market%20in%202020.ashx.
[234] Reuters Staff, "China's NEV Sales to Account for 20% of New Car Sales by 2025, 50% by 2035," *Reuters*, (October 27, 2020) https://www.reuters.com/article/us-china-autos-electric-idUSKBN27C08C.

was reached in 2018, with almost 4 million vehicles sold. Since then, it has been recorded a contraction in car sales, nonetheless estimates see growth in the future. Goldman Sachs forecasts that India will become the third largest market by 2025. Projected sales in India 2025 will be 7.4 million, while in China there will be more than 35 million cars sold.[235]

In order to maintain the status quo, throughout car's history, producers have constantly tried to oppose, delay and change regulations that could in any way, harms their business. As highlighted in the previous chapters, environmental laws are a prime example of the lobbying action of automakers, which often managed to delay emission requirements. The same strategy has been employed in the last few decades, in which environmental concerns, both by the public opinion and governments have increased substantially. For example, the Guardian discovered that since 2015, the main car producers, like FCA, BMW, GM and others, have been actively trying to lobby against the achievements of the targets set in the Paris agreement. According to the article, the sector sought to influence governments' environmental agendas and delay the introduction of stricter regulations and emission standards. While on one hand, many try to show their effort towards greener solutions by producing some electric vehicles, most of their spending is still devoted to conventional gasoline-powered solutions. Thus, it is possible to state that these are great examples of greenwashing. This is a marketing strategy that involves portraying to the public the image of being deeply involved in the environmental cause, but actually, it is only a façade, as the efforts made represent only a small portion of the business. The article continues with the example of Ford, which refused such accusation stating that it agreed to increase gas mileage in California.[236] Even though this shows some kind of commitment, it still is not enough. The article presented is based on a study developed by InfluenceMap, a research group, which discovered that among the most influencing corporation which are opposing policies aimed at reducing the impact of climate change, six were car companies, while the

[235] Goldman, "Goldman Sachs | Cars 2025," Goldman Sachs, (2010), https://www.goldmansachs.com/insights/technology-driving-innovation/cars-2025/.
[236] Sandra Laville, "Climate Crisis: What the Carmakers Have to Say," *The Guardian*, (October 10, 2019) https://www.theguardian.com/environment/2019/oct/10/climate-crisis-what-carmakers-say.

remaining pertained to the oil and gas industry.[237] From those six, FCA has been deemed the most influential, which along with Ford and GM have supported the revision of CAFE standards. While these car automakers claim to be in line with environmental agendas, it should also be noted that emissions from new vehicles have actually increased, mainly due to increased interest in the SUVs market.[238]

According to an article wrote by Pete Bigelow, a reporter investigating mobility issues, the automotive industry spent almost $70 million in lobbying actions, trying to aid their agenda, in the year of 2017 alone.[239]

Lobbying efforts are present in Europe as well. For example, Volkswagen was reported to have spent more than €3 million in 2014 in lobbying actions.[240]

Such efforts are even mon prominent when it comes to the oil and gas industry, whose aim is to postpone as much as possible the achievement of the targets agreed in the Paris Agreement. Niall McCarthy published an article on this subject on Forbes, stating that the whole industry spends on average more than $200 million in order to avoid implementation of environmental policies. BP's expenditure is the highest with $53 million, followed by Shell, ExxonMobil, Chevron and Total. The author states that their efforts are toward both the general public and politicians. Aiming at creating traction against climate change support.[241]

Sandra Laville wrote a similar article on the Guardian, supporting the idea that involved companies are using social media platforms to push their agenda, fighting back against climate change proponents and promoting the use of fossil fuels. The author also

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[237] InfluenceMap, "Corporate Carbon Policy Footprint - the 50 Most Influential," influencemap.org, https://influencemap.org/report/Corporate-Climate-Policy-Footpint-2019-the-50-Most-Influential-7d09a06d9c4e602a3d2f5c1ae13301b8.

[238] Sandra Laville, "Exclusive: Carmakers among Key Opponents of Climate Action," the Guardian, (October 10, 2019), https://www.theguardian.com/environment/2019/oct/10/exclusive-carmakers-opponents-climate-action-us-europe-emissions.

[239] Pete Bigelow, "Here's How Much the Major Automakers Spend on Government Lobbying," Car and Driver, (May 30, 2018), https://www.caranddriver.com/features/a20879691/heres-how-much-the-major-automakers-spend-on-government-lobbying/.

[240] "Power of Car Industry Lobby Makes Scandal Inevitable | Corporate Europe Observatory," Corporate Europe Observatory, https://corporateeurope.org/en/power-lobbies/2015/09/power-car-industry-lobby-makes-scandal-inevitable.

[241] Niall McCarthy, "Oil and Gas Giants Spend Millions Lobbying to Block Climate Change Policies [Infographic]," Forbes, (March 25, 2019), https://www.forbes.com/sites/niallmccarthy/2019/03/25/oil-and-gas-giants-spend-millions-lobbying-to-block-climate-change-policies-infographic/?sh=487f8c2f7c4f.

underlines that in 2019, oil companies' operating investments will increase by $115bn, with only 3% of that dedicated to low carbon options.[242]

Another time when the automotive industry tried to avoid regulations relates to the so-called Dieselgate and the Volkswagen group. In 2015, the EPA accused the German automaker to have faked emissions levels of its fleet. Even though this case does not relate to lobbying action, it still represents an instance where the car industry actively tried to bypass environmental regulations. In total, there were eleven million vehicles globally that did not respect set standards. On July 2017, the Dieselgate, which started in the USA, arrived in Europe as well and the European antitrust began investigating the case. Later that year, many of the members of the boards were accused and arrested for fraud.[243]

A further problem with current auto production relates to its delocalization. This is a very common phenomenon typical of the last several decades, which especially thanks to the opening of new markets had the opportunity to flourish.

Thanks to the work of Hammami et al. it is possible to really understand what delocalization is, its implications and why this is such a common strategy employed by numerous kinds of industry, from which the automotive as well. First off, delocalization is employed in order to gain some kind of advantage against the competition, which can be derived from lower tax regulations, lower labor costs, lower supplier costs or other cost advantage or efficiency outcomes. This is achieved through foreign direct investments (FDI), which transfer either partially or totally, the production process from a country to another, typically from developed to developing countries, without affecting the final product or service. If production is only transferred partially, the firm needs to carefully decide which production step to decentralize and which to retain, evaluating the possible trade-offs, like for example transportation costs, technological costs and other. So, it can be advantageous for the company, because of the reasons state above, but the state hosting the firm can benefit as well. Such countries accept FDI

[242] Sandra Laville, "Top Oil Firms Spending Millions Lobbying to Block Climate Change Policies, Says Report," The Guardian, (March 22, 2019), https://www.theguardian.com/business/2019/mar/22/top-oil-firms-spending-millions-lobbying-to-block-climate-change-policies-says-report.

[243] Corrado Canali, "Dieselgate Cinque Anni Dopo. La Storia Dello Scandalo Volkswagen Che Ha Fatto Tremare Il Mondo Dell'auto," Il Sole 24 ORE, (September 18, 2020), https://www.ilsole24ore.com/art/dieselgate-cinque-anni-dopo-storia-scandalo-volkswagen-che-ha-fatto-tremare-mondo-dell-auto-ADVAlBq

because they aim to decrease unemployment, get know-how and insight knowledge and more generally, enhance internal industry. For such reasons, they offer advantageous conditions to companies. The prime example, especially in the last decades, is China, whose labor cost is particularly competitive when compared to others. Easter Europe or Norther Africa are perfect examples as well. Most recently, Poland has received important FDIs, from FCA and Volkswagen. For example, the former decided to place production of lower-range cars in Poland, like for example Panda, while retaining production for premium models.[244] Hammami highlights four kinds of delocalization strategies, all with their gains and flaws and different targets. Namely centralized strategy, decentralized purchasing strategy, decentralized distribution strategy and decentralized strategy, whose descriptions are outside the scope of this chapter, but still it should be noted that delocalization is not just one strategy, but actually there are different, all with important differences depending on the degree of autonomy delegated to the newly open subsidiary.[245] This phenomenon is very diffused in the automotive industry. This is due to its high competitiveness, the importance of economies of scale and the price component, more or less appealing depending on the cost structure of the manufacturer. FDIs in this sector are extremely common. Brazil for example has been receiving increasing attention from Volkswagen, BMW as well as Nissan, all of which have invested in the country. While companies can gain important advantages from such decision, there are some important social drawbacks that should be understood. For example, in order to attract car companies, countries need to be sure that they can offer low enough labor costs, so local citizens are often exploited in the production process for low wages, child labor is not uncommon and more generally working conditions are often sacrificed in order to offer better deals to foreign companies. Furthermore, environmental laws are often less strict that those in Europe or North America, so delocalization not only can imply important social costs, but environmental as well. For example, disposal of dangerous chemicals or materials does

[244] Today Redazione, "La Fiat Delocalizza in Polonia: 'via La Panda Da Pomigliano, Sarà Hub Dell'Alfa Romeo,'" Today, accessed May 14, 2021, https://www.today.it/economia/fiat-panda-polonia.html.
[245] Ramzi Hammami, Yannick Frein, and Atidel B. Hadj-Alouane, "Supply Chain Design in the Delocalization Context: Relevant Features and New Modeling Tendencies," *International Journal of Production Economics* 113, no. 2 (June 2008): 641–56, https://doi.org/10.1016/j.ijpe.2007.10.016

not always follow strict rules, so that it can become a public hazard for example resulting in soil or water pollution, the overuse of fossil fuels or natural resources which can enhance the problem with global pollution and global warming. Raquel Maria Rigotto, conducted an extensive research about the effects of delocalization in the county of Maranguape, in Brazil. The author found that, due to a precarious regulatory framework, risks for the population are important. For example, liquid waste can cause both soil and water pollution and toxic agents can be inhaled by adults and children, potentially causing important damages to their health.[246]

Moreover, developed countries, like Italy, Germany and Japan, where factories were previously placed, risk large number of job losses, putting at risk thousands of families. Other potential risks are transfer and possibly the loss of know-how, higher logistic costs, slowdown of domestic economic growth and possibly, lower capital investment in the country the loss in reputation of the "Made in" brand and the heritage component of certain products.[247] In Italy, it has been estimated that in 2010's, FCA decisions about delocalizing led to the loss of about 20.000 jobs, representing the industry that saw the biggest number of job loss.[248]

It should also be noted that as more and more companies build subsidiaries in other states, some of the taxes that would have been paid to a country is actually diverted to the hosting one, taking away revenue from the original state.

In this section oppositions to change have been analyzed. The automotive industry is an industrial sector which is too important for many different states. For this a complete restructuring could very be difficult to achieve and probably many politicians and observers in the public opinion will not find acceptable the loss in terms of wealth for the GDP, as well as the potential job losses that could occur. A second very important aspect that should be noted relates to lobbying actions, employed by all the parties

[246] Raquel Maria Rigotto, "Exploring Fragility: Industrial Delocalization, Occupational and Environmental Risks, and Non-Governmental Organizations," *International Journal of Environmental Research and Public Health* 6, no. 3 (March 5, 2009): 980–98, https://doi.org/10.3390/ijerph6030980.

[247] PwC, "Delocalisation in Foreign Countries Strategic Issues for Italian Companies Active in the Retail&Consumer Sector" (2021), https://www.pwc.com/it/it/publications/assets/docs/delocalisation-foreign-countries.pdf

[248] Salvatore Cannavò, "Delocalizzazione, in Italia Persi 34 Mila Posti Di Lavoro in Due Anni. Emorragia Dalla Fiat," Il Fatto Quotidiano,)February 25, 2012), https://www.ilfattoquotidiano.it/2012/02/25/lexport-del-lavoro/193679/.

involved in the supply chain, even though the most important examples come from car manufacturers and energy supplying companies, that could lose such a big portion of business. Finally, the strategy of delocalization has become more and more common, since it allows to save costs and thus increase margins. This comes at a cost, in terms of social exploitation of foreign labor and environmental resources for the hosting country, as well as loss of jobs and potentially even loss of knowledge and know-how in the original country.

Chapter 4 – The automobile discussion in Italy

This chapter will focus on the major issues that arose in the press around the automobile between the 60's up to the 80's. in order to do this, the discussion will be assisted by a car magazine, which is probably the most famous in the country, Quattroruote. The magazine started in 1956 and it is still present today, reporting all the important news about this topic. It is a great source in order to get insights in the public discourse of the time. As it will be shown in the further sections, the magazine was often critical of the policies put in place by the Government, when it comes to topics related to the car. This is true especially in the early days, in the 60's, as the country was still recovering from the war and the economic boom, which brought Italy at the same level of the most industrialized countries in the world, did not happen yet.

By reading the articles of the period, it is possible to understand that the most pressing issues were very much the same that arose in the United States. For example, concerns about safety, the price of oil and its alternatives, as well as some starting worries about smog and pollution. Furthermore, it is possible to see how the car developed in Italy, thanks to detailed data about sales. Finally, the chapter will be aided also by the work of Federico Paolini "Storia Sociale dell'Automobile in Italia", where the author traces the history of the automobile in the country.[249]

After the war, general consumption grew exceptionally fast, and the transport sector was an industry that benefitted extremely from this added wealth. From 1951 to 1975 it is possible to record a 745% increase in consumption for this sector, becoming a central expense in every Italian family. [250] Its importance in the monthly budget of Italian families grew more and more, becoming one of the most important expenses. In 1970, Italians spent 7% of their earnings for transport purposes, with the biggest portion of that percentage dedicated to the purchase of cars.[251] Just like in other countries, the car in Italy was seen firstly as a status symbol, but then it became more and more a staple item, something that was extremely hard to substitute, also considering the inefficiency

[249] Federico Paolini, "Storia Sociale dell'Automobile in Italia", (Carocci, 2007)
[250] Federico Paolini, "Storia Sociale dell'Automobile in Italia", (Carocci, 2007): 63
[251] Il 7% del reddito italiano speso nel '70 per i trasporti, Quattroruote, October 1971

of the public transport sector, that was not able to keep up with the increasing number of Italian citizens. In just a few decades after WWII, the car became a symbol of wealth and status, that many even began to idolize.

"Having a specific car model rather than another, is a symbol of prestige for many, and without it, some feel somewhat less important. It is not uncommon that people prioritize the purchase of a car, rather than other more essential and useful expenses. […] Some men, without a car, may feel lost on the other hand, when they have it, they feel fulfilled. This is way the car is almost seen as an idol." [252]

From the statements reported above, it is possible to see many similarities with the way in which the car has developed in the USA. From an overall object of admiration, there was a shift in terms of interest in the specific model. Moreover, the growth of the vehicle, led many people to prefer it to any other modes of transport, creating a society almost dominated by this single way of transport.

In just 20 years, the amount of cars in the country grew exponentially. From less than a million in 1956 to more than 16 million in 1978 and in 1990 it became the country with the highest number of cars per thousand citizens. [253]

Moreover, having a strong domestic car industry represented a reason to be proud of being Italian, so much so that, at least at the beginning, a certain level of aversion towards foreign cars existed, even though with the years passing by, imports grew steadily.

In 1964, 83.65% of the cars sold were manufactured by an Italian brand, 69% of which were Fiat, a share that increased by 7% in just one year.[254] A record high was reached in 1967, when the domestic car production represents 88.5% of the total sales for the year.[255] In that year, the most sold vehicle was the Fiat 600. The trend of Italian economy car lasted for a very long time and Fiat stayed almost untouched as the biggest car manufacturer of the country for quite some time. For example, Fiat 500 was the most common car from 1966 to 1969. Other companies were not able to reach such market and focused on more niche ones. Alfa Romeo was the second most important firm in

[252] Steno Siccoli, Il mito dell'automobile, December 1972
[253] Federico Paolini, "Storia Sociale dell'Automobile in Italia", (Carocci, 2007): 65
[254] Graduatoria delle Marche più vendute in Italia, Quattroruote, December 1964
[255] Andamento semestrale delle vendite di autovetture italiane e straniere negli ultimi sette anni, Quattroruote, Ottobre 1969

the industry, and in 1964 it sold nearly 3000 vehicles, while Fiat sold ten times that amount. [256] This was justified by the modest monthly wage salary, as well as the amount of taxes put on cars with a bigger engine.

Probably the peak was reached in 1967, after that, Fiat started to lose some ground to both domestic and international car manufacturers, also because general richness in the country increased, so needs and taste for cars changed. For example, in 1980, the portion of new matriculation of domestically produced cars were 60%, showing a decrease of more than 20% in about fifteen years. Furthermore, when general demand for cars diminished, imports were the ones that held up their position in the market. [257]

Another very interesting data which is possible to see from the magazine is the total number of cars in the country and its growth. in 1949, there were only 266.928 cars, in 1964 there were 4.7 million, an increase of 800.000 from the year prior, which testimonies the sharp increase in personal mobility of the 60's. At the end of the decade, the number almost reached the 10 million level, more exactly 9.1 million, making the country the fifth country with the higher number of cars.[258]

Taking into account the number of cars per citizens, it is possible to see that personal mobility was the strongest in the central and northern part of the country, leaving the south behind in this statistic. In Rome, Milan and Turin there was one car every four inhabitants. On the other hand, in Cosenza or Foggia, the number skyrocketed to one every fourteen citizens, with Enna taking the record: one every eighteen citizens.[259]

More generally, the central and southern part of Italy were far behind, when compared to the northern regions, with the great exception of Rome. In 1966, from the total amount of car registrations, almost 55% was located in the regions of the north, while the rest was equally divided between the center and the south.[260]

Some people, seeing the problem that arose with automobility, like for example the traffic and congestion, the delays in the development of the highway net as well as the taxes imposed on cars and related items, felt like there was a general anti-car sentiment among the government and other authorities, or at best indifference.

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[256] In sei mesi 116-503 vetture in meno, Quattroruote, December 1964
[257] Dario Ruffini, 1980: le straniere in Italia regione per regione, Quattroruote, November 1981
[258] Vent'anni di automobile in Italia, Quattroruote, November 1969
[259] Le automobili in circolazione nelle 93 province in Italia, Quattroruote, October 1969
[260] Statistiche dell'automobile, Quattroruote, April 1967

Furthermore, it should be noted that authors often praised foreign countries for the way they did handle some issue, sometimes even without any actual reason, as it is much easier to see other doing better without considering other necessary factors that may have led to such success.

Nonetheless, it is hard to believe that such feeling was actually present, considering the amount of resources spent on roads, the importance of the car in everybody's lives as well as the contribution of the automotive sector to the economy, both in terms of GDP and employment. Rather than anti-car sentiment, one could argue that the administration of the cities or highways were not adequate nor efficient. Nonetheless, it should also be pointed out that general taxation on the sector increased throughout the years. Probably some of the excises and toll were too harsh. Drivers were basically taxed twice: once for the car itself and a second time for the oil purchased. Governments understood that the car had become a staple, with a very inelastic demand, so that it could become an interesting source of revenue.

Still, everyone recognized its importance, economically and socially, so that even though taxes were high, everyone did benefit from it and an anti-car sentiment seems more of a stretch than actually based on facts. Moreover, looking at the economic impact of the industry would leave any doubt on the non-existent of such sentiment.

Nonetheless, in the magazine it is possible to find articles where authors wrote:

"It seems like a true conspiracy: after the arab-israeli crisis of the 70's, and the resulting measures adopted, leading to gasoline prices going up, there were a number of attacks against automobility from many different sources: urbanists, ecologists and politicians. It seems like every problem that we have, were created by the car."[261]

Also:

"We do not understand the aversion of our regulators to the car, which is one of the main sources of revenues for the state. In total, in 1974, the revenues coming from taxation on cars and their use amounted to 3.265,7 billion of lire, almost one fifth of the total."[262]

[261] Enrico Saraceni, Non congiura contro l'automobile chi l'ama, Quattroruote, June 1976
[262] Ma perché tanto odiate?, Quattroruote, December 1975

From Paolini's ", Storia Sociale dell'Automobile in Italia", it is possible to understand that such a position was carried out in order to achieve a high level of deregulation of the automotive sector. In April 1946, it was announced the "Day of the Automobile", where drivers asked for the abolishment of the driving license and the recognition of the freedom to drive everywhere, in order to spread the vehicle as much as possible. [263]
During the 80's, following the Swiss example, some requested the formation of an actual party of the drivers.
Moreover, from the work of Paolini, it is possible to note the fact that many politicians praised and appreciated the increasing level of motorization, often considering it as necessary. This was because, with the phenomenon of suburbanization, public transport was not able to satisfy the needs of citizens, as the distances between homes and workplaces increased. The only mode of transport that could do that, with enough speed was the car. Thus, almost everyone considered this technology as fundamental and necessary for the economic wealth and overall well-being of citizens, and so for the growth and progress of the country as well. [264]

4.1 The highway system

One of the first topics to be covered was the highway system. Reading the various editions of the magazine, it is also possible to affirm that it is one of the most important ones, given the fact that there are multiple articles in every single edition of Quattroruote. After the war, Italy had to rebuild most of its infrastructure, from which the highway too. Since the 60's, great importance was given to it, as a way to connect the whole country in an easy and fast way. This would have triggered gains in the economy, in terms of commerce and tourism, but also it could contribute to a more socially cohesive country. The whole motorway plan began in 1961, after the proposal of Amintore Fanfani. The so called "Piano Fanfani" dedicated enormous amounts of resources for the development of the highway net. Before it, going from Milan to Naples

[263] Federico Paolini, "Storia Sociale dell'Automobile in Italia", (Carocci, 2007): 109-116
[264] Un sì al partito degli automobilisti, Quattroruote, July 1985

would have been considered almost an adventure, due to the bad conditions of urban and suburban roads. With highways, such a journey became much easier.

From a discourse by Aldo Moro, it is possible to grasp the (initial) need to coordinate the growth of local roads and the national highways, so that each location in the country could be easily accessible. Unfortunately, such principle was not central in the Fanfani plan.

"The big highways will need to be integrated with the rest of the national traffic mobility, […] and avoid concentrating it on a much smaller radius. […] Without such coordination, the social advantages that the highway could bring, would be of a much lesser importance".

Italy was beginning to enter the set of countries with the most developed economy and this brough much joy and proudness among its citizens. The speech continued:

"We are proud of such venture, which symbolizes the Italian dynamism and its ability to work, develop and advance, adjusting to the other more modern and civilized countries of Europe and the world."[265]

The differences between the north, center and the south have always been pretty deep, and after the war, disparities worsened. As the northern part was beginning to become more and more industrialized, the so called "Questione Meridionale" (Southern Issues), was relevant more than ever. Thanks to the highway and the development of the car, this problem had the chance to decrease.

The highway sector was one of the first to receive large amounts of funds after the war. From Paolini's work, it is possible to see that its development was not centrally coordinated, as hoped by Aldo Moro, but rather each road was built without taking into consideration the others, almost independently.

Much of the work's responsibility was given to the ANAS company which, due to its too frequent delays and mistakes, was frequently criticized in many articles. Roads were often too narrow, so that congestion would form in some locations. Another consequence of poorly maintained streets was the increasing the number of potential hazards and accidents. Moreover, the great majority of the highway was still concentrated in the northern part of the country. An interesting photo published in the

[265] Dal discorso del on. Moro, Quattroruote, November 1964

magazine in September 1966, shows the state of the art of the highway system in Italy. In the south, there were only some small parts of the Salerno-Reggio Calabria, the Autostrada del Sole and Canosa-Bari highway. An opposite situation could be found in the north, especially in the west part, where the concentration of roads was very high, and the regions were well connected.[266]

From a report it is possible to see that at the end of 1963, 1.430 km were built and active, but more and 2.400 km were not even started.[267] The remaining parts were then completed in the first few years of the 70's.

The discussion about the highway, and more generally roads was not always positive. Some were worried about the potential (indirect) impact of the highways on the beauty of the regions. This was because factories, warehouses and other enterprises that would have benefitted from such ease of transport, could have been built nearby, thus ruining the landscape. [268] The same could be said for new streets. This can also be understood from a letter of a former Turin citizen that after some years came back to the city:

"What a shame! All the greenery and vegetation are gone, leaving space for traffic: seeing the city so dirty makes me feel so disappointed." [269]

As suggested above, many were disappointed by the work of ANAS and the other authorities in the matter.

For example, a reader sent a letter to Quattroruote complaining of the state of the Serenissima Highway. Mr. Gismondi told the editors that the road was very unsafe. He recorded many car failures and accidents, caused by drivers that did not drive safely or cautiously, as well as because of the novelty of the technology, which many people were not used to. The author of the letter shows a level of dissatisfaction with the service which was probably shared by many Italians that had to use highways on a daily or weekly basis.[270] Moreover, due to its high toll costs, it is possible to say that users had every right to protest for such a service that was often expensive, but with many flaws.

[266] La situazione austradale, Quattroruote, September 1966
[267] Situazione autostradale attuale e programma per il prossimo quinquennio, Quattroruote, November 1964
[268] Il paesaggio lungo l'autostrada del Sole, Quattroruote, February 1965
[269] Chi restituirà l'antico incanto di Torino, Quattroruote, December 1972
[270] Le Magagne della Serenissima, Quattroruote, November 1964

Quattroruote, in an article published in December 1965, addressed the topic with a letter directed towards the Budget Minister, Giovanni Pieraccini. In the message, the author criticizes the government for its five-year plan of infrastructure development that did not take into account the needs of the country, but on the other hand was more focused on fulfilling political objectives. As it can be understood from "Transport and the Environment in Italy (1956 – 2006), written by F. Paolini, since the beginning of the motorization age, the relations between politics, the industry and other public administrations were very tied together. Thus, it is possible to say that the plan could have been laid down in order to get political benefits from it.[271]

The letter continues raising concerns for the Salerno-Reggio Calabria motorway section, which would be of fundamental importance for the growth of the Southern regions, but constant delays, lack of funds and changes of plan impeded a fast development. It took many decades for the whole motorway to be fully completed.

To show the inefficiency of the authorities, it should be noted another event. The article continues by highlighting the decision to build (at least in the beginning) only one lane in the certain parts of the section, instead of two lanes. This negatively impacted the flow of traffic and thus the efficacy of the sections. The main reason for this change of plan, was economic: the actual costs of the development were higher than early estimates and the state had difficulties in collecting additional resources.[272]

This motorway became the symbol of incompetence and inadequacy for many years and many articles were written about it. Since the works started in 1962, two years later only 30 were actually built, leaving more than 400 still to go.

The lack of central coordination mentioned above can be noticed also in "L'Adriatico si Avvicina a mezza Italia", where the initial excitement for the new highway section was immediately tamed by the lack of easy and fast access from the Bologna-Rimini highway to the Autostrada del Sole.

"Today, the Bologna-Rimini highway is like a beautiful woman whose beauty is impaired by a mole. That mole is the lack of an efficient link with the Autostrada del Sole and the urban traffic circulation of Bologna".[273]

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[271] Federico Paolini, "Transport and the Environment in Italy *(*1950-2006*)",* (2012): 220-221

[272] Una Mezza Porzione di Autostrada, Quattroruote, February 1965

[273] L'Adriatico si avvicina a mezza Italia, Quattroruote, July 1966

Even if there were many problems, it should be noted that the Italian system was still pretty developed, when compared to its European counterparts. In absolute terms, Germany was the first and Italy in second place. Nonetheless, there was still one issue that not many people covered. Italian politicians preferred to develop the highway net before the thousands of little urban and rural roads, that were extremely old and inadequate for modern traffic flow. An article wrote by Gianni Mazzocchi, highlights this contradiction. While in the 30's, the cars were not even 200.000, the number grew very rapidly in the 60's, becoming around six million, so that roads that were once acceptable, became unpractical for the number of drivers. It should be noted that on average, Italian people used much more secondary streets and roads, whose conditions, as highlighted above were not satisfactory, rather than highways. So, the policy of preferring highway development, rather than any other roads, was not really justified.[274]

It could be speculated that the decision to prioritize motorways rather than other kinds of road was rather political. This is because a widespread and developed highway net was a symbol of advancement for the whole country. Thus, Italy wanted to portray itself as a highly industrialized country, that could compete with any other European and world economies. Nonetheless, such rush left behind the real needs of the citizens. Furthermore, such projects required high sums of money, which attracted the interest of many.

As discussed above, people mostly needed secondary and urban roads. A great deal of people that had to work in the city had problems going from their home to work because of the poor conditions of the streets they had to use. This can be grasped reading an article published in the magazine:

"Highways represent only one infrastructure, but they are not everything: traffic flow is not only satisfied by them. Improvements in whole road network are needed."[275]

The problem became even more prominent when the phenomenon of suburbanization took place. More and more people were able to leave the city and stay in the outskirts, and to reach their work, they needed a car. As described in the previous chapters, there is a very strict relationship between suburbanization and car usage.

[274] Federico Paolini, "Storia Sociale dell'Automobile in Italia", (Carocci, 2007): 72
[275] Pensare alle strade, Quattroruote, October 1966

Furthermore, the car was not only for the wealthy anymore: more and more people could afford to purchase and maintain one. The car was central to the life of the Italian citizen. It followed the same trend happened in the United States, so connecting previously distant places, opening up new opportunities and allowing people to see the beauty of their own country. It was vital and fundamental for a modern life. With such growth of traffic, new and improved roads were fundamental.

Many highways were built where there was not really a need for them. In the region of Abruzzo, it is possible to find a very explicative example. Two parallel highways were built, Roma-Pescara and Roma-L'Aquila, which served an area where the amount of traffic did not justify two roads. Furthermore, they were relatively close to one another. Quattroruote was heavily critic about such decision:

"Spending billions per km for a double highway in Abruzzo is just non-sense… unless someone could benefit financially from this". Thus, almost hinting that there was something shady about the matter.

On the other hand, there were places whose amount of traffic would justify the construction of new highways, or even the improvement of existing ones, but the works did not seem to start. For example, in 1967, the Napoli-Salerno was one of the roads with the highest rate of cars passing. Even though technicians advised a maximum of 30.000 vehicles per day, in order to work efficiently, the average was 55.000, with peaks of 78.000. Such road was of extreme importance for the viability of the southern region, and thus for its economic development. Nonetheless, not many seemed interest in the project.[276]

At the beginning of 70's, there were more than 4000 km of highway all over the country, 2300 km of which were finished just in the prior five years.

During the oil crisis, the highway industry was hit as well. Traffic reduction meant also less revenues for the bodies controlling the highways. It was estimated a portion of 8-9% less in traffic, when compared to 1973. Furthermore, the situation was worsened by the general state of the economy, a general increase in costs and the annulment of special subsidies and tax incentives. Costs of maintenance often exceeded the potential revenues. So that some, like for example the Salerno-Reggio Calabria, simply stopped

[276] Piero Casucci, Urge una express-way tra Napoli e Pompei, Quattroruote, April 1967

requiring payments, since toll booths were more costly to maintain than the tolls themselves.[277]

The result was the increasing difficulty to continue and initiate new highways sections, even though in 1974, it was rather developed, especially in the North. The center and the south in the meantime had received some of the needed connections, even though there were areas where the highway was not present. For example, the region of Sardinia, the section between Livorno and Civitavecchia, Puglia and Basilicata were almost forgotten. The plan for the further years was to supply such areas, but the economic situation and lack of adequate liquidity, made such target more difficult to be attained.[278]

During these years, some of the projects were stopped and some funds were diverted to the advancement of more local and urban streets, since many of them were in not-so-great conditions.[279]

This situation worsened in the final years of the 70's, with the second oil crisis. The already high tolls increased even by 80% in some locations.

The development continued and in the mid-80's, there were more than 5900 km of highway, making Italy the third country with the most developed highways net in the world, after United States and Germany. Nonetheless, after such rapid progress, existing sections showed some problems due to the age. Many complained about the lack of adequate lighting in tunnels; some suffered from congestion due to maintenance works; communication about accidents were scarce, so that drivers were not able to take any deviations; police were rarely found; the asphalt was in bad conditions. Moreover, in order to fix some sections of the highway, drivers had to take deviations to other roads, sometimes with only one or two lanes. Repair works were frequent and may even happen during peak hours.

The 80's also represented a decade of new road building, as there were areas that were still not properly served. As highlighted above, from mid-70's there was a general stop. Examples of important section built were the Livorno-Civitavecchia, important

[277] Federico Paolini, "Storia Sociale dell'Automobile in Italia", (Carocci, 2007): 72
[278] Carlo Mariani, Autostrade e crisi, Speriamo nel '75, Quattroruote, January 1976
[279] Federico Paolini, Storia Sociale dell'Automobile in Italia, Carocci, 2007

connections with France as well as developments in the south and the two big islands, Sicily and Sardinia.[280]

From the beginning, extending the highway net has been one of the main priorities of Italian governments, both to increase productivity of the country and to achieve social cohesion. The increase in km of motorway is remarkable, considering also the fact that after WWII, Italy was a devastated country and had to be rebuilt almost entirely. The preference of choosing to focus on highways first, rather than other smaller and more local roads and streets was extremely criticized, also considering the issue that came with that, like safety and congestion. From the articles, it is possible to see that overall, the general public was generally positive with such growth, but still many highlighted the mistakes and delays made by the authorities, like ANAS, as well as the potential exploitation of such projects for political aims.

4.2 Safety on the roads

All along its history, Quattroruote had always shed light on the dangers of the automobile, mostly deriving from drivers themselves, rather than the vehicles. It is possible to find in almost every edition, an article dedicated to the issue, whether it was about urging people to drive responsibly, mourn for some victims or explaining the importance of driving safely and using specific tools like safety belts. Nonetheless, the frequent invitations to careful driving rarely achieved their goal.

"Unfortunately, the exhortation to prudence do not seem have had any significant effect, even when they are accompanied by dramatic statistics.", said Gianni Mazzocchi, one of the most important authors of the magazine, in an article of May 1972.[281]

As stated above, it is possible to find references to safety since the early beginnings. In an article named "Ignorata Sicurezza" (Safety ignored), referring to the cars presented in the Paris fare, the author states:

[280] Giorgio Dugnani, 1980 le autostrade che abbiamo…, Quattroruote, January 1980
[281] Gianni Mazzocchi, Suicidatevi che civilizzate il paese, Quattroruote, May 1972

"Except for the Swedish with Volvo, in general the manufacturers, especially American ones, have ignored an essential feature of the car: safety."

This was probably due to the fact that it did not attract much interest yet, said the author.[282] In the later years, it is possible to understand a change in this regard. More and more people started to take the issue much more seriously, also directly asking regulators to take action, like for example making safety belts mandatory.

Car crashes and other incidents were not uncommon at the time. Roads and streets were not in great condition, they were often narrow, with low visibility, poor lighting and road sings. Adding to the problem, drivers were often reckless and aggressive when on the road, so much so that Italians became known for such characteristic. As written in an article:

"We do not respect laws and act without discipline because we have not been well educated when it comes to driving […] Education should be thought to everyone, in every school and class, starting at a young age."[283]

Italy had one of the worst records of car incidents among the countries with the highest rate of motorization. Taking into account Germany, France, UK, USA, in 1955, Italy had 4.8 deaths per 1000 cars, second only to Germany with 4.9. In 1960, the rate dropped to 3.4, while Germany achieved 2.7. Four years later, the number dropped again to 1.9, even though it was still the highest among other countries. It should be noted too that the number of absolute deaths increased overtime. Luckily, not with the same speed as the number of cars in the streets. [284]

The number of incidents was high enough to worry the public opinion.

"Car accidents that resulted in casualties, between 1960 and 1963 were: 8197 in 1960, 8986 in 1961, 9683 in 1962 and 9839 in 1963 […] The automobile, for many of us, is not something to enjoy and have fun with anymore, but simply something to be worried about. On suburban roads, the dangers are many, while in the city, using the car is extremely uncomfortable and not sometimes even useless, since there is a lack of places to park. These are not new problems, and for this reason the passiveness with which they are treated by politicians is disarming […] Which are the innovations that are

[282] Ignorata Sicurezza, Quattroruote, December 1964
[283] Pietro d'Armini, La sicurezza stradale verrà dalla educazione circolatoria, Quattroruote, April 1968
[284] R. Sarti, Un triste primato italiano, Quattroruote, May 1966

worthy of being called that, in the field of security? We do not feel to be wrong if we only cite stuffing the dashboard and safety belts."

The article goes one highlighting some of the pitfall and dangers that everyday drivers need to endeavor, without seeing any noticeable change or innovation.

It should also be noted that the author attached a letter from the Italian Automobile Club, where it is possible to see that only in 1964, there were 350.000 road incidents.[285] The trend stayed pretty constant even throughout the first couple of years of the 70's. Even though car accidents were a little bit below the 350.000 level, casualties increased, with a peak of 11.078 in 1972.[286]

If compared with the number of cars in the streets in the same period (4.7 million), the number is very worrying. In 2019, ISTAT record 172.000 car incidents, with many times as vehicles as there were in 1964.[287]

Year	Injured	Died instantly	Died because of injuries	Total deaths
1958	153710	7137	1481	8618
1959	167798	7160	1207	8367
1960	201285	8197	828	9025
1961	218945	8987	884	9871
1962	224449	9683	1305	10988
Average	193237	8233	1141	9374

Road related casualties between 1958 and 1962[288]

Many car crashes were the result of bad driving behavior. Reading a letter sent to the journal, it is clear that many drivers had a problem with anger and frenzy.

"Driving is becoming more dangerous and difficult not only because of the traffic, but also because of drivers themselves, which act and move almost in an antagonistic way,

[285] Piero Casucci, Poca luce e molte ombre, Quattroruote, February 1965
[286] Gianluca Favro, Gli incidenti stradali nel 1972, Quattroruote, September 1972
[287] ISTAT, "Incidenti Stradali in Italia," www.istat.it, October 27, 2020, https://www.istat.it/it/archivio/245757.
[288] Automobile Club Italia, Ufficio Stampa, Gli incidenti stradali in Italia per regioni e provincie nel nord, nel centro, nel sud e nelle isole, Quattroruote, November 1964

against one another, making us all enemies […] The car now gives me more anxiety than joy".[289]

The magazine spent a lot of time blaming incompetence, bad-manners, lack of discipline, and recklessness. At the end of the day, the ones that make the decision behind the wheel are the drivers.

At the time, safety belts were rarely used. To reverse this trend, some states, like for example the UK, passed laws to make built-in safety belts mandatory. UK was not alone. Actually, when comparing Italy with other industrialized countries of the European region, it is possible to see that in 1975, it was the only one that did not pass any regulation in this sector. In 1977, the members of the European Single Market, so Italy too, agreed to comply to specific safety regulations. Just to make few examples: safety belts became a staple in cars and cars' interiors faced a general redesign in order to diminish potential harm to people in the case of car crashes. [290]

Nonetheless, most of the European countries, Italy included, did no force people to use them. The only exception were Belgium and Spain, although in the others, the discussion about the topic was very promising. [291]

Safety belts were an extremely important innovation in the field of safety but still, many refused to use them. Nonetheless it is important to report, at least from what it is possible to read from the magazine, that many people saw safety belt as an important innovation and even for laws about it.

Another important problem with car incidents was the consumption of alcohol and driving, a problem that persists still today.

Many European nations had strict laws, with set limits in terms of alcohol levels in the blood. For example, France, West Germany and the Netherlands had established a limit of 1.5 while in Austria it was 0.8. This law, along with public campaigns against this phenomenon, had a great success in preventing people from drinking and driving, since the number of tickets emitted for this felony dropped in Austria. On the other hand, in Italy, it was not considered as a problem, and laws were much looser, making it extremely difficult to charge and fine someone because of driving while drunk.

[289] Riccardo Mantovani, Misantropo e disperato, Quattroruote, May 1969
[290] Sicurezza: allineamento con il MEC, Quattroruote, December 1975
[291] Gli incidenti possono diminuire, Quattroruote, September 1975

This can be understood from an article of August 1966:

"In Italy, there is somewhat of a confusion between being euphoric and drunk: the traffic laws only punish the clear state of alcohol intoxication, so that road police cannot do much against the driver that even though has drank, can still present himself as normal". He goes further saying that penalties were emitted only in clear cases, as many police report attest:

"We (the police) intervened after the warning of the Migliarino toll booth, we stopped a car that was zigzagging in the highway. The driver was asked if he was drunk and he said, "You are right!".[292]

It should also be noted that at the time, the police rarely used alcohol tests, since there was not a set limit of alcohol concentration in the blood, after which the person could be fined

Nonetheless, it is strange to see an article in the same publication that encourages drinking beer before driving, as it shortens response time:

"Many have rushed their conclusion deeming any kind of alcohol, no matter the source or quantity, to be bad […] The test conducted by the Professor Antonelli signals a triumph of the beer, as perfect drink for drivers: a glass of beer betters psychic and attentive functions. So before driving, drink a glass of beer and we guarantee a more precise driving."[293]

So, it could be argued that there was much confusion about the effects of alcohol, not much research in the field and thus also journalists were not able to give a univocal truth. This negatively impacted the perception of the public, so that it was totally normal to drink alcohol and then drive.

"It is common to downplay and be ironic about the influence of alcohol while driving. Nobody has ever solved a problem by ignoring it. We believe that alcohol, even in small doses, should not be consumed when driving and that after some glasses, break and the gas pedal are used more instinctively than actually being used thoughtfully."[294]

[292] Sandro Cova, Alcol e automobilismo, Quattroruote, August 1966

[293] La birra aiuta a guidare meglio, un boccale alla partenza, un viaggio più sicuro, Quattroruote, August 1966

[294] Sandro Cova, Alcolismo e guida, Quattroruote, September 1966

Probably some of the tests proposed, just like the one mentioned above, were not the result of a thorough scientific study and it may be also speculated that some may have been funded directly by wine or beer companies, in an effort to discredit the data about car crashes and alcohol consumption.

Moreover, some people simply preferred to downplay the seriousness of the situation, as the letter, from a reader published in the magazine, shows:

"Terrible things happen, it is true, but I do not feel like it is appropriate to give them so much space and importance in the press […] It is good to know, but it is useless, and even dangerous to alarm and worry too much." The magazine then responded to the reader that the driver him/herself should be careful and respectful while driving. Nonetheless, it should be pointed out that it is possible to find many contradictions in the magazine. First, the article about the beer, mentioned above, but also the continuous advertising of beer, wine or spirits, that seems totally inappropriate and out of context in a magazine that encourages people to be safe while on the road. [295]

Just to make an example, in the December 1972 edition:

"Should we suggest to drivers to give up alcohol, in the name of wisdom? Of course not. We suggest "Royal Drink", the pocket-sized drink which are made for drivers".[296]

Of course, they do not represent the opinion of the authors of the magazine, since they were advertising, but still readers could infer the wrong idea, thinking that drinking and driving was not that bad.

In the beginning of the 80's, the government was working on new traffic rules, and alcohol was a highly debated issue. The newly proposed regulations called for detention of significant fines for those that were found with a level of alcohol concentration superior to 0.8.[297] These new rules were extremely important, since they fill many legislative gaps that were present with previous versions, and definitely helped drivers understand better the risks of not being careful.

Concerning safety, there was another topic that frequently talked about: speed limits. At the time, it was common to have roads without any specified limit of speed. Some European countries did implement them, and from a report published in January 1972,

[295] Stefano Olmi, Esortare alla prudenza non è allarmismo, Quattroruote, August 1966
[296] L'unico drink concesso all'automobilista, Quattroruote, December 1972
[297] A. Centis, S. Cuti, Alcol nemico del volante, Quattoruote, January 1981

it is possible to see that such limits produced positive outcomes, with a decrease in car crashes and damages to both things and people. In Switzerland, it was estimated that such policy saved almost 200 lives. Nonetheless, in Italy there was still some resistance. Furthermore, as the author of an article suggests:

"In Italy, the problem is not establishing speed limits, but making people respect them."[298]

Authors deemed speed limits as potentially positive, but the real turning point for road safety would be personal accountability and caution. For this reason, in the magazine it is possible to find many articles pushing people to use cars first of all as tool and not as a toy to have fun with. It is not uncommon to find al least of one of them in every monthly edition of the journal.

The magazine also published many letters coming from the readers themselves where they state that the car should be driven fast. Thus, it is possible to see a country almost divided in two: people believing caution and respect should be the ultimate characteristic of a good driver, while others held the belief that capable drivers were the one that were able to go fast.

"The automobile is built to go fast, and it is a tool that should be used only by those who are capable to drive fast. You (referring to the magazine) say that the car should be employed by everyone, I say that people should earn the privilege to have a car by learning to go fast."[299]

This passage goes almost against the democratization of the car, favoring a more exclusive view of it.

However, after praising the careful and prudent driver and writing, there were other articles that depict scenes of great speed as common and normal.

"In general, in the highway, a car that is able to reach 200 km per, should arrive to 150 km per hour maximum: in a straight road, without any other car in the way, in particular section, it could even reach 170-180 km per hour".[300]

[298] Si riduce la velocitò, Quattroruote, January 1972

[299] Salvatore Mariani, I superuomini non usano più soprattutto quando guidano, Quattroruote, June 1966

[300] Né psicanalista né confessore: basta buona volontà, Quattroruote, May 1969

To a contemporary reader, this assertation, seems extremely dangerous and almost irresponsible, also considering the state of the technology, which cannot be compared to todays.

In the beginning of the 70's, more precisely in the October 1971 edition, people start to clearly associate the car to an actual weapon, highlighting the fact that many drivers are often not aware of the potential consequences of bad driving behavior, even at moderate pace. In the article "Omicida chi uccide (anche se l'arma è un'automobile), the author, Luciano Cerulli, also points out to a critical gap in the Italian law system:

"Some drivers seem to act like actual killers. In case of car crashes though, the law does not treat them as such: in my opinion we should start to talk about homicide".

The law about vehicular homicide will be passed many years after this article, but it is possible to note that the public discussion about the topic started around this time. [301]

During the final years of the 70's, the industry started to perfect the airbag as well, even though it took some years before regulators made it mandatory for car manufacturers to provide it.

Adding to the problem, was the fact that people driving without a license were much more common than today, highlighting the fact that many did not really comprehend the potential dangers of driving even at moderate pace.

In October 1979, it was published a letter were a fourteen-year-old admitted that he had been driving for quite some time. The authors responded:

"This letter shows the level of recklessness and disregard of the dangers to which many people expose themselves, their relatives and other people."[302] Considering that it was an article dating back to 1979, relatively recent in time, it could be speculated that in the early days of automobility, such problem was much more severe and intense. This allows contemporary readers to understand the level of foolishness and thoughtlessness that many Italian drivers had.

Quattroruote also individuated important factors that often did contribute to car crashes. Overall distraction, sleepiness, dangerous overtaking, lack of adequate of safety distance between cars, pneumatics in bad condition and also bad weather conditions.

[301] Luciano Cerulli, Omicida chi uccide (anche se l'arma è un'automobile), Quattroruote, October 1971
[302] Incoscienza e assicurazione auto, Quattroruote, October 1979

Just for lack of attention and sleepiness, there were almost 1000 incidents in the highway, between January and March 1978.[303]

Another issue that contributed to a lack of general safety on Italian roads is the very low number of traffic police. In 1972, there were only 9000 men controlling drivers and their potential unlawful behavior. Of course, when there is a lack of general control and supervision, it is more likely that people do not respect laws, putting in danger themselves as well as others on the street. In that same year, a draft law was being discussed to increase state's funding and thus allowing to hire more policemen. The problem was not solved in the years after. In a letter published January 1984, the reader complained about bad driving behaviors of many and the lack of adequate control by the authorities:

"I have been driving in the streets and highways of northern Italy, but now more than ever I have been witnessing recklessness, foolish and sometimes even criminal behaviors. All without any adequate measures to stop these phenomena. In particular it is possible to see in the highways that speed limits are rarely respected. There are uncountable overtakings in the right lane, people driving in the emergency lane and even improvised speed races from lorries […] Where are the police cars? Personally, I have not seen them very frequently. It could be argued that police prefer to do their patrols in the city centers." [304]

In 1971, another major decision that can be considered to be in the realm of safety, was adopted: the insurance was made mandatory. This was a very "tormented" policy, as it written in an article of June 1971, since there were many critics. [305]

An important report about road safety was drawn up by WHO, signaling that in most of the 26 most industrialized countries in the world, car related death rates were increasing, even when considering the rise in motorization. Between 1955 and 1974, such escalation in Italy was +40%. The author of the study allocated the reason for such increase mostly to alcohol consumption.

The article strengthened public opinion's attention on the topic, and in the subsequent years, it is possible to observe harsher measures to tackle the problem. For example, at

[303] Gianni Mazzocchi, Preghiera ed esortazione a tutti i lettori, Quattroruote, November 1978
[304] Andrea Forti, Autostrade: dov'è la polizia?, Quattroruote, January 1984
[305] Carlo Mariani, Assicurazione obbligatoria, Quattroruote, June 1971

maximum level of alcohol concentration was established in Italy too.[306] Since then, it is possible to see an increase in the number of articles published in Quattroruote facing the issue. Even though it is hard to think that it was the study abovementioned alone, that triggered such growth in attention, it probably helped. Furthermore, in the mid-80's, another issue was presented, which was drug use and driving. Before that period, no article was written about it and the attention was extremely low.

Adding to the issue of road safety was the lack of guardrails in the highways and the insufficient width of the traffic divider

In July 1966, authority responsible for Italian highways, ANAS, promised, after many years of people pushing the company, to install guardrails in the whole highway net of the country.

Some sections already had this safety tool, for example Milano-Serravalle had it since 1963. In that section, car crashes that resulted in casualties, diminished to more than half and injuries too, even considering that the level of transit increased. [307]

Unfortunately, after the initial announcement, the authority had financial troubles so that the installation was postponed few years.[308] The total cost of just the guardrails was about 40 billion lire, an extremely high amount for the time, to which it should be added also labor and secondary costs.[309] Advancement was done in some highways, but not in other. In 1972, of the 127 km of the Torino-Milano highway, only 22 km had guardrails. This lack of safety tools, as well as the heavy traffic, made it one of the most dangerous in the country.[310]

As highlighted in the article "E le barriere dei sicurezza sulle autostrade?", there was a great pitfall in the relationship between the country and the body in control of highways: all the revenues that exceeded the level forecasted for the year, were collected by the State, instead of being invested in development and advancement of better roads. [311]

[306] Alcol incontrollato e droga dimenticata, Quattroruote, December 1986
[307] Il guard-rail riduce gli incidenti, Quattroruote, April 1966
[308] E le barriere di sicurezza sulle autostrade? Quattroruote, April 1967
[309] Ultime sui guard-rails, Quattroruote, June 1967
[310] Sulla Torino-Milano gravissimi incidenti, Quattroruote, April 1971
[311] E le barriere di sicurezza sulle autostrade, Quattroruote, April 1967

Safety was a major concern for Quattroruote from the start, even though it is probably correct to say that the same worries were not shared by drivers. This can be understood from the recklessness and thoughtlessness that characterized many Italian drivers and that resulted in an incredible amount of car crashes. So much so, that Italians became known for these two characteristics. Of course, some of them were due to the technology still being new to most citizens and the poor conditions of many streets. Furthermore, alcohol consumption was extremely dangerous and common, and many seemed not to be worried about it. Luckily, throughout the years, legislators as well understood the dangers of driving while intoxicated, and thus introduced alcohol limits, just like other European countries.

In order to decrease the potential harm of accidents, many safety related innovations were put in place, which saved lots of lives. Safety belts and airbags were definitely one of them.

Thanks to the many articles dedicated to the issue, it is possible to speculate that with time, drivers too became aware of how dangerous a car could be and thus many decided to drive more carefully.

4.3 Pollution

With the growth of motorization, one of the major consequences has been environmental. Not only are cars themselves pollute air, but also related industries are contributing to the problem.

Initially, along with the mass construction of highways, one of the concerns of the public opinion was the potential ruin of the landscape. It was not directly connected with environmental issues or pollution, but it simply aimed at preserving the natural beauty of the country. This was also reinforced by the fact that in most of the edition of the magazine, there was a section dedicated to showing off beautiful Italian places to which one could travel to and visit. Even though that was the main concern for many years, environmental pollution started to get some initial attention from the public as well, but at the beginning, it was very minimal. After the blow-by was introduced in American vehicles in the late fifties and early sixties, Fiat introduced that technology as well in all its vehicles, except for its most sold one, the 500. It was a totally new feature for the

Italian market, and many did not understand its function or purpose. This was also due to the fact that the public discourse about smog and pollution was still at its beginnings.[312] Nonetheless, with this introduction in the mid-60's, it is possible to record the first time the topic got attention from the press.

Most of the articles related to this topic came from abroad, especially the U.S., which at the time was rather ahead. In the section of the magazine dedicate to foreign press, a general summary of the laws and regulation introduced in the American country to fight air pollution were often reported.[313] It was also documented a concerning study that showed that 15% of the total smog in Buffalo, New York, came from cars' exhaustion.[314] Thanks to such news, the readers were being introduced to such issue and they certainly helped pave the way for the discussion about pollution and car usage in Italy.

Another example regarded the discussion about the Clean Air Act, passed in the USA in 1970, where the main issue highlighted in the article reporting that, was the cost car manufacturer had to endure, rather than the environmental benefits.[315]

In the 70's, the public concern about pollution started to change. To serve as a testimony, in 1970, an anti-air pollution draft law was presented to the Senate. It aimed at restricting and lowering the levels of some of the compounds that were found to be responsible for air pollution, mainly CO. Even though some of the toxic agents that we all now recognize as such were not included in the draft, it still represents one of the first examples of anti-pollution actions.[316] The draft was approved in March the same year.

The position of the Quattroruote about the issue was quite ambiguous: as it will be show in the later pages, even in the same time period, some articles denied the contribution of cars' exhaustion to the pollution problem and downplayed its importance, while others recognized its role.

Furthermore, not all citizens were aware of the dangers of pollution and there were some letters sent to the magazine, complaining about an alleged overabundance of articles in the general press about this matter.

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[312] Che cos'è il blow-by, Quattroruote, November 1964
[313] Ward Automotive Reports, Lotta antismog, Quattroruote, November 1969
[314] Per combattere lo smog, Quattroruote, August 1966
[315] Inquinamento: lotta senza quartiere in USA; Quattroruote, October 1971
[316] Carlo Vernaschi, Contro l'inquinamento, Quattroruote February 1971

“How can it be that everyone, Quattroruote too, is talking about pollution? “. The letter goes on stating that this debate has been blown out of proportion. Responding to the angry reader, the author of the article explained the dangers of CO and the other toxic agents that come out of cars’ exhaustions.[317]

About pollution, a committee for the reduction of toxic emissions, composed by Eni, Esso, Mobil, Fiat and Alfa Romeo was created and in 1971 it even drawn up a report about this problem. This was later sent to the Ministry of Health and Ministry of Transport. Even though it was not published to the press, it can be speculated that this might have been one of the first example of Italian lobbying in the topic of pollution. This is because, stricter laws on air quality would have been directly in contrast to the financial interest of the companies abovementioned and developing less polluting technology would have increased the cost for R&D, as it happened in the USA. Nonetheless, these are just speculations. [318]

Even in the mid 70’s, authors of Quattroruote failed to address clearly dangers of air pollution. Maybe because the consequences of long-term exposure to toxic agents coming from cars’ exhaustion were still not well documented, understood and many did not experience yet the harmful effects. Moreover, it could be argued that the magazine did not want to hurt its own interests as well as readers. Nonetheless, there were some drivers who worried about pollution, even though they represented the great minority. A certain level of interest from the public can also be seen from the letters and articles, even though it was still a very close niche.

In the edition of February 1972, it was published a writing from a reader that complained about air pollution in Naples, also highlighting the fact that many other citizens did not seem to bother the smoke coming from cars.

“The problem is totally ignored, since people do not even close their car windows when going through a tunnel, or turn their engine off when the traffic is so bad that cars do not move for a long time […] Is it possible that the Ministry of Public Transport does not know that it is totally abnormal the amount of black smoke coming from an engine?” [319]

[317] Steno Siccoli, Inquinamento: una minaccia spaventosa, Quattroruote, April 1971
[318] Inquinamento: Bilanci e programmi, Quattroruote, November 1971
[319] Michele Nardella, A Napoli l’inquinamento record, Quattroruote, February 1972

The oil crisis 1973-74 helped shape the discussion. Along with energy dependence and scarcity, the dangers of polluting agents coming from cars were recognized. An article published in 1973 shows it, as both pollution and energy scarcity are treated together:
"The lack of energy and the consequent necessity to find new nonpolluting sources and the need to avoid waste are fundamental problems that researchers have been promoting for quite some time, but many refused to study, comprehend and sold. The Arab blackmailing forces us to face this lack of energy […] The use, and often abuse of the car highlighted its dangers".[320]
In the same edition it is possible to find an article that almost goes in the opposite direction. From the lines below, the response of the magazine seems to be a clumsy way to defend and protect automobilists that felt attacked by English media. The magazine deemed the English discussion about pollution a simple act of aggression, even though at the time there were already scientific studies that made the dangers of the cars evident.
"It is the biggest source of pollution and the main reason behind the energy crisis, it occupies too much public space, it is dangerous, and it falls apart quickly. These are the accusation moved by the English press toward the automobile. They are not new, but it is peculiar seeing the attacks towards the car and the persistence with which they are proposed. Just like in France, in UK too there seems to be an anti-car position."[321]
In 1975, new anti-pollution laws were introduced in Italy as well, regulating the level of CO and HC, respectively lowered by 20% and 15%. Such news was discussed primarily in technological terms, and very little space was dedicated to the dangers of toxic agents. The author wrote:
"Such decision is very important (referring to the anti-pollution law), since it represents a step forward towards the reduction of air pollution, which can be even a menace for our survival, ecologists say".[322] This was the only reference to the dangers of air pollution in the whole article. A great deal of attention should be put on the way pollution was presented. The author reported a statement said by a separate group of people, the

[320] La crisi petrolifera, Quattroruote, December 1973
[321] Contro l'automobile, Quattroruote, December 1973
[322] L'auto "fuma" meno, Quattroruote, November 1975

ecologists, somewhat detaching himself from such announcement and implying that it may not represent the view shared by the magazine.

During the middle years of the 70's, it is possible to notice a more substantial interest about pollution.

Given the regulations imposed as well as the general increase in interest about the topic, emissions became another factor to keep in consideration when purchasing a car. In every edition of the magazine, it is possible to find a section dedicated to car reviews. From the beginning years of the 70's, it is possible to notice that in those sections, a pollution test was added.

More and more articles were written about the environmental issue, deeming it as extremely dangerous and showing a general consensus about it.

"The ecological problem, that more and more is worrying woke people, is triggered a general increase in sources of pollution. Environmental degradation is determined by a continuous growth of our consumption levels, which require more and more facilities, infrastructures and products ready to be used and changed, but at the same time that will not decompose at the same speed rate. So, adding to the air pollution caused by exhaustion of all the different vehicles and industries, the noise and smell, we shall also endure the mass of waste, car and other electrical appliance cemeteries that reminds us of the wastefulness, typical of our economy […] It is also important that drivers do not close themselves in their shiny boxes without considering the consequences of their indiscipline and their abuses.".[323]

In an article published in July 1973, Antonio dal Monte explained in detail all the negative consequences for human's health and well-being of the toxic agents caused by the car. This is a very important essay because readers can really grasp the reasons why air pollution should be fought. In the final part he also proposed some possible solutions.[324]

In September 1973, it was published a study conducted by a swiss medicine center, which revealed that toxic agents, like CO, could get into the vehicle while on the road too, compromising the health of the driver and the potential passengers. This danger was especially real when traffic and congestion were very high, so that cars were stuck

[323] Lodovico B. Belgiojoso, Enrichetta Ritter, Uso ed abuso, Quattroruote, July 1972
[324] Antonio dal Monte, Inquinamenti da gas di scarico, Quattroruote, July 1973

for one behind the other without enough flow of air. [325] After many years, the magazine denounced the fact that many cars still did not have a system to change air inside the car. [326]

Still, in 1976, articles like these were present:

"The automobile causing pollution is like an old tale […] The real causes are the ones cited above (trash and litter thrown and left on the streets)."[327]

Italy was not in the forefront of this battle. Ecologist groups in other countries like United States, UK, France and others, were much bigger, important and developed. As noted above, there were many letters published in the magazine where people tried to downplay the problem, sometimes even saying that the magazine was talking too much about pollution, something that did not deserve so much space in the journal. However, there were also others that were deeply concerned. Thus, it is possible to see the Italian public discourse about pollution and the environment as deeply split between those that believed it and those who did not.

Some also feared that an increase in the ecologist views would hurt the economy. A letter sent from a reader summarizes perfectly this view. In the note the reader feels that part of the society that was fighting for the ecologist matter, was actually obstructing the development of tourism facilities. He made the example of Viareggio, an extremely popular destination for many tourists, whose development may have been completely banned if ecologists had been more popular at the time. Thus, he viewed the matter as an obstacle to growth rather than an actual danger that could deeply impact society. For the reader this was especially true in the southern region, economically behind when compared to the rest of the country, where there is an extremely high amount of beautiful landscapes, spots and natural attraction.[328]

With the article written in 1978, "Energia, Ecologia e Ambiente", Quattroruote showed an even more interest in ecology and protection of the environment. This can be interpreted also as a sign of a change in the public discourse as well. This article was pushed by the Italian release of an important book about the issue, "Energia, Ecologia e

[325] Il monossido di carbonio nell'abitacolo, Quattroruote, September 1973
[326] Abitacolo: stop ai veleni, Quattroruote, December 1988
[327] Più educazione, meno inquinamento, Quattroruote, April 1976
[328] Salvatore Spoto, La difesa dell'ambiente naturale dà benessere, Quattroruote, August 1973

Ambiente", published by American authors Richard Wilson and William Jones in 1974, which had a lot of success in the U.S.

"The Italian discussion about the relationships between energy and ecology and about the impact of such disciplines on the environment, showed how far behind the scientific culture of the public opinion is in the country […] As it is possible to see from the wide range of topics tackled, the book is especially important for regulators as well as the public opinion".

The article is also important because it clearly states that the Italian public debate was far behind, when compared to other industrialized nations. Furthermore, it should be noted that the authors talk about the dangers for the people as well, not only the potential harm to the environment. Both the benefits and the dangers from energy use are underlined.

"Anyway, energy use can lead to diseases and death of some or several people […] The biggest stock of oil can be found in the Middle-Eastern countries, and since it is a finite resource that will end, a war for it is not that inconceivable […] The fate of humanity, given the use and abuse of energy resources, totally depends on us".

The article concludes with an image of an offshore drilling facility, describing it as a "monster".[329] This article is significant also because it was one of the most detailed one at the time and it blatantly states the dangers of oil, which most people still refused to accept or simply ignored.

Starting from 1983 it is possible to see that Italian magazine and the public opinion started to discuss about the dangers of lead, present in gasoline. The UK banned the toxic agent just like Austria. Furthermore, the latter also enacted a subsidy of 600.000 lire for the purchase of a vehicle with catalytic converter.[330] On the other hand Italy and France did not forbid the use of lead, at least in the beginning. Such measure was adopted some years after. One of the reasons for such decision was that Fiat would have needed time to adapt its production and also because it invested large sum of

[329] Lodovico B. Belgiojoso, Enrichetta Ritter, Energia, Ecologia e Ambiente, Quattroruote, September 1978

[330] Senza piombo, Quattroruote, March 1985

money into engines that did not satisfy those requirements. Thus, its approval was delayed for some time. [331]

In 1988 more draft laws were proposed and discussed in the Parliament in order to lower the amount of toxic agents in petrol:

"The warning raised by Quattroruote in the August edition about the increased of carcinogenic emissions, from 40% to 70% of petrol (when catalytic converter is not used) when compared to the super, has been taken up by the Parliament. A group of representatives has proposed a draft law to limit the amount of benzene and the octane number."[332]

Such article shows how the ecologic wave increased in popularity and more and more people became aware of its importance. Moreover, it should be noticed the use of the word "carcinogenic", which had never been used before in the magazine.

The magazine always looked at the USA for issues relating the car. In August 1980 it is possible to find an article where the EPA, the authority for environmental protection, reported that anti-pollution regulation put in place, have worked and air quality had improved dramatically. Established a maximum level of toxic agents in the air, it was recorded that in 1980 the number of day where levels exceeded such level decreased by 32%.[333] Articles like these are important for Italian consciousness because they show to the public that measures actually work and results arrive.

Probably because of such increased interest, oil companies tried to improve their reputation and image with the public. This might be the reason why they were often involved in public works. For example, Mobil Oil Italy helped fund some renovation works for some Middle-Age monuments in the city of Spoleto, for which the mayor gave a celebration plaque to the CEO of the company. [334]

Pollution became a relevant problem rather late, when compared to other countries like the USA or even the UK. They were the ones that led the debate about the topic. Their actions and measures were reported in the pages of the magazine with some kind of

[331] Piombo nella benzina, Quattroruote, October 1983
[332] Ancora equivoci sulla benzina verde, Quattroruote, December 1988
[333] Più pulita l'aria in USA, Quattroruote, August 1980
[334] Notizie del mese, Quattroruote, September 1978

distance, almost suggesting that the problem did not concern Italy. In the 70's it is possible to notice a certain level of apprehension in the public debate, which since then became more and more evident. Still, Quattroruote adopted a rather ambiguous stance on pollution, deeming it as dangerous in some articles and downplaying its importance in others. Probably, knowing that the car was one of the major sources of air pollution, authors were trying to protect their interests. At least in the beginning, it was much more concern with the preservation of the beautiful landscapes of the country, than actual air pollution.

Nonetheless, in the mid-70's and beginning of the 80's the magazine started to use much harsher words to describe the problem, associating it also to very dangerous diseases like cancer. Probably, the fact that people started to understand its impact on health and well-being, made them take the issue much more seriously, shaping the opinion of Quattroruote. During that time-period it is possible to note a rise in the number of letters sent by readers to the magazine where they worry about it. Still, some others thought it was not a problem, so there was much resistance against environmental policies, like the catalytic converter or the abolition of lead in fuel.

Finally, it could be argued that the two oil crises, and the consequent worries about energy scarcity, helped people grasp the entity of the problem.

4.4 The automobile and gender roles

Sexism played a role in the development of the car in the Italian society as well. A reader wrote on the magazine:

"Even if I will be deemed as antifeminist and reactionary, I cannot stand women that drive automobiles: the automobile is a technical product and in order to drive it, people familiar with such technology, as well as possess that character typical and even exclusive of males, that makes everything technical familiar. Women are great at home and should do things that they are supposed to do: weavers, actresses, singers, dancers, maybe even writers."[335] So it is possible to say that society did permeate cars as well.

[335] Donne al volante, Quattroruote, February 1965

The debate followed in the issue of August 1967 with the article "A woman that can drive", showing the importance of the car for the independence of all women.

"Nowadays, women are not prevented to drive by the physical strength required by past ignition technology. By simply turning the key, they can drive wherever. This thanks to the evolution of our ways of living as well as the technical progress that came with it."

The author continues:

"Since the early days of automobility, men have always saw themselves as masters of the road". Moreover, in those pages, the author lists all the bad habits of male drivers, which have cost them the stereotype that Italians all drive recklessly.[336]

This idea was advertised also by Fiat itself, that promoted the new 850 with automatic gear, perfect for the ladies.[337] From this it is possible to see a parallelism between the initial discourse between ICE and EVs in the American press and Italian journals.

An interesting finding was published about this topic. In Western Germany, it was calculated the driving test failure rate for both sexes. In 1968, 25.3% and 27.8% of respectively men and women failed, showing the readers that ideas about women inability to drive was fundamentally wrong and with any evidence supporting it. Moreover, the person with the highest number of infringements was a man, with 38. All the other statistics proved dismantled that belief. [338]

Nonetheless, adding to the first article mentioned at the beginning of the section, a poll among women, in the edition of July 1966, revealed that almost 70% of the interviewees agreed to the statement that, in general, there are prejudices towards Italian women behind the wheel. [339]

Once again, the behavior of Italians was quite ambiguous on this topic. The ones that viewed women driving as bad, were probably the same that attended car fares and enjoyed the presence of women.

Luckily, progress was made and seeing a woman driving a car became totally normal, even though there are still stereotypes regarding their ability.

[336] Una donna che sa guidare, Quattroruote, August 1967
[337] Automatiche per tutti, Quattroruote, April 1966
[338] Al volante meglio gli uomini o le donne?, Quattroruote, November 1969
[339] Anche la donna deve avere l'automobile, Quattroruote, July 1966

In the 60's, gender segregation was still very present, and the car did not make exception. Thus, it is possible to see articles that support the theory that women should not drive. Luckily, this view did not last very long, and the growth of the motorization included women as well. Nonetheless, it should be noted two important remarks: some stereotypes about women's ability to drive still live today and the fact that while some men did not accept women behind the wheel, were rather happy to see them at cars fares.

4.5 Traffic congestion and parking spaces

Traffic and congestion were themes heavily talked about. Even if the amount of cars was not even comparable to the one we have today, the roads and streets did not catch up with the increased level of motorization. So that while number of cars skyrocketed in the 60's, the flow of traffic was constrained to streets that dated back to the 30's. They were first of all unsafe, poorly managed and maintained, narrow and simply not enough to satisfy the traffic.

"Those who drive in many Italian cities, are used to the chaos."[340]

Rome was (and still is today) an emblematic example of such problems. The lack of parking space was another issue.

"Nowadays it does not even make sense talking about the issue hole in the streets, since they are the norm. Some are real sinkhole […] In Rome it is either impossible to move by car, or travel in total chaos."[341]

Naples was another city with great traffic flow issues, with poor road condition and the public administration that seemed to not car at all.

"For a long time, politicians have promised development of Via Argine, adding one more lane. We are still waiting".[342]

Also:

[340] Gianni Mazzocchi, Vogliamo il caos? Quattroruote, July 1968
[341] Caos o vuoto, Quattroruote, February 1971
[342] Filippo Amirati, Vita dura per gli automobilisti a Napoli e dintorni, Quattroruote, September 1971

"Public transport, just like in other Italian cities, are insufficient: citizens are forced to use to car to move around."[343]

Adding to the problem of poor road condition, congestion and inefficient flow of traffic was the rapid growth of the city. More and more houses and homes were built, almost without control or a master plan, which ultimately increased the number of cars circulating in the Southern province.

In 1975, the problem of the city was partially diminished with the construction of an orbital road, which increased the potential flow of traffic. Nonetheless the problem did not end, but it was simply mitigated

Moreover, as the magazine highlights, 12 million Italian citizens lived within the urban borders of ten big cities. Such high concentration, compounded with the lack of proper infrastructure and adequate flow of traffic could only lead to increased traffic and congestion. Giorgio Dugnani, author of the article "Alla larga dalle città", wrote:

"There are often phenomena of complete paralysis of city mobility, which cause big costs and losses to the whole urban community."[344] As he continues, part of the problem could be mitigated by employing suburban roads so that some of the traffic could flow outside city centers, and some cities have already put in place such practice. One example is Bologna or Genova.

The very low width of the streets and the lack of adequate parking also impeded some to upgrade their car to a classier or more expensive model. As a reader of the magazine wrote:

"I would like to leave my old 600, to which I am very close, to buy a car of a superior quality, and I was thinking about the 125, nonetheless it would be a shame to change, since the 600 is much more comfortable to drive in the city […] I am also concerned about not finding space to park it: the 600 can be parked more or less wherever, while this won't be the case with the 125. To me, the parking issue is so pressing that I am tempted to use the car only for long journeys […] In the city, the issue is so bad that I would not be able to use the 125, or any other car that is not small". This should be taken into consideration because it did not only represent a futile whim. Since it was a

[343] A Napoli troppe auto o troppe case, Quattroruote, December 1972
[344] Giorgio Dugnani, Alla larga dalle città, Quattroruote, February 1971

problem for many people, on the long run, it could negatively impact the automotive sector and given its importance, the whole Italian economy.

The magazine then answered:

"Even for the parking problem, the inefficiency, hostility and indifference of our legislators is unquantifiable."[345] At the time, even though the car was not a privilege anymore, it started to be a necessity, it was still treated as if it was, so that all the facilities that had to come with it were slow to arrive. Moreover, since in the city places to park the car lacked, many used to stop at the sides of the road, making the lanes even narrower, impeding a speedy flow of traffic and potentially increasing the dangers of driving, especially when the visibility was low and lighting poor. This not only made the streets more dangerous, but it also hit the businesses. This is because if people know they will not be able to park the car nearby the store, they will probably not come at all. From what it is possible to understand from the discussion in Quattroruote, the debate about this topic was present in the public opinion and deeply felt by drivers. Conferences, discussions, investigations and others were conducted, but still the legislators failed to address the issue efficiently. Some proposed to build multilevel parking facilities or underground parking spaces, but still the words did not translate in concrete actions. An article titled "Il Dramma del Parcheggio", the author tries to give out some proposals in order to mitigate the problem. One of these is the use of parking meter and parking disk, often used in other nations, in order to encourage leave the place as soon as the need to stop ends. Also, another idea was the creation of car-free areas in the city centers, which only partially solved the problem, because in order to function properly, it needs efficient public transport and parking spaces outside the center, two things that made the proposals difficult to be enacted.[346]

In 1972, it was inaugurated an extremely big underground parking in Rome, which even though it was designed in 1964, and much had changed since then in terms of motorization, could solve part of the problems with congestion. Lack of parking was often pointed out as one of the major sources of traffic.[347] Unfortunately, operations like the one just described, took many years to complete, while motorization kept

[345] Aldo Raggio, Parcheggio: vecchio tormento, Quattroruote, June 1967
[346] Il dramma del parcheggio, Quattroruote, July 1967
[347] F. Daneo, Duemila auto sotto Villa Borghese, Quattroruote, June 1972

increasing, leaving administrations constantly behind. Furthermore, especially in the 80's and 90's, many of the areas that could have been dedicated to public goods, like parking, parks or other facilities, were dedicated to house-building, thus increasing population density in areas already suffering from congestion.

Still, there were many cities where the problem was not solved whatsoever. Naples is one of those. In the city, there was a growing problem with people without any authority, that decided where people could park or not.

"It is not like years ago, now they are actual criminal that want drivers to pay a bribe if they want to park."[348]

Moreover, many legislators that proposed new solutions did not seem to take into consideration, or even worse, care about the bigger picture. Each initiative, even if well-thought, did not achieve the target hoped because there was no coordination between one another, resulting in no real steps further. Traffic flow was improved in a location, but worsen in another, so that it was often simply moved, not solved.

Adding to the problem, inefficiencies in the public transports impeded some to switch from individual mobility to buses or trams. To testimony such insufficient service:

"In a big city (like Milan), everybody would use the public transport, only if its service was efficient. […] As far as the metro goes, it is the ideal mode of transport in big cities, but for now it only serves a minority of the citizens."[349]

The metro was often identified as the perfect transport for public services and even if at the time, the metro in Milan was relatively small, it still proved its efficiency. Nonetheless, regulators did decide not to invest in such option, mainly for its costs, which were often scary. On the other hand, many opted for increased service of buses and trams, so that people would be much keener on giving up the car. This plan did not really work: public service was not efficient enough to encourage people make the change and congestion remained unsolved.

Also:

"In Italy, an office worker could do without a car, and use public transport services instead, only if they were better managed".

[348] Antonio Amitrano, L'oro di Napoli pagato ai posteggi, Quattroruote, February 1985
[349] Mi servirà l'utilitaria? Quattroruote, July 1968

In the article above mentioned, Gianni Mazzocchi blames the present and past governments for such poor management, since they have not been able to forecast the growth of the automobile sector and thus have not been able to adapt cities to such revolutionary change. Furthermore, due to uncontrolled house building, population density grew without any regulation.

"Cities had to be planned and expanded following specific criteria, that would take into consideration individual mobility, which on the other hand has been totally ignored."[350]

Generally, most experts agreed that the solution to the increased level of congestion and high traffic, especially in urban parts of the city was to increase the supply, the efficiency of public transport, as well as the coordination among them, and increase the number of streets and roads, in order to shift some of the traffic flow, from the city centers to the outskirts of the city.

Another initiative, which was also connected with environmental preservation, pollution, public health, and safety, was the creation of specific traffic-free zones. During the 70's and early 80's, it was also connected to saving oil, since such areas were one of the most congested ones. These were typically the city centers, where the streets were the narrowest and thus congestion could form much more quickly. One of the first example was Milan. In the summer of 1972, cars were forbidden to travel in the Duomo square and some other streets nearby. The only exceptions were public transport and taxis, in order to incentivize their use. One of the reasons for such decision was the potential damages of cars (noise, vibration, smoke) to the monuments. From there, the area grew, including more or less the whole center of the city. The same was done in Rome in the Colosseum area and some other locations. In the later years, the whole concept was adopted by many other cities all over the country.[351]

Some were very critical of such policies. As it is possible to note from the article "Città proibite" in Quattroruote:

"Many people praise the closure of urban centers to the car as the solution […] Many administrators have supported the thesis of the ecologists simply to hide their negligence and inefficiency. As a matter of fact, it is far easier to ban the use of the car,

[350] Gianni Mazzocchi Vogliamo il caos? Quattroruote, July 1968

[351] Carlo Mariani, Innovazioni nel traffico urbano, le isole pedonali, Quattroruote, August 1973

rather than take smart decisions to modify the city and adapt it to the present and future needs."

Thus, part of the public opinion saw such decision just as a simple, but ineffective solution to a problem that administrators and politicians had not been able to resolve.[352]

It is possible to note how, at the beginning, regulations for vehicles were very few, but then, with the extreme growth of motorization, almost without control, politicians progressively understood the need to put some kinds of limits. Free-traffic zones are an example, but also anti-pollution laws or higher penalties and fines for crimes committed on the streets and many others.

Adding to the problem of congestion, especially in highways and extra urban roads, there was the issue with the train system, Quattroruote described it as such:

"It is known that the train system is not good (euphemism); we are not only referring to the passenger service, the delays, strikes, dirt, dangers, the stations etc. […] Rather than improving railways, the State decided to favor road transport (damaging others as well) making diesel oil cheaper than regular petrol."[353]

Rather than using train for long distance transport, Italy most often used roads, increasing the unimodal transport problem and traffic on roads. This almost created a vicious cycle, where railways were not able to satisfy a certain level of demand, because of inefficiencies that were not covered by investments, so that typical lorries were used instead. Moreover, there were no policies that even tried to encourage rail over road, at least for large distances. From the work of Paolini, it is possible to understand the problem quantitatively.

From the table below, it is possible to note how roads and streets developed at a much higher rate than any other transport infrastructure. Such investments, at the end, encouraged the use of one specific mode of transport over the others.

[352] Città proibite, Quattroruote, April 1988

[353] Gianni Mazzocchi, Tassatori del cavolo, Quattroruote, December 1980

Year	Railways	Roads	Tram
1950	21,550	170,657	1,729
1960	21,277	191,746	1,386
1970	20,212	248,978	665
1980	19,715	296,270	581
1990	19,576	304,271	449
1950-1990	-9.2%	78.3%	-74%

Infrastructure length in km[354]

When considering the percentage of tons per km transport, it is possible to see that railways went from 19.42% in 1970 to 11.6% in 2000, while roads from 44.2% to 67%. Thus, it is possible to see that while train-based logistic declined around 8% through the years, road increased by more than 20%.[355]

Public infrastructures and other facilities were not able to keep up with the increasing number of motorizations. Cars grew much faster than dedicated infrastructure. Moreover, with the suburbanization trend, people had to use the car.

This lack of proper forecasts led to congestion and traffic, especially in urban areas, where the streets were often narrow. Furthermore, the lack of parking spaces implied that many drivers decided to park their cars on the side of the roads, making them even narrower and constricting traffic flow. From the data shown above, it is possible to see that even for long-distances, roads were always the preferred choice. If instead, railways were used, there would not be a great amount of lorries occupying lanes in the highways. Finally, administrators often tried to tackle the problem by adding more streets, which often simply moved the traffic but did not resolve it. On the other hand, investments in public transport were very scarce, so that it was not appealing enough to make people give up their cars. One successful example was Milan, which was positively received by citizens, even though initially its radius was extremely limited. It is possible to delineate a parallelism between the measures taken by U.S. administrators and their Italian counterparts. As seen in previous sections, many American cities

[354] Federico Paolini, "Transport and the Environment in Italy *(*1950-2006*)",* (2012): 222
[355] Federico Paolini, "Transport and the Environment in Italy *(*1950-2006*)",* (2012): 223

decided to invest in new motorways, instead of buses or metros, a policy that was not successful.

From the analysis reported above, it is possible to understand that the issue was not solved, and Quattroruote still identified it as a problem in the decades from the 60's up to the 80's. The main reason for such failure was and still is today, a lack of vision and consideration of the bigger picture. The measures put in place were not coordinated and did not belong to a more comprehensive plan and thus served as short-term relief. To this day, many Italian cities still suffer from congestion.

4.6 Rises in oil prices and alternatives

As highlighted above, one of the reasons why automobilists felt attacked, was the excises imposed on oil, which increased its price. Italy had one of the highest taxes levied on petrol. In 1971, it cost 152 lire per liter, 118 of which were just taxes, meaning that the net price was 22% of the final one.[356]

By the end of the 60's there was an increasing, even though rather small, interest in electric vehicles. To testimony this many articles were published in Quattroruote. The magazine often reported the involvement of many car makers in this technology. GM with Electrovair II and Electrovan, Ford, as well as Fiat, which included batteries to its 1100. Nonetheless, authors were often skeptic of the potential of the electric. The reasons for such skepticism of course were the limited range and the need of an extensive infrastructure to charge batteries fast.[357]

General interest for alternative sources of fuel skyrocketed especially during the Yom-Kippur war and the subsequent rise in price of oil. From a graph reported in the April 1976 edition of Quattroruote, it is possible to see the evolution of the prices per liter of oil. In a 20-year period, it increased by 163%, even though the sharp rise started in 1973, with the Arab-Israeli conflict. With the second oil crisis, in 1979, prices reached a new high of 500 lire per liter, consolidating Italy as the most expensive country for oil and the

[356] Gianni Mazzocchi, Primato sgradito, Quattroruote, July 1972
[357] L'elettromania, Quattroruote, December 1967

one with the highest percentage increase in price. Nonetheless, it should be noted that a great portion of the final price was actually due to taxes.

The reduction in supply and increase in prices of the first oil crisis was so deeply felt all over the world, that global consumption of oil decreased by 1%, for the first-time since WWII. This statistic is even more important when compared to the level of growth in the previous years. From 1963 to 1973, consumption increased on average, by 8% each year.[358]

In order to fight such increase, France decided to allow for a certain level of deregulation of oil prices, a policy that probably most drivers hoped Italy would pass as well. [359]

Year	Month	Oil Price (lire per liter)
1956	November	152
1960	May	110
1964	February	120
1969	February	140
1973	September	185
1973	November	200
1974	February	260
1974	July	300
1975	November	315
1976	13th March	350
1976	18th March	400
1979	May	500

Oil prices per liter between 1956 and 1976.[360]

During the mid 70's, when this debate was probably getting the most attention, many started to discuss about potential alternatives to oil. Initially, such interest was driven by the price of oil being so high, but then, as seen in the previous section, it involved the issue of air pollution too. Moreover, some feared that at that rate of consumption,

[358] In regresso il consumo mondiale di petrolio, Quattroruote, December 1975
[359] Francia: prezzi liberi per benzina e gasolio, Quattroruote, March 1985
[360] Gianni Mazzocchi, Sacrifici? D'accordo… ma per tutti, Quattroruote, April 1976

supply could decrease substantially, so that a change in propulsion was considered as possible in the future for many years. Some viewed almost positively the oil crisis, as it could smooth consumption and make oil stocks last longer, allowing for progress in the field to be done.

"It should be kept out the idea that if oil price stayed at pre-Kippur levels, oil supplies may have finished before anyone discovered a legitimate alternative".[361] Furthermore, it should be noted that such period of crisis, since 1973, led to a steep reduction in car registration. A peak was reached in 1974, with 148.550, which then decreased to 139.994 and 73.149 for 1974 and 1975 respectively.[362]

An article published in the September 1971 edition, wrote:

"Oil experts affirm that, given present oil quantities, there will be enough supply for the next 35-40 years."[363]

Such argumentation became even more diffused during the two oil crisis. In 1980:

"The oil crisis is shocking the whole world; oil is doomed to end up and the lucky ones that have great supply can increase prices to unsustainable levels."[364]

Arab exporting countries unwillingness to supply more oil made car drivers understand the importance of such resources, so that the magazine exhorted them to save as much oil as possible, moderate the speed and avoid driving too fast.

Documenting the Dutch decision to ban vehicles on Sundays, the Quattroruote stated:

"Dutch Sundays are like this, the same could happen all over the world, because of the oil crisis: cars parked, as well as other vehicles with an engine, and streets will find their ancient calm again."[365]

Exploiting energy coming from the sun was one of the most talked about alternatives. It was not considered as a power for cars, but for other types of industries, leaving more supply of oil for cars themselves, and thus, reducing general consumption.

"Capturing sun energy and transforming it into usable energy is a not a fantasy, but a reality. It is done in japan, Israel, Australia and Germany […] Unfortunately the

[361] Non tutto il male per nuocere, Quattroruote, April 1975
[362] G. Migliavacca, La discesa continua, Quattroruote April 1975
[363] C. F. Zampini Salzar, Per il petrolio il futuro è già inquietante, Quattroruote, September 1971
[364] Steno Siccoli, Ripetiamo che sono per ora inevitabili le centrali nucleari, Quattroruote, June 1980
[365] Domeniche senza benzina, Quattroruote, December 1973

technology to do so is still insufficient in Italy."[366] Multiple articles were published on this topic in the same edition of the magazine.

Others also pushed for atomic energy, which at the time got many people talking. Some highlighted the great potential while others feared it, because of its use to end WWII and its aftermath, which was still very vivid in everyone's minds.

Responding to a letter, Steno Siccoli wrote:

"The time we are living may push some scientist to find a definitive solution to the energy issue, so as to free us from such condition of dependence that we have been living for at least the last ten years […] People against nuclear power are afraid since the word "nucleus", or "atom", evokes the frightening memory of the atomic bomb. […] Others suggest, in order to avoid nuclear power, to exploit natural gases and methane gas, obtained by the distillation of organic waste, which positively viewed by ecologists, since it is a nonpolluting resource […] In conclusion, it is important to remember that we all should do the best to save energy: either by using the car only when necessary or building less energy-demanding vehicles".[367]

Nonetheless, at the time, nuclear power seemed to be one of the most promising energy sources, which could solve the energy problem. UK and France were ahead in this, and nuclear power was already widely used in those countries.

Steno Siccoli, an author of the magazine, wrote:

"(nuclear power) is the only one that can reduce substantially the need of oil […] The use of nuclear energy in Europe, currently satisfies about 20% of total electric energy needs, while in Italy, it only does 2%."[368]

Such thesis was further proposed in other articles as well. The main aim was not to decrease oil consumption directly from transport, since an alternative to oil was extremely hard to find but reduce it from other industries and use nuclear power as a source for electricity.

"Savings need to be done in those areas where oil can be easily substituted. It cannot be substituted in the transport sector; on the other hand, it can be done in other sectors: industries, production of electric energy and heating […] It needs to happen a

[366] Steno Siccoli Energia solare, Quattroruote, October 1976
[367] Steno Siccoli, Per ora inevitabili le centrali nucleari, Quattroruote, October 1979
[368] Steno Siccoli, Ripetiamo che sono per ora inevitabili le centrali nucleari, Quattroruote, June 1980

whole structural change of the traffic, in particular it needs to radically change the car […] Solar energy is still far away, wind and geothermal power are insufficient: in order to satisfy the needs we need to resort to nuclear energy."[369]

Diesel was another propelling source that got much attention in the 70's. Even if it was cheaper, many car enthusiasts highlighted its poor performance, when compared to the traditional ICE car, which could impair energy savings. Moreover, through the years, diesel prices went up too, especially due to state-imposed excise on diesel cars, the highly criticized "supertax". Nonetheless, there was still a substantial economic benefit to buy a diesel car, especially because that technology was used for lorries, so that the State decided to keep diesel prices constant, in order not to hurt the logistic sector. At the beginning, most of the diesel car were manufactured by foreign brands. The only Italian car in this market was the Alfa Romeo Giulia. Nonetheless, in the further years, Fiat and others Italian brand understood the demand of the market and adjusted their offer. Unfortunately, Italian infrastructure was not ready for this change, as the number of petrol station dedicated to diesel were very scarce, causing long queues and waiting times for those requiring diesel. Furthermore, adding to the problem was that this type of power was adopted by large trucks. So those delays were not only caused by few petrol stations, but also by many lorries filling up, which could take a lot of time.[370] Nonetheless, this shows that more and more people were interested and bought diesel-powered cars. In 1984, diesel cars represented 34% of the total matriculations for the year, with peaks of 50-60% in some regions. A portion that was one of the highest, if not the highest in Europe. [371] This was especially true in the mid-80's, where more and more car manufacturers, also Italian, started to approach the market, improving the technology as well and thus solving some of the problems that it had at the beginning. Just to make an example for this matter, it is possible to find an article in the edition of March 1985, dedicated to the injection pump, which had been tailored to diesel needs and thus such cars got better.[372] Technological innovations made performance almost the same as conventional ICEs. Furthermore, this grown attraction is also shown by the

[369] Steno Siccoli, In attesa dell'energia solare indispensabile la nucleare, Quattroruote, December 1980
[370] La fila per il gasolio, Quattroruote, March 1979
[371] Diesel: non è sempre un affare, Quattroruote, February 1985
[372] Enrico de Vita, Il diesel ridotto al silenzio, Quattroruote, March 1985

amount of diesel car reviews in the magazine, which increased throughout the years. It is possible to say that this topic was one of the most discussed ones in the 80's.

Many, especially in the USA, were also studying alternative ways to produce propelling energy sources to substitute oil, like for example from ethanol and methanol, even though such projects at the end did not achieve the target.

In the final years of the 70's, increasing interested was given to the electric power. To testimony this, there was an entire car fare dedicated to EVs in Philadelphia. Most of the vehicles presented were still prototypes, but such convention is important and signaled a change in the public discussion. An Italian brand was present too: PGE collaborated with ENEL and showed off its Van 8. [373] There were other Italian prototypes of the EV, like for example Zele Zagato, Fiat Xi 23, a van developed both by Fiat and ENEL and some others. Quattroruote greeted the news nicely, highlighting the benefits of EVs over traditional ICE vehicles: less pollution, less noise and easier to drive, important characteristics especially in the city centers, where pollution and congestion were extremely dangerous.

The research about this topic, for a long time, came mainly from the United States. From an article published in July 1980, a study forecasted that by 2000, there will be around 10 million electric cars, increasing from 1700 of 1980. In Italy, this topic did not attract much attention, probably because people only saw prototypes with great range problem and lack of charging infrastructure, so that the technology seemed utterly unattainable.[374]

It is possible to note more and more articles dedicated to the electric technology, especially from the beginning of the 80's. As mentioned previously, this concern probably was the effect of two major oil crisis which made oil price skyrocket, fears about energy dependence as well as growing apprehension about air pollution and its effects of human beings' health.

Another power source that was considered (and could be used also for generating electricity), was biogas, made mainly by methane, derived from processing organic

[373] L'auto a batteria quando avrà mercato?, Quattroruote, November 1978
[374] Vetture elettriche nel 2000, Quattroruote, July 1980

waste. At the time, it was extremely expensive, even though it represented an efficient way to recycle waste.[375]

Even though the public opinion, or at least Quattroruote, was very concerned with energy security and alternative energies, the magazine reported politicians' stillness about the topic.

"To govern is to forecast, everybody knows it, except for our politicians, which are not capable of taking specific measures to face the energy issue. They only talk about those measures: mention great projects which are never followed by action."

The article goes on listing all the potential energy sources which could help decrease such energy dependence, also making examples of the work of other countries, highlighting the fact that progress in Italy is extremely slow.[376]

Oil price have always been one of the main reasons why drivers felt attacked by the State. The anti-car sentiment mentioned at the beginning of the chapter comes directly from the amount of taxes and excises put on gas. As a matter of fact, a great portion of the final price was simply tax. Such proportion was the highest in Italy than almost in any other European country.

With the oil crisis of 1973-74 and the other one in 1979, more interest was dedicated towards alternative sources of power. This was because everyone understood the fact that oil is a limited resource, and the two crises helped this statement sink in Italians' minds. Everyone already knew that, but probably thought that it would have lasted for much longer and these two events made people realize that it was a false belief. Quattroruote believed that since at the time, there was not an adequate substitute to oil, the other industries should be the ones to make the transition to other sources, in order to lower the general oil consumption. Still, it is possible to find some examples of investments in EVs, even though most of them came from overseas. Nonetheless, it should be noted that the energy crises led to a renewed interest in the technology.

The magazine denounced the stillness of the Government when it came to tackle find new alternative power sources. The discussion about solar, wind or nuclear power did

[375] L'auto a biogas non è una novità, Quattroruote, October 1980

[376] Steno Siccoli, …soltanto parole, Quattroruote, February 1980

not evolve in actual measures and actions, unlike countries like France and UK which made use of substantial amount of nuclear power. Italian public opinion was mostly afraid of it because of the terrible memory of Nagasaki and Hiroshima and later Chernobyl.

By analyzing the Italian public discourse, it is possible to see many similarities with the American one, as the themes and topics were the same. Traffic and congestion are just one example of such commonalities. The same could be said for pollution, safety as well as alternative power sources. The only difference is the time. The sharp increase in car ownership in the U.S.A. happened around the 30's and 40's, while in Italy it took place in the mid-60's and 70's.

Since the 80's, it is possible to see a change in the editorial plan of the magazine. Social matters started to take less and less space in the pages and more articles were dedicated to the actual cars. The magazine decided to publish a higher number of articles treating car reviews and more in general, technological innovations. Still, in some editions it is possible to read pages about car crashes, congestion and environment, nonetheless the frequency and the strength of such passages is much lower than in the decades prior.

The reasons for such change could be multiple and it is not possible to pinpoint with certainty just a few.

Quattroruote represents the view of a specific niche of people, with a particular interest, thus it is not possible to state clearly and with confidence that findings can be generalized to the whole Italian population. However, some speculations can still be done. Since the first edition, Quattroruote uncovered many different issues that had an impact both automobilists and society too, since the car was starting to become more and more central to the life of Italian citizens. Some of those diminished or completely solved. For example, safety of the street was increased, safety belts became a standard built-in feature, streets started to get in better condition and driving under the influence of alcohol became less of a plague. Nonetheless there were others that still had to be fully faced and tackled. Thus, it cannot be stated that the interest diminished because such issues were considered solved, since they were far from that.

Environmentalism started to get some traction in the mid-70's, and by the time Quattroruote diminished the coverage on the topic, a solution was still not found. The

same could be said for congestion: big cities like Rome or Milan still suffer today from such problem.

First, it should be noted that Gianni Mazzochi, first director of the magazine, passed away in 1984. It could be argued then, that the new director, Raffaele Mastrostefano decided to change the editorial plan and focus more of cars' enthusiasts that were less concerned with the issue around the car and more interests in the vehicles themselves. It could be speculated that the general legislative immobilism may have simply exhausted the authors, who did not see any of their requested answered. As noted above, some of the problems persists today, as they require a comprehensive set of interventions and general urban changes.

Another reason for the change, especially regarding issues related to the environment and air pollution, is that by recognizing the high contribution of the entire automotive industry to the problem, authors preferred to defend their own category.

As mentioned before, it is not possible to state that the decreasing interest for the issues discussed above showed by Quattroruote, reflects a decrease in interest by citizens as well. This is shown by the regulations implemented by Italy in the environmental field. To serve as a testimony, the European Green and White Paper are a great source. They represent an early attempt to harmonize and solve issues that regarded all of the countries in the European Economic Community.

One of the first examples of such initiative was signed on June 27th, 1990, the "Green Paper on the Urban Environment". The document analyzes the topic of deep and spread urbanization and the problems that are linked to it, like degradation and pollution. The paper finally, gives some possible lines of action as well, in order to tackle such issues. Moreover, in 1989 and 1990, many conferences were held about the topic.[377] Such initiatives represent a sign of interest from the community, which do not find equivalent space in the pages of Quattroruote.

During the following years, more and more papers were drawn up. For example, "For a European Union Energy Policy in 1995, "The Impact of Transport on the Environment" in 1992 "European Transport policy for 2010: Time to Decide", as well as others more

[377] Commission of the European Communities, "*Green paper on the Urban Environment – Communication from the Commission to the Council and the Parliament*", (June 27th, 1990): 1-4

recent. [378] More specifically, the former deals with energy policy. After the two oil crises which deeply impacted European countries, the paper tries to give a framework of operation about the issue for all the states involved and aims at coordinate efforts and interests. The latter treats air pollution and the greenhouse effect which is exacerbated by modern mobility paradigms and hopes for global cooperation. In the very beginning it clearly states that the current consumption levels of industrialized countries are the real source of the issues related to the environment, but also put at risk the ability of future generations enjoy comparable levels of wealth.[379] The last one cited above aims at harmonizing and optimizing transport policies in order to achieve sustainable development. From the paper mentioned previously, it is possible to note the frequent use of the word "sustainability", which was hardly used in other publications before. This is a sign of change, which is most likely reflected also in the public opinion and the general press of the states involved. However, Quattroruote is an exception to this as it took another direction, trying to focus more on technological aspects, rather that issues revolving the car.

It is also possible to state that such interest in energy use, environmentalism and approaches to mobility problem grew in importance in the following years. For example, sustainability and alternative sources of power are becoming more and more present in the political agenda of many parties, both in Europe and the USA. Of course, this is more relevant in some specific countries, but it symbolizes the fact that people too are increasingly worried about such topics and take them more seriously than even before. Even though much of the laws proposed on these works were not mandatory for the Member States to implement, but were simply suggestions, they still serve as a testimony of the increasing interest in environmentalism, pollution as well as other issues that sprung up with motorization.

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[378] Commission of the European Communities, "*For a European Energy policy – Green Paper*" (January 1st, 1995): 1-129
Commission of the European Communities, "*Green Paper on The Impact of Transport on the Environment – A Community Strategy for Sustainability*" (February 20th, 1992): 1-56
Commission of the European Communities, "*European Transport Policy for 2010: Time to Decide – White Paper*", (September 9th, 2001): 1-110

[379] Commission of the European Communities, "*Green Paper on The Impact of Transport on the Environment – A Community Strategy for Sustainability*" (February 20th, 1992): 1

Even if a fair comparison is hard to outline, because of a lack of adequate counterpart, it is interesting to uncover the evolution of the American debate during those same years. Since the 70's, the US government passed more and more laws dedicated to air pollution and environment preservation. This too is a sign of a more intense consciousness among citizens about the topic. For example, the Clean Air Act was often amended to include more stringent and stricter regulations. Other instances are the Energy Policy Act, passed in 2005 treats energy production, renewables included or the Pollution Prevention Act (1990).

Furthermore, that was also a time where environmental groups got more traction and interest by the general public. Their mission then stopped from being a niche one and became somewhat more mainstream. This was made possible also because of important environmental catastrophes, like the Santa Barbara oil spill, as well as elevated levels of pollutants in cities like New York and Los Angeles. Such environmental sentiment is described more in details in the second chapter, more specifically in the section dedicated to the subject, giving the idea that American citizens too started to be more aware of the dangers and the need to act accordingly. Thus, once again it is possible to trace a parallelism between the United States and Europe.

Conclusion

The thesis aimed at exploring the emergence and the establishment of the modern automobility paradigm, made of individually owned ICE vehicles, as well as its evolution. Initially, this was done by giving the reader an historical background about the diffusion of the technology throughout the 19th and 20th century. Then, the issues and problems that arose during the 20th century, which pushed for a substantial change in the model, and other forces that were concerned with maintaining the status quo, are presented. Even though many critics pointed out to the unsustainability of the model in the long term, there have been frequent attempts to keep it as it is.

Out of the issues that became evident during the 20th century, air pollution and environmental degradation are probably the most important ones. This is because the problems that were observed during those years, are the same that society must face today. The work of Ralph Nader, "Unsafe at Any Speed", was pioneering and extremely

innovating for the age. For the first time, it was presented a proof of a direct cause-effect relationship between the spread of automobility and dangers for the environment and extreme decrease in quality of air, causing harm to people. Nader showed how dangerous the toxic agents coming from cars' exhausts really are. As a further evidence of the threat to the public health, in 1953 and 1966 New York reached extremely high levels of pollutants in the air, causing deaths of many citizens as well as respiratory problems to others. Moreover, the Santa Barbara oil spill of 1969, as well as other similar disasters increased people awareness about the topic. Events like those, helped people understand the dangers of abusing oil and related products. During the subsequent years, many environmentalist groups were born, like for example Greenpeace.

Nonetheless, the automotive industry did not seem to be touched by such sentiment and kept its business as usual. As a proof, in the second chapter some letters exchanged between Kenneth Hahn, a Los Angeles County supervisor, and Henry Ford II, former president of the Ford Motor Company, are presented. They show, on one part the concerns of many and the need for a change, while from the other, they demonstrate the indifference of the automotive industry for the problem. Since the risks were well documented, it is hard to believe that Henry Ford II or other automotive brands' presidents were not aware of them. On the other hand, it is more likely that they simply did not want to face them, because it would cost them a lot of money, thus hurting their business.

During the 60's, the United States as a whole started to pass some laws aimed at reducing the toxic agents in the air. Nonetheless, such legislations were rather loose and did not manage to solve the problem of pollution. Nonetheless, it should be noted that they represent the first attempts to regulate an industry that, for the most part, was left without much central guidance. This was due to the fact that before, people were much more concerned with the gains for the national economy and the general benefits of having a strong automotive industry.

Another aspect that prevented any major changes to happen is the fact that the car supply chain is very long and complex and it affects other sectors, which could be negatively impacted if the production suddenly diminished. Furthermore, lots of jobs depend on the current automobility model. For the reasons explained above, any government that would try to regulate much more strictly the industry would find lots

of resistance both from the owners of the companies as well as from the citizens themselves that work at those factories.

Another great factor of resilience is the deep relationship between people and cars. Automobility is highly engrained in today's culture, and many would interpret a change in the mobility paradigm as a way to change the whole Western culture. In the second chapter it was possible to observe the fact that cars not only have a pragmatic function for people, but they also have a symbolic significance. They stand for freedom and liberty. Cars also represents some characteristics of the drivers' personalities, and they are a symbol of achievement. Furthermore, painting, poetry and movies helped raise the car almost to a God-like level.

The importance of the cultural aspect and the contribution to the economy represent two of the strongest oppositions to any possible change of the mobility mode.

The abovementioned pressure to change and oppositions are the most significant in the history of automobility because they hold true today still. Environmental preservation is one of the biggest challenges of the 21st century and the effects of air pollution and global warming are now visible by anyone. On the other hand, the automotive sector has constantly grown. The pressures were not strong enough to achieve their objective and to influence the development of the automobility paradigm. The short-term gains for societies were simply too high, while the pressures were not enough. More specifically, effects of global warming and environmental decay seemed so far away, that they did not seem to constitute an immediate threat.

The thesis has also showed that, at least for the time being, it is not feasible to change only one of the two main factors of the paradigm. Shifting to electric vehicles would not solve the problems explained in the previous pages, as EVs' production and use have deep consequences too. First of all, it needs to be produced through renewable resources, but right now this is not always the case. Then, it should be noted that emissions and pollution also happen during the extraction of resources like cobalt and lithium, that may also not be enough to satisfy the demand, as well as during the whole production process of the car. Furthermore, the mining sector raises ethical and social issues too.

In the recent years, something has started to change in the last few years, indicating that a radical change might be in sight. Thanks to movements like "Fridays for Future", that

call for a global intervention in the matter, more light has been shed on the topic, increasing public awareness and concern for the future of our planet. More and more research has been conducted in the field, documenting the hazards. The threats given by pollution to human health and the dangers for the whole planet are now well documented, understood, and undeniable. Critics of the current automobility paradigm are greater in number and louder than before and very few people believe that it is sustainable and that it will stay the same way for longer.

This is visible also in the political field. More and more political parties center their program on policies that tackle this problem.

With such renovated consciousness about the negative effects of cars' usage, more and more influential parties may decide to stir the path and put in place a real change.

The model given by individually owned ICE cars may not work in the future. Congestion, which was a problem individuated even before, has become almost unbearable in some cities, difficulties in transport are keeping away many people from exploiting opportunities and oil is a finite and highly polluting resource. These factors, as well as many other are pushing now more than ever for an alternative automobility system. Phenomena like car sharing services or the widespread use of services like Uber and Lyft are a sign of the times that are changing and may help us make some predictions of how the model will evolve and change.

The historical background given in the first chapter is fundamental in order to understand how the future could evolve. The beginning age of automobility could be described as service-based, because of the usage of taxicab companies, but then thanks to Henry Ford and his cost-reducing strategies, it became product-based. Nowadays the reverse can happen, shifting back to the service-based model where there are less individually owned cars. In the future, more and more people, unable travel easily and quickly in the city with their own car, may decide to use the services abovementioned. Moreover, a less car-centric mobility may arise, focusing on alternative modes of transport.

The American example was central for the discussion because it is highly representative of how societies behave in general, even though they belong to different countries. This is shown thanks to the analysis of the Italian case, through the magazine Quattroruote and the work of Federico Paolini. Even though there are small differences, the end

results is the same. As it was possible to note, the same issues that arose in the United States, emerged in Italy too. The only difference is the timeline. Since automobility spread much earlier in the American country, the problems were evident a few decades later in Italy.

Once again, mirroring the American case, the individual and societal benefits of millions of cars in the streets were extremely high and the risks did not seem to justify a change. Moreover, since the phenomenon in Italy happened so fast, many citizens did not have the opportunity to personally experience the negative consequences, thus diminishing the pressure to change. Furthermore, the portion of people that saw the whole system as unsustainable was really small an unable to put more pressure.

The findings of the last chapter put the basis for a generalization of the phenomenon of automobility, suggesting that evolution was extremely similar, and the future could be too. As a matter of fact, nowadays, Italian citizens are aware of the outcomes and more and more people are changing habits. For example, before one had to have a car, while now, car sharing services are appearing in the country. Even though Uber still has not being able to work in Italy, it is very likely that it will happen in the near future. These may seem smaller changes, but actually they symbolize a much bigger change.

The thesis, through its historical perspective has shown the establishment and the evolution of the automobility paradigm in the USA, as well as in Europe, with the Italian case. By highlighting the limitations of the model, the work may contribute to understanding the sustainability problems related to it, and by looking at the past, it may help the reader understand how the future could unfold.