

The University of Akron

IdeaExchange@UAkron

---

Williams Honors College, Honors Research  
Projects

The Dr. Gary B. and Pamela S. Williams Honors  
College

---

Spring 2021

## Less Commute Miles. Decreased Tire Wear. What Would You Do?

Dylan Schwarz  
das225@zips.uakron.edu

Brendon M. Ford  
bmf78@zips.uakron.edu

Brandon D. Hadinger  
bdh69@zips.uakron.edu

Abbie N. Pearce  
anp90@zips.uakron.edu

Jacinta M. Pikunas  
Follow this and additional works at: [https://ideaexchange.uakron.edu/honors\\_research\\_projects](https://ideaexchange.uakron.edu/honors_research_projects)



Part of the [Accounting Commons](#), [Acoustics, Dynamics, and Controls Commons](#), [Business Administration, Management, and Operations Commons](#), [Business Analytics Commons](#), [Business and Corporate Communications Commons](#), [Corporate Finance Commons](#), [Finance and Financial Management Commons](#), [Navigation, Guidance, Control, and Dynamics Commons](#), and the [Other Business Commons](#)

Please take a moment to share how this work helps you [through this survey](#). Your feedback will be important as we plan further development of our repository.

---

### Recommended Citation

Schwarz, Dylan; Ford, Brendon M.; Hadinger, Brandon D.; Pearce, Abbie N.; and Pikunas, Jacinta M., "Less Commute Miles. Decreased Tire Wear. What Would You Do?" (2021). *Williams Honors College, Honors Research Projects*. 1427.  
[https://ideaexchange.uakron.edu/honors\\_research\\_projects/1427](https://ideaexchange.uakron.edu/honors_research_projects/1427)

This Dissertation/Thesis is brought to you for free and open access by The Dr. Gary B. and Pamela S. Williams Honors College at IdeaExchange@UAkron, the institutional repository of The University of Akron in Akron, Ohio, USA. It has been accepted for inclusion in Williams Honors College, Honors Research Projects by an authorized administrator of IdeaExchange@UAkron. For more information, please contact [mjon@uakron.edu](mailto:mjon@uakron.edu), [uapress@uakron.edu](mailto:uapress@uakron.edu).

Less Commute Miles. Decreased Tire Wear. What Would You Do?

Final Research Paper

Brendon Ford, Brandon Hadinger, Abbie Pearce, Jacinta Pikunas, and Dylan Schwarz

Akron Associates of Tire Analytics



University of Akron

Honors Project in Business Admin 003

## Table Of Contents

Title	Page
Table of Contents .....	1
Project Scope .....	2
Goodyear Report .....	5
Automotive Industry Report .....	10
Past and Present Industry Trends .....	14
Future Industry Outlook .....	17
Goodyear's Options for the Future .....	26
Financial Outlook of Options .....	29
Research Transition .....	31
Methodology for Primary Research .....	32
Survey Results .....	34
Final Recommendations .....	40
Works Referenced .....	42

## Project Scope

With the flagrant recognition of the coronavirus as one of the most impactful viruses in the history of the world, it is important to study how the effects of such a disease can create troublesome ripple effects in the world. Covid-19 has caused the death of hundreds of thousands of individuals and has negatively impacted the lives of American's all across the country during the nationwide lockdown. Decreased work commuters, minimal road travel, and little need for car repairs created issues for The Goodyear Tire & Rubber Company. The University of Akron has teamed up with Goodyear to explore such effects and to answer the proposed research question by Goodyear: *Less Commute Miles. Decreased Tire Wear. What Would You Do?*

Discussed in this research paper will be how the decrease in commute miles by American drivers due to the coronavirus has impacted American drivers and what that means for a rubber and tire company such as Goodyear. Reviewed in the write up will be the impact the virus has had, whether or not Goodyear should pivot, expand, or downsize the business, and the resolution this research team has provided. We will accomplish this objective by the following action plan including a Project Scope, Goodyear Report, Automotive Industry Report, Present and Past Automotive Trends Report, Goodyear's Options for the Future, Financial Outlook of Options, Decision and Analysis, and Presentable Course of Action.

The Akron Associates of Tire Analytics (*AATA*) research team comprises several of The University of Akron's most scholarly honors students. Each individual brings a set of valuable assets to the table with backgrounds of all different calibers. Group members have different degrees helping drive diverse input and collaboration throughout the research and problem-solving development.

The Project Lead for the team is Dylan Schwarz. Dylan Schwarz is a senior earning a Bachelor's in Business Administration with a major in Corporate Finance. With plenty of experience as a Finance Intern in the Strategic Business Area at the J.M. Smucker Co. and an Equipment Manager in the University of Akron's Athletic Department, Dylan brings analytical expertise, financial acumen, and leadership skills to the group. At the J.M. Smucker Co., Dylan was responsible for facilitating a monthly financial review for a +\$100M global coffee brand, reporting national daily coffee shipments, tracking green coffee futures' trends, and using advanced analytical software to support marketing brand teams with ad hoc financial analysis. Dylan was also responsible for supporting numerous brand initiatives through the stage gate process by working cross-functionally with different teams to build in-depth financial analyses.

The communicative role of the team is led by Jacinta Pikunas as the Project Communicator. Being a member of multiple student organizations on campus, she exercises the skill of communication in multiple outlets such as in the University Student Ambassadors, the Student-Athletic Advisory Committee (SAAC), the CBA Dean's Team, and the University of Akron's Women's Golf Team. Her proficiency in interactions within all of these groups and organizations makes her ideal for the role of Project Communicator on this team. Not only do her current commitments to school organizations develop her growth as a successful communicator, but they also require her to learn the useful skills of teamwork and cohesiveness. Jacinta is a current senior working to attain a Bachelor of Science in Accounting by the end of the coming spring semester, Spring 2021. Additionally, she plans to remain at Akron for a fifth year of studies in aim of earning an Accelerated Master of Taxation by end of the spring semester, Spring 2022. Given her background of studies at the University, she is able to extend her skills of structured thinking and statistical analysis to our team.

The Project Administrator is senior Brandon Hadinger, who is also obtaining a Bachelor of Science in Accounting. He plans to begin studying for the Certified Public Accountant exam once he graduates in May with the required 150 credits. Brandon brings public accounting experience from 415 Group in Canton, where he worked as an External Audit Intern for eight months. He also has experience working as a Plant Project Services Intern and an Internal Audit Intern at The J.M. Smucker Company. Furthermore, Brandon served as President of The Accounting Association his junior year and was a member of the national accounting honor society known as Beta Alpha Psi. With his internship and leadership experiences, he is a great asset to the team with plenty of accountancy understanding.

Brendon Ford is the team's Project Content Coordinator. As a fourth year Integrated Marketing Communications major, his 4-year commitment to working in retail brings valuable knowledge of management skills to the team.

The final member and Project Team Monitor is Abbie Pearce who is a senior with a double major in Sales and Marketing Management. Pearce brings forth sales experience with her recent internship with Palmer Holland in their inside sales department and is also a member of the U of A's Women's Golf Team. With her sales knowledge and teamwork skills, she makes for the right fit in monitoring the teams' work.

## **Goodyear Report**

The foundation of what is now one of the world's most renowned brands in the tire and rubber industry, has a unique story as to how it was born. The namesake of The Goodyear Tire & Rubber Company can be traced back to its origin of inspiration linking to a man of the name, Charles Goodyear. Born in the year 1800 as the oldest of six children, he grew up in New Haven, Connecticut, where he was raised by his parents Amasa and Cynthia Goodyear. As a young man in his early 20's, he took interest in the business of hardware and decided to pursue the industry relocating to Philadelphia, Pennsylvania (Guise-Richardson, 2013). It was not until the early 1830's in which he began to explore his interest in gum elastic or, as it is more commonly known, rubber (Goodyear Corporate, 2020). His fascination with rubber directed his efforts to years of tinkering and experimentation with the material in aim of developing a durable, all-weatherproof piece of rubber. Finally, in the year 1839 after what seemed like endless years of trials, Charles Goodyear, by mere accident, stumbled upon his greatest advancement in the crafting of rubber. He discovered "that steam under pressure, applied for four to six hours at around 270 degrees Fahrenheit," on rubber mixed with sulphur supplied the quality weatherproof rubber he had worked tirelessly to attain (Goodyear Corporate, 2020). This process of heating applied to the pair of rubber with sulfur led to what has since then been coined as the chemical process of Vulcanization (Fisher, 1939).

Although Charles Goodyear is accredited with the development of the Vulcanization process, The Goodyear Tire & Rubber Company which exists today has no association with Charles Goodyear or any of his family members (Guise-Richardson, 2013). The founding of the corporation did not establish its roots until nearly a half a century after the founding of the process by Charles Goodyear when a man of the name Frank A. Seiberling "purchased the

company's first plant with a \$3,500 down payment" (Goodyear Corporate, 2020). On August 29, 1898, "Goodyear was incorporated with a capital stock of \$100,000" in the respectable city of Akron, Ohio (Goodyear Corporate, 2020). Beginning with a meager staff of 13 employees, The Goodyear Tire & Rubber Company entered into production primarily supplying bicycle and carriage tires. The timing of their entry into the tire and rubber industry could not have been better as "the bicycle craze of the 1890s was booming" and the advancement of the "horseless carriage" was introduced into consumer markets (Goodyear Corporate, 2020). The business found itself quickly expanding, and by the year 1926, The Goodyear Tire & Rubber Company earned the title of the world's largest rubber company (French, 1987). David E. Hill, who purchased \$30,000 of stock in the company, became the first president. The Goodyear Tire & Rubber Company elected its first CEO, Paul W. Litchfield, in the year 1900 and he serviced the company for a total of 59 years (French, 1987). The dynamic leadership and commitment to the good of the brand by men such as Seiberling, Hill, and Litchfield helped to build Goodyear into the thriving success of a corporation it is today.

The origin of Goodyear's symbol of the Wingfoot came into existence two years following the start of production in the year 1900. What would become recognized as a world-renown symbol representative of The Goodyear Tire & Rubber Company, was decided upon by the leadership team in a meeting taking place at Seiberling's home in Akron (Goodyear Corporate, 2020). Attached to a stairway in Seiberling's house was a statue of the famous Roman mythological god, Mercury. Historically, this god was ruler of trade and commerce, but more notably, Mercury is remembered as being the messenger between all the gods. As the messenger god, he is further distinguished for his quickness in delivering the messages with which he was tasked. This characteristic of his often lends to the commonly depicted visage of him having a



Wingfoot reflecting his speediness. Given the knowledge of Mercury's most attributed characteristics as messenger of the ancient gods, a consensus was reached between Goodyear's leadership to select Mercury's Wingfoot as the company's trademark signifying the speed and deliverance of Goodyear tires (Bird, 1992).

Throughout the twentieth century, Goodyear faced many challenges such as the occurrence of the Second World War which presented an onset of difficulties which they bravely battled. Along with many challenges in pursuit of growth of the business, Goodyear also experienced many successes and contributed to many advancements in the tire and rubber industry. Goodyear's beginning developments include the first synthetic rubber tire, the first nylon tire, and the first all-season tire. With these developments, along with the introduction of their blimp, *The Pilgrim*, as the "first commercial non-rigid airship to use helium," and their exploration into space as the supplier of *Apollo 14's* tires, Goodyear has continually impressed the world with their innovations (Goodyear Corporate, 2020).

Taking a current look into Goodyear's situation in the tire and rubber industry, Goodyear is still held to be one of the world's leading brands for tire and rubber innovations. In the year 2013, they established the grand opening of their global headquarters in Akron, Ohio (Goodyear Corporate, 2020). They currently service a multitude of countries worldwide ranging over parts of Europe, Asia, Africa, and the Americas while collectively netting over \$15 billion in annual sales (MarketLine, 2020). According to a recent report, *Current trends and perspectives in tyre industry*, conducted by Chicu, N., Prioteasa, A.L., and Deaconu, A., they formulated a SWOT analysis on The Goodyear Tire & Rubber Company giving greater insight into their current situation in the industry (2020). Also in this report is found that Goodyear's current strengths are manifested in their "creation of a strong and sustainable brand, based on innovation," as well as

their “integration of all segments, starting from NASCAR to commercial tyres has a very good synchronization.” (Chicu et al., 2020). Adding to these strengths, Goodyear also maintains a healthy balance of focus on their customer’s needs while continuing to be receptive to the demands that the market presents to them. As for the company weaknesses which Goodyear is working through, the *Current trends and perspectives in tyre industry* report finds that their “Inventory control suffers due to cost fluctuations.” which significantly “affects the prices and quality of the products and ultimately, the branding strategy.” (Chicu et al., 2020). Additionally, due to the volatility of the global markets that was highly impacted by the pandemic of COVID-19, considerable presence of Goodyear on the global scale serves as a fragility to the brand making any possible threats a potentially heavier burden (Chicu et al., 2020). This, in turn, directly affects Goodyear’s expenses, increasing their costs. As for current opportunities which Goodyear may capitalize on, there exists a greater demand in emerging markets outside of the U.S. for an increase in the auto and motorcycle markets (MarketLine, 2020). Although this emerging market presents many new areas for growth in Goodyear, it is one which requires more intensive research and exploration before making any business investments. Besides venturing into a new market, the *Current trends and perspectives in tyre industry* report finds that opportunities lie in the seemingly “high potential for luxury tyres of category 17 cm or higher.” (Chicu et al., 2020). While Goodyear continues to inspect their future business prospects, they also remain attuned to all of the threats which are present to them. They are in close competition with other companies in the industry, specifically Bridgestone and Michelin, who all pressure one another into producing the greatest results possible so as not to fall behind in the race. The global pandemic of Covid-19, which continues to this day, exposes Goodyear to the scare of medical complications of their employees and staff leading to the “possibility of closing the tyre

plants.” (Chicu et al., 2020). Not only does the pandemic pose a threat to the health and safety of their staff, the pandemic has also created a highly uncertain commodity market which makes the prices of materials such as rubber and necessary chemicals for the vulcanization process subject to the scare of drastic cost fluctuations.

Leading the charge in the future of The Goodyear Tire & Rubber Company is current President, Chairman of the Board, and CEO, Richard Kramer who serves as the general corporation oversight (Goodyear Corporate, 2020). Alongside him is the Executive Vice President and CFO, Darren Wells, who is tasked with the focused governance of all of Goodyear’s financing, planning, and investment activities. Together, the team of Wells and Kramer in conjunction with the help of their enormous staff worldwide are confidently launching Goodyear into the future decades of the twentieth-first century.

## **Automotive Industry Report**

The tire and rubber industry has been a longstanding empire of growing businesses built domestically and internationally. Within the automotive industry, Goodyear's primary American competitor is The Cooper Tire & Rubber Company. Beyond the domestic market resides other competitive tire manufacturers such as Bridgestone and Sumitomo from Japan, Continental from Germany, and Michelin from France. Notable foreign competitors, such as Bridgestone and Michelin, still compete with Goodyear's product line within the United States of America. The American tire industry holds a market size of roughly \$17.5 billion as of October 18, 2020; this is a decline of 2.7% over the prior five years ("Industry Market Research," 2020). The domestic industry consists of 113 tire manufacturing businesses with nearly 42,730 employees.

With economic fluctuations and industry changes over the past few years, the tire industry has fallen from its growth trends, especially with the recent Covid-19 impact. The domestic tire industry has slightly rebounded with a recent increase in market size to \$19.2 billion ("Industry Market Research," 2020). Market research conducted by IBISWorld shows hopeful claims that the tire and rubber industry will continue to recover from its recent slump given the following factors (2020). The first factor that would benefit the growth and stability of the industry would be the depreciation of the U.S. dollar. This would influence an increase in demand for the products within the tire industry from consumers in foreign markets; these markets include, but are not limited to, Canada, Mexico, and Australia. The second factor focuses on an estimation of an increase in car sales at the conclusion of the pandemic. A nationwide increase in car sales would directly cause an increase in consumer need for tires. Lastly, the third factor that would correlate to the restoration of the tire market would be a higher demand for cars. An increase in the demand for cars significantly raises the total miles driven

measurement for American citizens. These factors are all dependent upon each other and may become beneficial in the potential restitution of the tire industry.

There are various other challenges that have taken place for Goodyear and its competitors. Amid the Covid-19 global pandemic, many companies have experienced and endured the furloughing of employees to various extents. Furthermore, companies within the tire and rubber industry have felt the pressure of the decreasing demand for cars and, more importantly, for tires. Due to the costs associated with owning or leasing a car, many families have been financially limited with the employment loss that has taken place worldwide from the pandemic. This has resulted in less cars on the roads during 2020, meaning less tire tread on the asphalt.

Other changes that are affecting the industry on a strategic, product-level basis are the innovations of automobile products. For example, Goodyear has recently entertained the usage of soybean oil to replace the petroleum-based oils that have been used in Goodyear's premium tires. Robert Woloszynek, Goodyear's chief engineer of polymer science, stated that soybean oil has been proven to enhance tire traction on wet and snowy surfaces (Schunk, 2020). The renewable resource improves tire performance due to its ability to provide compounds a more flexible temperature range; it also creates opportunities for greater manufacturing capacity and less energy output in production. Furthermore, there have been significant inventions and technological advancements with electric vehicles that have impacted how manufacturers are approaching tire tread designs. Electric vehicles do not produce noise from a combustion engine due to the silenced battery powered engine. Therefore, the primary noise inside the cabin of an automobile is the sound created from the tire contact with the road. Creating a quieter tire tread has become a more popular task for tire manufacturers with the increasing production of electric

cars. Some tire manufacturers, such as Bridgestone, are developing new campaigns to further the push for clean tire production and the usage of environmentally safe compounds. Bridgestone launched a new campaign titled “A Layered Journey,” which is their mission to produce tires solely from sustainable materials by 2050, including the rubber extracted from natural rubber trees (Tire Business, 2020). "This new campaign highlights our approach to sustainable procurement of natural rubber, which includes environmental stewardship practices, respect for human rights, support of fair labor practices, and increased transparency," states Bridgestone’s global chief business strategic officer, TJ Higgins. Outside of the Covid-19 pandemic effects, the tire and rubber industry has various other challenges to focus on while competing with international businesses.

As of February 22<sup>nd</sup>, 2021, Goodyear has made the proposal for an acquisition of Cooper Tires. This deal, valuing Cooper Tires at \$2.5 billion, will prove to be a massive deal for the Akron tire manufacturer (Goodyear, 2021). The Cooper Tire & Rubber Company is considered the fifth-largest North American tire manufacturer measured by annual revenue. The transaction elevates Goodyear’s positioning and distribution not only domestically, but also globally by nearly doubling its presence in countries like China. As of now the acquisition has not occurred, as a vote from Cooper shareholders is to take place on April 30<sup>th</sup>, but the acquisition could bring in astounding results for Goodyear (Kopcha, 2021). If The Cooper Tire & Rubber Company chooses to disregard the contract and end the deal, they are capable of doing so but only after paying a contract termination fee of over \$83.4 million to Goodyear (Kopcha, 2021).

Combined, the two companies would have around 60 factories, 70,000 employees, and 2,500 service centers. All of these would earn more than \$17 billion in annual sales. Furthermore, the acquisition creates numerous short and long-term financial benefits for

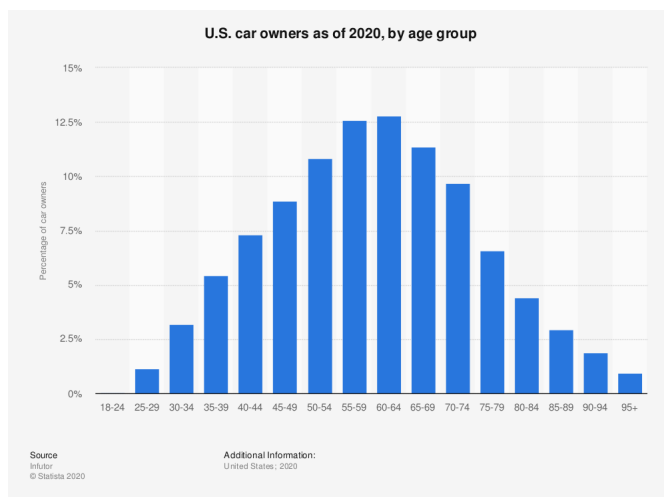
Goodyear; these benefits include \$165 million in recurring, or run-rate, cost synergies for the next two years of business and an increase in net present value through the usage of Goodyear's U.S. tax attributes (Goodyear, 2021). Goodyear's tax attributes directly boost free cash flow through the reduction in cash tax payments. Goodyear would also obtain a major hold over the US tire distribution and retail channels and be able to combine its strengths with Cooper's in the light truck and SUV segment (PYMNTS, 2021). Goodyear's momentous acquisition opens the door for opportunities to invest in new autonomous and fleet solutions. "The addition of Cooper's complementary tire product portfolio and highly capable manufacturing assets, coupled with Goodyear's technology and industry leading distribution," states Rich Kramer, Goodyear CEO, chairman, and president, "provides the combined company with opportunities for improved cost efficiency and a broader offering for both companies' retailer networks. We are confident this combination will enable us to provide enhanced service for our customers and consumers while delivering value for shareholders." With the shared values between the two businesses and the newly acquired market positioning, Goodyear's vision of growth remains limitless.

## Past and Present Industry Trends

Over the past few years, innovations in the tire industry have begun to pop into the daily routines of tire manufacturers. These innovations included things such as perfecting the “Magic Triangle” (Nelson, 2018). This triangle, being a balance of three performance attributes, was hard to prevent taking too much away from one attribute to accomplish another. This has been made much easier in recent years. Computers can now be used to simulate different tire designs under different forces between the tire’s protector and the different surfaces of road on which they would be used (Izhutkin, 2018). This lessens the time of testing significantly, thus allowing manufacturers to put out higher quantities and better quality products on a consistent basis. Technology has not only helped create well-balanced tires, but it has made its way into them as well. As vehicles have become more advanced, the tires that come on them have had to keep up with the progressions. Many now come with sensors built-in to alert drivers of the condition of their tires. This innovation was all occurring during the fourth industrial revolution (Xu, 2018). This current industrial revolution is characterized mostly by automation of production building off the previous industrial revolution, which started to meld digital aspects into the consumer’s daily life. While this has created many concerns involving the jobs that are now able to be

automated, the rates at which production is escalating are uncanny.

In 2020, most tire manufacturers have taken a massive hit in sales. It nearly goes without saying that this, in many ways, is related to the state the world finds itself in with the COVID-19 pandemic. According





to the Bureau of Travel Statistics, travel within the U.S. is down 29.3% as of October 18, 2020, in comparison with the data of the same date a year prior in 2019. To further put this into perspective, on October 18, 2019, a whopping 9,200,635,324 miles were recorded as traveled miles for that day (BTS, 2020). Data collected from the TSA also shows that their traveler throughput numbers are down by millions compared to last year's data. As a whole, the level of travel in 2020 has significantly trended downward. This decrease is in direct correlation with the amount of wear on tires which has also experienced less wear than in previous years, ultimately lowering the overall demand for tires. A couple of other factors which are important to consider when analyzing the reduction in travel are the people who drive most as well as those who own the most cars. According to the Federal Highway Administration, the age groups that drove the most ranged between the ages of 20-34 and 35-54 (FHDA, 2018). It is estimated that both groups drive about 15,000 miles per year (per person). An interesting element to note in this data is that both groups would be considered of the typical working age, meaning that many of their miles driven are coming from their daily commute to the office. Looking at who owns the most vehicles, according to Statista and Infutor, the age group to own the most cars is the 60-64 age group. This is followed by the 54-59 age range, and subsequently the 65-69 aged consumer grouping (Statista, 2020). This data is graphically represented in the above chart. More intriguing than these findings is the considerably low number of car owners in younger age groups. The number of younger car owners such as those of the Millennial Generation nearly match, identically, to those of the elderly age group, between their 80's and 90's. Based on data from the Panel Study of Income Dynamics, Nicholas J. Klein and Michael J. Smart discovered that many Millennials are not purchasing cars for economic reasons. However, it has been found that there is a slight increase in the number of younger car owners when they become independent from their

parents. Although, a large sum of the younger generations are not viewing a personal vehicle as a necessity in their daily lives (Klein, 2017). Many young adults are choosing not to invest in a vehicle and are rather opting to direct their funds into other items of which they place higher priority. In considering the direction younger drivers are moving towards with less vehicle usage and the presence of COVID-19 inhibiting travel, the rationale for the significant downward trend of tire wear is better understood.

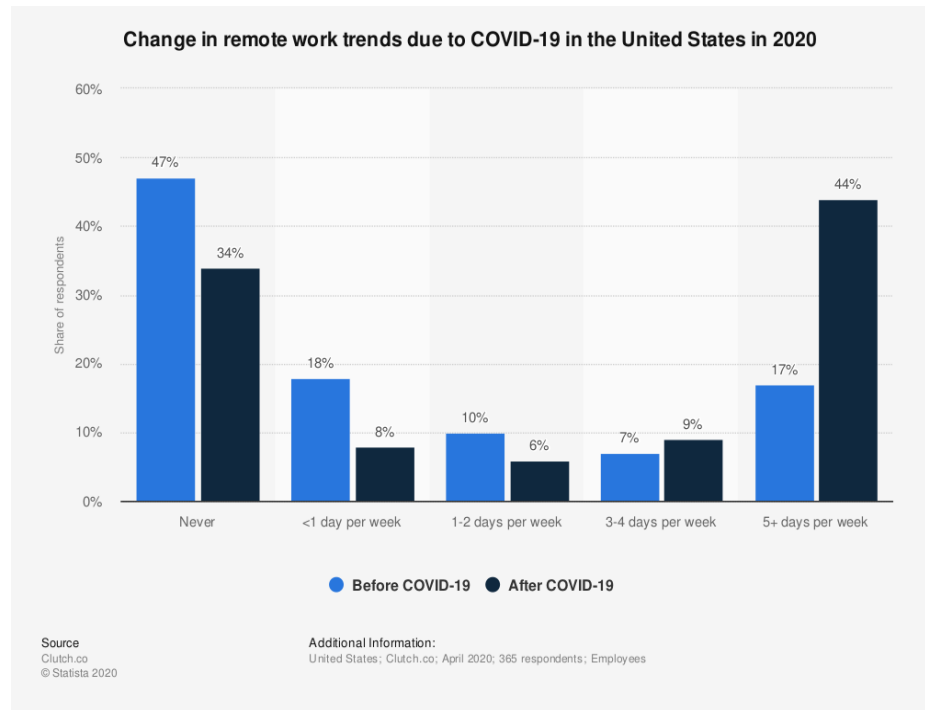
## Future Industry Outlook

As we have taken the time to analyze the automotive industry in the past and present, it is equally important to take the time to prospect what the future of the automotive industry will hold. As critical as it is to focus on the here and now, the question still remains: *Less Commute Miles. Decreased Tire Wear. What Would You Do?* Future trends will be discussed including that of the following: remote working, ridesharing, popularity of electric vehicles, the effect of noise reduction in cars, and why tire analytics may impact the future of the tire business. We will also evaluate the future value of Goodyear's relationships with its individual consumers as well as Goodyear's relationship with car manufacturers.

There is no question that the traditional understanding of the workplace has moved away from physical gatherings to a more online, remote format. This trend was steadily progressing prior to the Covid-19 pandemic and since then, the push to work remotely has skyrocketed exponentially. The transition from working in the office to working from one's home is going to have a substantial impact in the automotive industry in the years to come. As workers' commutes are decreased and even eliminated in certain cases, the direct effect on tire usage can be seen with the coronavirus paving the way for this anticipated shift. Naturally, the number of commuting miles will decrease during weekdays and lead into lower numbers on the weekends due to the fact that less workers will be driving to work. The most recent statistics which will be subsequently analyzed also indicate the growing movement in this direction.

The following graph is representative of 365 American employees who possibly moved from working in-office to remote due to the coronavirus. The "Before Covid-19" statistics are indicated by the light blue bar graphs while the "After Covid-19," or up until April 2020, are

indicated by the dark blue bar graphs. It is of great importance to recognize that 44% of the represented population works remotely five days per week (Holst, 2020). More than half of the represented population (67% exactly) works



from home at least one day out of the week, unlike before the coronavirus, when only 52% of the population worked from home at least one day out of the week (Holst, 2020). As time progresses, it will be interesting to see where this trend will migrate. Due to the uncertainty of when the Covid-19 pandemic will be “over,” it is nearly possible to accurately project with statistical certainty where the effects of Covid-19 will lead.

As established previously, the trend of working remotely is certainly increasing, and considering the rise of the trend before the virus, it appears that this is a trend that is here to stay. Such drastic change in the workplace will hinder commute miles which is a preparation that will need to be necessarily considered. This is a trend that will continue to develop in the future and most likely will only plateau or continue to grow.

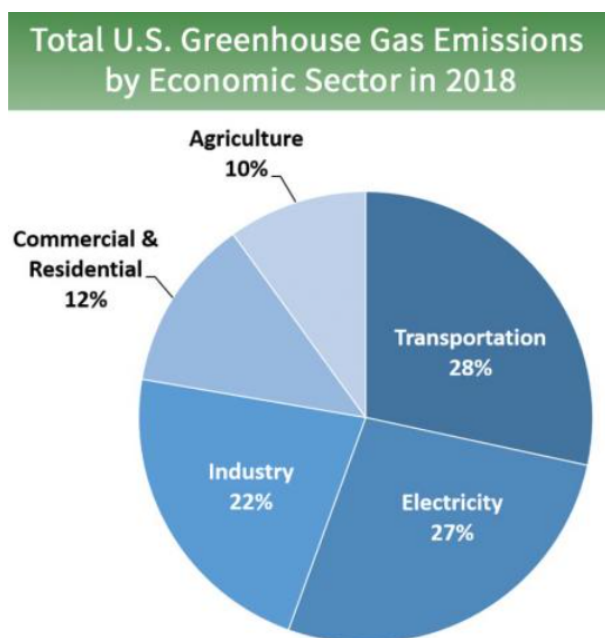
The presence of Covid-19 immensely affects industries that are directly correlated with the automotive industry such as that of the ridesharing community. It is an additional trend that

the automotive industry must consider and how it might affect future sales for The Goodyear Tire & Rubber Company. Platforms such as Uber, Lyft, etc., were on the rise prior to Covid-19. Since the presence of Covid-19, less people are using such services in their day to day lives. The market size for the ridesharing industry started at \$61.3 billion in 2018 and since then has grown immensely (Arevalo, 2020). The market size is projected to reach \$220 billion by 2025 (Arevalo, 2020). However, that is not considering the effects the coronavirus will have on ride sharing. Ride sharing enterprises such as Uber and Lyft get funded from activities such as corporate travel, nightlife in cities, vacationing, and suburb to city trips. For corporations, it is uncertain whether or not the decreased travel will only be an impact from Covid-19, or if this was a trend that was already in motion prior to and will stay even when Covid-19 is under control. Otherwise, activities such as nightlife, vacationing, and residential to city travel will pick up post-coronavirus. For those reasons you can expect ride sharing to pick back up, but whether or not with the velocity that was previously projected is questionable.

As the world continues to put more efforts into reducing our carbon emissions, substitutes for combustible engines will become much more prevalent. As seen in Figure 1, transportation accounts for 25-30% of the emissions we produce in the United States, according to the EPA (Sources of Greenhouse Gas Emissions 2020). While electricity also makes up the same portion of emissions, the way electric vehicle automakers, such as Tesla and Chevrolet, have marketed the benefits of owning an electric vehicle has led consumers to believe they are making an eco-friendlier choice by purchasing an electric vehicle. This belief has also been reinforced by state governments by subsidizing the purchase of electric vehicles in some areas. Considering the total cost of federal electric vehicle subsidies in the United States could end up costing upwards of \$20B (Bosworth & Patty, The Current State of Electric Vehicle Subsidies 2017), a common

argument is the cost of reducing carbon emission through subsidies is vastly greater than the impact of the EPA's current estimates for the future impact of carbon emissions.

Figure 1 - (Sources of Greenhouse Gas Emissions 2020)



While this discussion will continue, the current purchasing pattern of consumers would lead most people to believe that electric vehicles will take control of a large portion of the market share for automotive production. For 2019, total electric vehicle Sales were up 81% versus the previous year in the United States. In September of 2019, electric vehicle market share of new car sales in the U.S. grew to 2.6% (Schefter & Zaccagnino, Issues & Policy Electric Transportation 2019). Considering the rapid growth but small share of electric vehicles – a few conclusions have been made.

First, the process of transitioning from combustible engines to electric engines will take a long time. The automotive industry is enormous – with ~17 million cars being sold in the U.S. in 2019 (Wagner, U.S. vehicle sales 1978-2019) – even rapid growth of new innovation will take time to take over the share of the automotive market. To quote Elon Musk – “There's a vast base of industry, vast transportation system. Like there's two and a half billion cars and trucks in the world. ...The new car and truck production, if it was 100% electric, that's only about 100 million

per year. So, it would take - if you could snap your fingers and instantly turn all cars and trucks electric, it would still take 25 years to change the transport base to electric. It makes sense because how long does a car and truck last before it goes into the junkyard and gets crushed? About 20 to 25 years.” (Sutherland, 2018).

Second, as the world transitions to electric vehicles, the automotive industry will have the responsibility of delivering needed and desired innovation to consumers. These innovations will include necessities, luxuries and everything in between. The Akron Associates of Tire Analytics recognize the possibility of a different outcome in the future of automobile engines. We remain particularly persuaded to operate in the electric vehicle segment. This motivation is a reaction to the recent communication from Prime Minister Boris Johnson that the United Kingdom will ban combustible engine vehicle sales by the year 2030 as part of a green initiative (Frangoul, 2020). This unexpected announcement will exponentially accelerate the transition to electric vehicles in the United Kingdom in comparison to Elon’s timeline for the U.S. - and will quite possibly put pressure on other world leaders to adopt similar plans of acceleration.

As previously mentioned, electric vehicle sales are growing at an exponential rate, but the total share of the market is still rather small. In fact, according to Canalys, electric vehicles only accounted for ~2.2% of the global vehicle market in 2020, and account for about only 1% of light-duty vehicles on American roads now. (Xie, et al. 2021) While the market share for electric vehicles continues to be a fraction of the overall automotive market, we have confidence this will certainly not be the case in the future. During our primary research portion of this project, recent announcements from automanufacturers and government officials have given us even more confidence that we can expect an automarket heavily dominated by electric vehicles in the near

future. Our team felt it was important to outline these news events to inform our audience of the current and future status of the automotive industry.

Perhaps the most noteworthy announcement came from newly elected President Biden, who unveiled a \$2 Trillion infrastructure plan in March which is currently being named ‘The American Jobs Plan.’ Included in this new infrastructure plan is a \$174 Billion commitment to investing in electric cars in order “to win the EV market” according to the fact sheet provided by the White House. (FACT SHEET: The American Jobs Plan) This investment would be made through point-of-sales rebates and tax incentives, as well as a national network of half a million electric vehicle chargers. (Motavalli, 2021)

The ZETA Group, or the Zero Emission Transportation Association, is an industry trade group representing 50 member companies including Tesla, Lucid, Rivian, Proterra, and others who have laid out a six-part strategy to help provide federal policymakers with a comprehensive roadmap to achieve 100% electric vehicle sales by 2030. The trade group has also encouraged the government to see the tax credit production cap lifted “until adoption rates are sufficient to ensure we meet our 2050 net-zero emissions target”. (Policy Platform, 2021) This net-zero emissions target was a huge point in Joe Biden’s campaign as a part of his ‘Plan for Climate Change and Environmental Justice,” and given the current market share for electric vehicles in the U.S. it seems like a huge undertaking, but with groups like Zeta guiding the process and a \$174 Billion commitment for the government, the goal seems to be more and more reasonable.

Apart from the recent announcements made by the U.S. government and President Joe Biden, the global automotive market seems to be moving in the same direction. In March of 2021, Audi CEO Markus Duesmann made the announcement in an interview with Frankfurter



Allgemeine Zeitung, that Audi will no longer develop a new combustion engine. This is not to be confused with Audi's sales of combustion engines, which can be expected to continue for many years to come. This announcement did not come as a surprise to those involved in the automotive industry, as a week earlier, Mercedes, a rival to Audi, made a similar announcement, confirming that no new generation of internal combustion engines would be developed. Markus Schäfer, the board member responsible for development at Mercedes, told the Handelsblatt that the company had completed their development expenditure for the "FAME" engine family. "This means that the bulk of the investments can now really go into electromobility," Schäfer said. (Randall, 2021)

Just weeks after the Audi announcement, Volkswagen, the parent company of Audi (along with other luxury auto brands such as Porsche, Lamborghini, Bentley, and Bugatti), followed the trend; they made the announcement that they also have no plans to develop new internal combustion engines. This was no surprise as the brands often share the same engine architecture, but it further proves that consumers should prepare for an electric future (Hogan, 2021).

One innovation that has been widely discussed by the automotive industry is the need for a quieter ride. Considering the negligible sound that electric engines produce and the higher price tier they operate in, our initial focus will be to produce an innovative noise reducing technology to provide a quieter ride in electric vehicles. Success in this particular segment of the market will allow for expansion and offerings in all classes and price tiers of automobiles.

While there is currently a plethora of U.S. patent applications for tire noise reduction technology, no design has yet to shock the industry and take over. But let's be frank, noise reduction in tires is not a new conversation, and tire producers have been making efforts to

reduce the noise of tires for decades. The complexity of tire design has been a barrier to the improvement in noise reduction technology in tires, and there is a clear trade-off in the properties of the tire. The elements in a tires' tread serve multiple purposes. As most people are aware, the tread of a tires main job is to give the tire traction, especially in inclement weather such as rain or snow. What most people aren't aware of is that the elements in a tires tread is also designed to reduce the noise in the tire. Not only does a tires tread need to have traction and noise reduction, but it also must maintain its strength throughout its expected life.

As we investigate further into the technology behind noise-reducing tires, it's important to understand how sound is produced from a moving tire. Tires are often tested using the unit of measurement "repeating time interval" or RTI for short, which is the amount of time it takes a tire to fully rotate and return to the same spot it was touching the ground previously. Every time a component of the tire completes an RTI, it will make a unique noise. The high rotations/minute that a tire incurs while it is being used will cause this noise to compose into a harmonic. If a tire had the same components all the way around, equally distanced, it would create a constant pattern

of noise. Currently, patents in the U.S. use different elements in the grooves of the tire to mix up the pattern of noise, as seen Figure 2. In turn, the different tones and pitches are orchestrated to create a pattern of noise with the least amount of recognition to the passenger of a vehicle. These patents test the limits of the trade-off between the regulated characteristics of a tire. In order for this innovation to move forward, new designs must reduce tire noise without reducing the other properties of the tire.

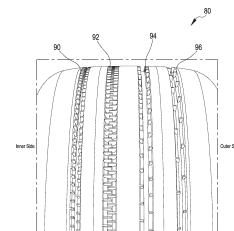


Figure 2 - Sabbatini, Fortunato, & Ciaravola. (2019). US20200317005A1. U

# THE EV TIMELINE

## 2021

Mercedes, Audi, and VW  
announce plans to no  
longer develop internal  
combustible engines

## 2020

Electric Vehicles account  
for ~2.2% of the global  
market

## 2030

100% Electric Vehicle  
sales in the U.S., as  
advocated by the industry  
trade group, ZETA

## 2050

Goal for Net-Zero  
Emissions in the U.S., as  
announced by President  
Biden

### **Goodyear's Options for the Future**

The Akron Associates of Tire Analytics would like to explore the possibility of using some variety of an audio or vibration sensor in pneumatic tires to analyze the noise or vibration of the tire. Assuming there are different tones or vibrations from driving on asphalt, concrete, brick, etc.; then you would be able to have a tire sensor that interprets the varying levels of noise or vibrations and communicates with a noise cancelling device in the wheel well to produce varying levels of ambient noise that regulate the noise that passengers in the vehicle are able to recognize. We will build off this idea with the questions like what companies would be good candidates for partnerships, does Goodyear's R&D team have the ability to complete this project, how much capital investment would be required, are there any similar ideas, etc. to investigate in our primary research.

To begin research in the audio manufacturing industry, it is important to explore any prior or currently existing relationships established with automotive manufacturers. A comprehensive investigation into the current world of audio manufacturing in automotive vehicles will allow our team to make decisions around the best methods for completing this technological exploration. In the first instance, our team will be able to learn about the current agreements of reciprocation between each of the companies and how those agreements are progressing on each end. We will be able to analyze what processes are going well in the existing partnerships as well as components of their relationship that are in need of improvement. Advancing with this knowledge, then, our team will be able to develop a more efficient and harmonizing method of interaction that can be applied to future partnerships Goodyear establishes with audio companies. As for the second aspect of value in researching existing partnerships between companies in the automotive and audio industries, our team will be able to learn about the innovations already

being performed and developed within other companies which can help direct the focus of Goodyear's future partnerships. Energy will be saved in avoiding areas of research already explored, and novel segments can be pursued. In exploring new ventures with businesses in the audio industry, a few dominant companies such as Bose, JBL, and Logitech come to mind. When determining which companies would make for the most successful partnerships with Goodyear, we will look at factors of each company such as the audio companies' interest in pairing with an automotive company, their future vision of the brand, their dominant strengths and weaknesses in their respective industry, and their capabilities in entering into a partnership with a company of Goodyear's caliber. Depending on these and other related factors, we hope to find the most fitting audio business that will work in unison with Goodyear in attaining their goals for growth and development.

Additionally, when exploring the potential of utilizing some form of audio measure to analyze tire vibrations, it is important that our team assess the research and development capabilities of Goodyear. First, our aim is to gain a better understanding of the research projects already being conducted by Goodyear. We would like to know the extent of Goodyear's experience with present and past research and development projects related to our idea to better gauge their capabilities for our future research. Having this knowledge will help us to better grasp the size of their research projects, the teams involved in executing the research, the time requirements for the projects, and any outside hiring of staff or resources necessary for the success of the projects. All factors such as these greatly affect the course research and development takes in any project undertaken. For instance, if Goodyear has primarily conducted smaller and more localized studies in prior research projects, then for any future projects, Goodyear will most likely wish to proceed in the same manner. Smaller projects typically

translate to less outside staff required, monetary investments, and time necessary to execute the goal of the research. Likewise, if Goodyear has primarily funded more large-scale and investment-heavy projects in the past, they will be more likely to do so in future projects requiring more resources, time, and capital.

### **Financial Outlook of Options**

It goes without saying that the cost analysis of a project is directly related to the size of the project and the nature of the research being performed. Recognizing this limitation, an accurate cost analysis will only be executed after primary research allows us to project a reasonable outcome with more clear expectations in mind. From this establishment, factors such as the initial capital investment, cost of labor, and expense of resources can be estimated. Other factors such as the location the research will take place and the risk factors induced with the research will also need to be examined in order to produce an accurate estimation of the total cost of the project from conception to completion.

Further questions following the cost analysis of a research project will be related to the execution and conclusions of the research. If in the instance the audio companies have partnered successfully with Goodyear in implementing audio technology into tires reducing the noise passengers are able to recognize while driving, then we are led to examining the effects the product will have on the consumer market. Goals will need to be established regarding the expected sales and profits intending to be made off of the product as well as the volume necessary to fulfill consumers needs. Will Goodyear have to be concerned with the cannibalization of their other products once the improved tire is introduced? Will the improved noise-cancelling technology of the tires create a new business segment in the market? The markets that Goodyear is wishing to appeal to must be narrowed down and then targeted. Focusing on particular markets will help Goodyear concentrate its energies in areas where the product will generate maximum revenue and production. Likely, large car manufacturers will serve as the focal point of Goodyear's appeal in selling the product. In particular, large automotive companies such as Tesla and GM who gear their automobiles to be quiet and

noise-cancelling vehicles may be more likely to take interest in investing in a noise-reducing tire boosted by audio sensor technology and sound-cancelling advancements.

Within the current situation for Goodyear, an exact financial plan for this expenditure is out of reach. The technology may be available for businesses to partner and implement, but it has yet to be manufactured and built into a personal vehicle. However, our team has a plan to further our research and develop innovative ways to reduce the sound emitted from tires. First, we plan to target a partner to reach new conclusions regarding ambient sound technology used in vehicles. We believe that finding a partner will entail working with some of the leading companies in Active Noise-Cancelling Technology. According to an article from Forbes, it is evident that Bose, Beats, Sennhauser, MPow, Apple, and Sony boast some of the best performing headphones and earbuds that incorporate this tech (Forbes, 2020). Another aspect to look into is the new tire; our team believes that new research may need to be done to discover a new tire pattern or rubber compound for the tire that reduces sound or vibrations. Sumitomo has created a tire that incorporates “Silent Core Technology” (AfterMarketNews, 2015). This tech incorporates an ether-polyurethane foam inside the carcass of the tire, reducing sound from the tire by 10 decibels and sound from within the cabin by 4 decibels. While we were incapable of finding any financial reports on production of the tire, we do believe that through more research, we will have a better understanding of the costs associated with the previously described options.



## **Research Transition**

Secondary research undoubtedly provides purposeful and necessary insight, however it is imperative that there also be a primary research component in pursuit of the development with this project. As our team transitioned efforts from a secondary level of study into a primary standard of research, options and outlooks were further delved into helping to give our developments a more definitive and clear shape. It proved quite valuable for us to take what was learned from the secondary research, refocus in on what topics needed more analysis and exploration, and then create a study that examined those important aspects. While we hoped to gain insight to the available partnerships and technological requirements to overtake such a project, we realized there was importance in first gathering relevant demographic information to further our understanding of the current market environment.

Overall, the secondary research performed provided an excellent basis for our team to begin with in attempting to address Goodyear's research inquiry to the best of our ability. It aided greatly in directing the route of our primary research. We quickly realized in conclusion of the secondary research that much more data gathering and groundwork had to be completed in order to best formulate a plausible solution for Goodyear. In the segments ahead of this research report, we detail the particulars of our primary research efforts including the methodology applied, results of our created survey, analysis of the results, and the final recommendations we ultimately provide to Goodyear.

### **Methodology for Primary Research**

Primary research is an integral part of any study and is conducted to gather data that is directly correlated to the topic at hand. The collection of this data is managed and controlled by the research group initiating the study. The primary research method applied for this focused research project is accomplished through use of an online survey. Through the use of online survey conductors and distributors, namely Qualtrics and CloudResearch, we were able to gather substantial data in support of the development of our research.

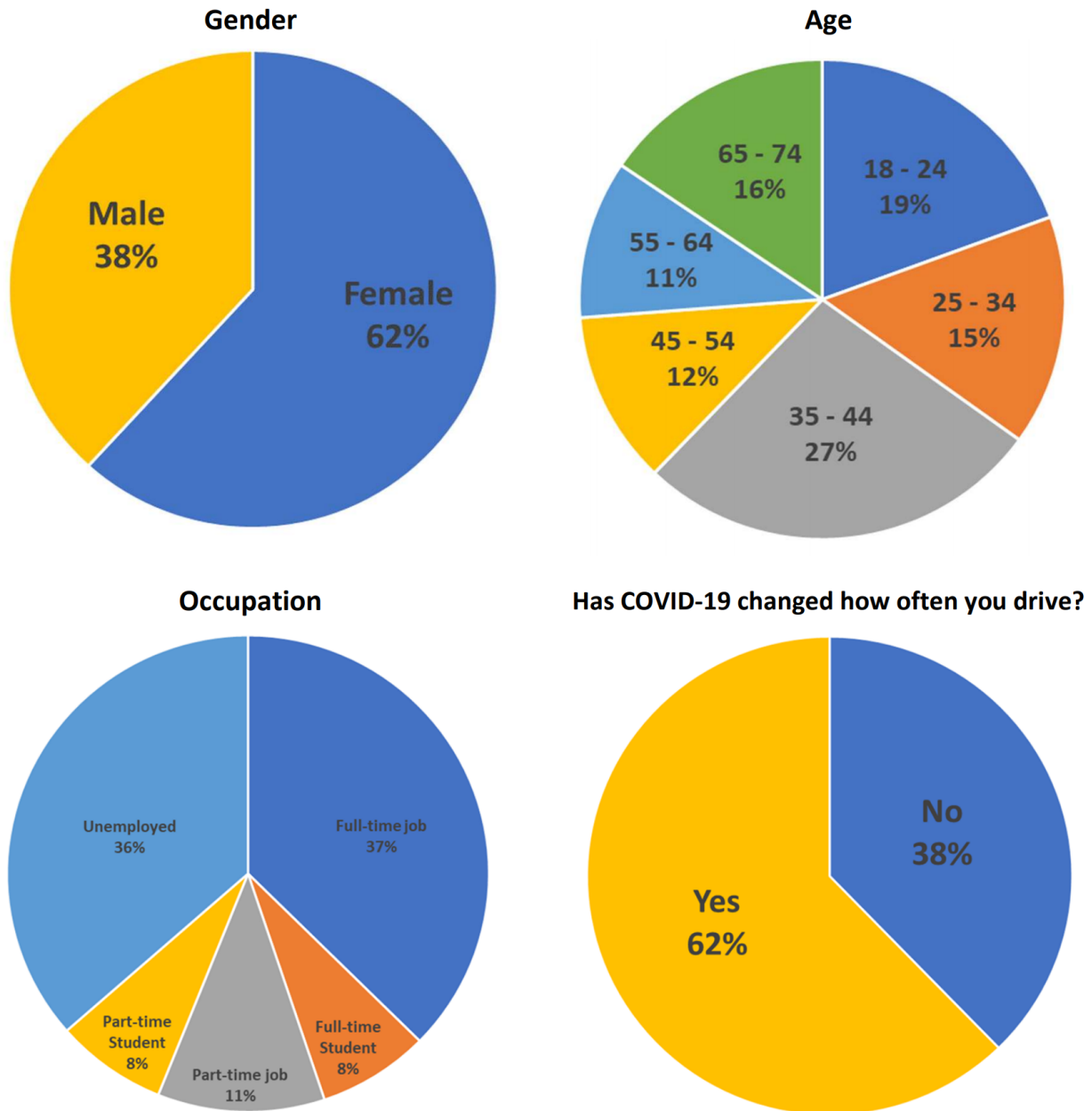
Qualtrics is a platform used to design, articulate, and publish surveys of any length and caliber. It is the program that our team used to gain further insights on our research project. Additionally, we used a platform called CloudResearch to distribute the survey virtually to randomly participating individuals. CloudResearch is a program that administers a survey in a way that encourages a broad sample of participants. Hence, our team selected use of this platform in order to diversify the pool of our participants. After creating a series of survey questions relevant to our research, we published our Qualtrics-made survey through CloudResearch and received timely results that represented a wide spread of participants. Had we not opted for use of CloudResearch, our sample population would most likely have been saturated primarily with college students at The University of Akron. Thus, our team was quite appreciative for the benefit of CloudResearch in gathering a dispersed demographic of individuals. As a small incentive to complete the survey, we offered each participant who took the survey the monetary offering of \$1.25 upon completion of the survey. We believe that offering this minor incentive aided in the timely and thorough completion of responses received from the survey.

The base framework of the survey consisted of sixteen both open and closed ended questions aimed at understanding the who's, what's, where's, and why's of the population. Demographic questions such as age, gender, and occupation were important pieces of information for us to gather in order to recognize the different segments being analyzed. The bulk of the questions were written to unfold the following cross examinations: how the pandemic affected each person differently through their work and driving habits, people's tire expenses, the noise of their vehicle cabins, the desire and need for quieter vehicles, and expectations for owning electric vehicles in the future. The overarching goal of the questions was to better understand if there is an existing need for quieter vehicles. And to the extent, then, that this need is in existence, our team can better communicate to Goodyear ways in which to best suffice and satisfy the need.

## Survey Results

\_\_\_\_\_ In development of our team's primary research, the sixteen-question survey we created was completed by 107 participants. The participants were in no way particularly selected and the variance of the results assists in reflecting the wide demographic surveyed. The spread of participants can best be seen through the spread of ages. The group of individuals who completed the survey serves as our sample population for purposes of this research. Our sample population will be referenced throughout the remainder of our analysis to compile patterns of similarity, difference, and consistency.

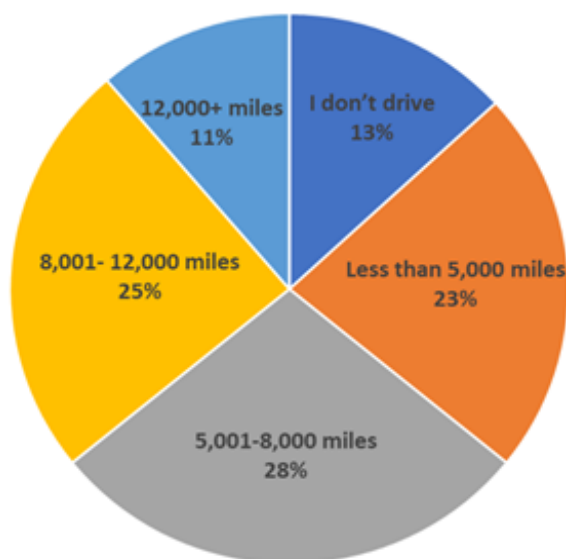
In total, the youngest age group ranging from 18-24 years old contained 19% of individuals partaking in the survey. On the other end of the spectrum with regard to the oldest age grouping, the 65–74 year old participants compromised a total of 16% of the sample population. As for the age groups existent between the youngest and oldest segments, they comprised the remaining 65% of those surveyed. The disbursement of age, overall, is allotted with considerable evenness. With reference to the gender of the individuals who completed the survey, the distribution is not as evenly divided. Females made up 62% of the population whereas the Males only totaled to 38% of the sample size. Including both the male and female segments, a combined total of 84% of individuals were found to have, own, or lease a car. Hence, only 14% of the sample population did not have access of some form to the usage of a vehicle. When asked if the frequency of driving has changed due to the onset of COVID-19, the majority of individuals responded “Yes” to the prompt. Conversely, then, the other 38% of the population disagreed that the amount he or she drives has been changed by COVID-19. A compilation of graphics referencing the statistical data discussed above is displayed in the following visual:



A total of 64% of the surveyed individuals registered themselves as being either Full-time or Part-time Students or Full-time or Part-time occupation holders. The remaining 36% of individuals identified their occupational status as being Unemployed. In response to the inquiry of those who work remotely, an even one-fifth of the population reported themselves to

be working fully remotely. Slightly surpassing the individuals who work fully remote, 24% of individuals responded to the prompt as working fully in-office. In combination of both in-office and remotely working individuals, 14% of participants reported that they are operating under both forms of labor. The number of miles driven per year was apportioned into five overarching categories of total distances. Ranking as the most commonly traveled amount of miles per year according to the sample population was the 5,001-8,000 mile range with 28% of the population reporting to belong in this mileage segment. The results of the five categories of miles traveled are summarized with the visual below:

### How many miles do you drive per year?

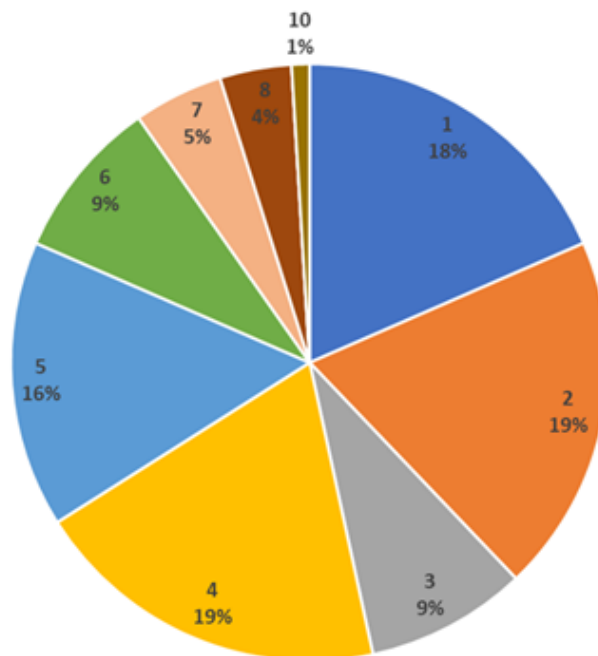


As seen from this compilation of responses from the participants, a total of 64% of the participants all traveled at least 5,001 miles throughout the course of a year. Further, of those 64% of individuals, a whole 36% of them travels a minimum of 8,001 miles per year. The

findings of the apportioned miles traveled of each of the participants per year is an important piece of analysis to consider when directing the course of our research efforts.

Upon gathering information of a more primal essence from the participants, we delved further into the intricacies of the individuals' driving habits and preferences relating to their vehicle usage. When asking the participants if they feel a need for a quieter vehicle, over half of the sample population answered that they do, in fact, feel a need for a quieter vehicle. Similarly, when prompted with the question, "Do you think installing in-cabin, noise-cancelling technology into the vehicle would provide you with a better experience driving?", just over half of the population agreed to this question affirming that they do believe the experience would be better. The statistic even increases when asked the same question in view as a passenger of the vehicle. A total of 61% of the respondents agreed that the experience would be better by installing the technology as a passenger of the vehicle. Although the majority of individuals agreed that installation of such technology would create a better experience when riding or driving in a vehicle, the strong majority responded in a subsequent question that they would not be willing to pay additional money to attain a quieter vehicle. Just over one-fifth of the sample population, precisely 22% of the individuals, answered that they would be willing to pay more for a quieter vehicle. In describing the noise of the vehicles that the individuals currently drive through representation of a number scale ranging from 1-10, the results of the responses are provided in the graph below:

**On a scale of 1-10, 1 being the quietest & 10 being the loudest, how loud would you describe the noise of your vehicle while driving?**



By analysis of the given chart, a combined 54% of the population is seen to rank the noise of their vehicle to be of a value of 4 or higher in reference to the number scale described in the question. Hence, through interpretation of the results, over half of the population rated the noise of their vehicles to be of a considerable presence. When asked what reasoning best described the desire to have a quieter vehicle, most individuals chose the response that “It’s nice to have peace and quiet in the car.” This response comprised 51% of the participants' choices. Less commonly chosen were reasons such that the individuals’ vehicles are quieter than the tires or that the individuals would be more aware of other vehicles on the road. Both of these secondary responses each claimed 14% of those surveyed leaving the last 21% attributed either to the reasoning that children take naps in the car or for another reason unspecified.



In interest of the frequency of tires purchased, we posed a question based upon how often individuals buy new tires. According to the results of our survey, 97% of the sampled population buys new tires 1-2 times at least every 5 years. Within that statistic, 60% of the individuals denoted that they purchase new tires 1-2 times every other year. In observing that the majority of the sampled population purchases new tires at least every other year, this information proves to be quite useful in navigating the direction of the consumer market within the tire industry. In a futuristic-styled question presented to the participants, our team asked the estimated number of years in which they expected to own their first electric vehicle. Of the five choices provided as responses to the question, 38% of the individuals selected the 0–5 year option. While through our secondary research we began to gather the growing interest of this segment in the automobile industry, the results of this particular question greatly aid in affirming the positive connection between the findings of our secondary research. While we understand that the sampled population does not necessarily reflect with complete precision the entire population within the tire industry, the data from the survey we collected enables us to more clearly identify the overarching trends and present movements of the market.

To close out the survey, we proposed a question to the participants challenging them to think futuristically. We asked in how many years they expect to own their first electric vehicle. The results of this question were quite dispersed. One third of the respondents answered that they do not plan to ever own an electric vehicle while just over another third, at a total of 38% of participants, selected the choice for owning one in the next 0-5 years. Within the next 6-10 years, an additional 22% of individuals acknowledged that they expect to own an electric vehicle. In summary, then, it is reported that a total of 60% of the respondents expect to become electric vehicle owners within the next 10 years.

### **Final Recommendations**

Following our primary research, we have concluded that the timeline for this project should be delayed for at least 3-5 years and then readdressed with new market research relevant at that time. We are confident in the potential of our business idea, but due to a multitude of factors creating differing elements of uncertainty, our team has concluded that Goodyear's efforts would currently be better appropriated in the development of their newest acquisition with Cooper Tires. The strategic merging of Cooper Tires with Goodyear displays great depth in potential, and our team feels strongly that Goodyear's energies can be most beneficially manifested in emphasizing the improvement of the acquisition's cost efficiencies and newfound market share. The reasoning behind this decision is primarily attributable to two factors. The first of these is the large capital expenditure spent to acquire Cooper Tires coupled with the lofty capital requirements necessary for the newly proposed project. Assuming both capital investments simultaneously would be too exhaustive on Goodyear's financial scope, most likely leaving little capital for their shareholders. Additionally, as a secondary factor, our primary research has led us to believe that while governments and auto manufactures are preparing to make the switch to an electric vehicle dominated environment, consumers are still not ready to make that transition within the next five years (38% of those surveyed) to electronic vehicles. Hence, the affirmation of the potential business venture proving to be profitable for Goodyear cannot be granted at this time.

While our primary research was initially set to focus on potential partnerships available to Goodyear as well as the technological requirements needed to accomplish such a task, our team reevaluated that it was best to refocus our research efforts to identify the current consumer opinion on the necessity for such a project. Our primary research highlighted some concerns we

had moving forward with the project and provided us greater clarity in making prudential decisions regarding the progression of the business proposal. In view of our findings, we still strongly advocate the need for a quieter tire in the automotive industry and acknowledge its present existence as the world continues to transition to quieter electric vehicles. However, we do not believe that the average consumer recognizes the need, currently. We can attribute this lack of awareness to the limited share electric vehicles have in the marketplace ~ 2% in the U.S. With such a low presence such as this, consumers have not been given the experience necessary to begin making the connection for this need. In consideration of both the constantly changing environment of the automotive industry as well as the technological advancements to be made in the next 3-5 years, our team has concluded that it is best to delay further developments of our research proposal until the project is revisited at a later moment in time.

### Works Referenced

- Arevalo, Tony. "Ride-Sharing Industry: Facts, Statistics, and Trends (2020)." *Carsurance*. 14 August, 2020.
- Average Annual Miles per Driver by Age Group. (2018). Retrieved November 13, 2020, from <https://www.fhwa.dot.gov/ohim/onh00/bar8.htm>
- Bird, Barbara J. "The Roman God Mercury." *Journal of Management Inquiry*, vol. 1, no. 3, Sept. 1992, pp. 205–212., doi:10.1177/105649269213004.
- Bosworth, R. C., & Patty, G. (2017, October). *The Current State of Electric Vehicle Subsidies* (Rep.). Retrieved <https://www.strata.org/current-state-of-electric-vehicle-subsidies/>
- Bridgestone unveils new sustainability campaign. (2020). *Tire Business*, 38(15), 8.
- Brown, Kyle. "Trinseo: Innovation a Key to Sustainable Tires." *Rubber & Plastics News*, 15 Aug. 2019, [www.rubbernews.com/suppliers/trinseo-innovation-key-sustainable-tires](http://www.rubbernews.com/suppliers/trinseo-innovation-key-sustainable-tires).
- Changes in Mobility by State: Bureau of Transportation Statistics. (2020). Retrieved November 13, 2020, from <https://www.bts.gov/content/changes-mobility-state>
- Chicu, Nicoleta, et al. "Current Trends and Perspectives in Tyre Industry." *Studia Universitatis, Vasile Goldis" Arad – Economics Series*, vol. 30, no. 2, 1 June 2020, pp. 36–56., doi:10.2478/sues-2020-0011.
- "FACT SHEET: The American Jobs Plan" *The White House*, The United States Government, 31 Mar. 2021,

[www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/](https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/).

Fisher, Harry L. "Vulcanization of Rubber." *Industrial & Engineering Chemistry*, vol. 31, no. 11, 1939, pp. 1381–1389., doi:10.1021/ie50359a015.

Frangoul, A. (2020, November 18). The UK plans to ban sales of diesel and petrol cars from 2030. Retrieved December 07, 2020, from <https://www.cnbc.com/2020/11/18/the-uk-plans-to-ban-sales-of-diesel-and-petrol-cars-from-2030.html>

French, M. J. "The Emergence of US Multinational Enterprise: The Goodyear Tire and Rubber Company, 1910-1939." *The Economic History Review*, vol. 40, no. 1, Feb. 1987, p. 64., doi:10.2307/2596296.

Goodyear. "Goodyear to Acquire Cooper, Creating Stronger U.S.-Based Leader in Global Tire Industry." *Goodyear Corporate*, 22 Feb. 2021, [corporate.goodyear.com/en-US/media/news/goodyear-to-acquire-cooper-creating-stronger-us-based%20leader-in-global-tire-industry.html](https://corporate.goodyear.com/en-US/media/news/goodyear-to-acquire-cooper-creating-stronger-us-based%20leader-in-global-tire-industry.html).

"Goodyear Tire & Rubber Company SWOT Analysis." *MarketLine, a Progressive Digital Media Business*, "Industry and Manufacturing," 13 May 2020.

Guise-Richardson, Cai. "Redefining Vulcanization: Charles Goodyear, Patents, and Industrial Control, 1834-1865." *Technology and Culture*, vol. 51, no. 2, Apr. 2010, pp. 357–387., doi:10.1353/tech.0.0437.

“History.” *Goodyear History* | *Goodyear Corporate*,  
corporate.goodyear.com/en-US/about/history.html.

Hogan, Mack. “Volkswagen Will Also Stop Developing Internal Combustion Engines.” *Road & Track*, Road & Track, 22 Mar. 2021,  
www.roadandtrack.com/news/a35901171/volkswagen-will-also-stop-developing-internal-combustion-engines/.

Holst, Arne. “Remote Work Frequency before/after COVID-19 2020.” *Statista*, 3 July 2020.

Industry Market Research, Reports, and Statistics. (2020, October 18). Retrieved November 11, 2020, from <https://www.ibisworld.com/united-states/market-research-reports/tire-manufacturing-industry/>

Industry Market Research, Reports, and Statistics. (2020, October 19). Retrieved April 14, 2021, from <https://www.ibisworld.com/industry-statistics/employment/tire-manufacturing-united-states/#:~:text=There%20are%2045%2C594%20people%20employed,the%20US%20as%20of%202021.>

Izhutkin, V., Zonov, A., & Borisov, A. (2018). Application of Computer Modelling in Engineering Education on the Example of the Design Automobile Tyres. *2018 IV International Conference on Information Technologies in Engineering Education (Inforino)*. doi:10.1109/inforino.2018.8581718

Klein, N. J., & Smart, M. J. (2017). Millennials and car ownership: Less money, fewer cars. *Transport Policy*, 53, 20-29. doi:10.1016/j.tranpol.2016.08.010

Kopcha, Joy. “Cooper Shareholders to Vote April 30 on Goodyear Deal.” *Modern Tire Dealer*, 1

Apr. 2021,

[www.moderntiredealer.com/articles/31718-cooper-shareholders-to-vote-april-30-on-good-year-merger](http://www.moderntiredealer.com/articles/31718-cooper-shareholders-to-vote-april-30-on-good-year-merger).

Kopcha, J., & Senior Editor & Digital Projects Editor After more than a dozen years working as a newspaper reporter in Kansas. (2021, March 18). 7 things to know about the Goodyear-Cooper deal. Retrieved April 14, 2021, from <https://www.moderntiredealer.com/articles/31664-things-to-know-about-the-goodyear-cooper-deal>

Motavalli, Jim. "Biden Commits \$174 Billion to Developing Electric Cars-in the US." *Autoweek*, 2 Apr. 2021, [www.autoweek.com/news/a36004838/biden-commitment-to-electric-cars/](http://www.autoweek.com/news/a36004838/biden-commitment-to-electric-cars/).

"Policy Platform." *ZETA*, 21 Jan. 2021, [www.zeta2030.org/policy-platform/](http://www.zeta2030.org/policy-platform/).

PYMNTS.com. "Goodyear-Cooper Tire Merger Heats Competition." *PYMNTS.com*, 23 Feb. 2021,

[www.pymnts.com/news/retail/2021/goodyear-cooper-tire-merger-heats-up-competition-among-auto-service-chains/](http://www.pymnts.com/news/retail/2021/goodyear-cooper-tire-merger-heats-up-competition-among-auto-service-chains/).

Randall, Chris. "Audi Abandons Combustion Engine Development." *Electrive.com*, 22 Mar.

2021, [www.electrive.com/2021/03/16/audi-abandons-combustion-engine-development/](http://www.electrive.com/2021/03/16/audi-abandons-combustion-engine-development/).

Reisinger, D. (2020, November 10). The Best Noise-Cancelling Headphones In 2020. Retrieved November 13, 2020, from

<https://www.forbes.com/sites/forbes-personal-shopper/2020/08/06/best-noise-cancelling-headphones-2020/?sh=68288193a9a9>

Schefter, K., & Zaccagnino, M. (2019). Issues & Policy Electric Transportation. Retrieved November 04, 2020, from

<https://www.eei.org/issuesandpolicy/electrictransportation/Pages/default.aspx>

Schunk, A. (2020). Goodyear making big tire-production strides with soybean oil. *Crain's Cleveland Business*, 41(39), 22.

Sources of Greenhouse Gas Emissions. (2020, September 09). Retrieved November 04, 2020, from <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

Staff, B., Alert, B., & Antenora, B. (2015, October 06). Falken's New Silent Core Technology To Reduce Tire-Generated Drive-by And Cabin Noise. Retrieved November 13, 2020, from <https://www.aftermarketnews.com/falkens-new-silent-core-technology-to-reduce-tire-generated-drive-by-and-cabin-noise/>

Sutherland, J. (2018, September 26). Full Transcript: Joe Rogan Experience #1169 - Elon Musk Sonix. Retrieved November 04, 2020, from <https://sonix.ai/resources/full-transcript-joe-rogan-experience-elon-musk/>

TSA checkpoint travel numbers for 2020 and 2019. (2020). Retrieved November 13, 2020, from <https://www.tsa.gov/coronavirus/passenger-throughput>

Wagner, I. (2020, July 16). U.S. vehicle sales 1978-2019. Retrieved November 04, 2020, from <https://www.statista.com/statistics/199983/us-vehicle-sales-since-1951/>

Wagner, I. (2020, October 01). U.S. car owners by age group 2020. Retrieved November 13, 2020, from <https://www.statista.com/statistics/1041145/us-car-owners-by-age-group/>



Xie, et al. "Global Electric Vehicle Market 2020 and Forecasts." *Canalys*, 8 Feb. 2021,  
[www.canalys.com/newsroom/canalys-global-electric-vehicle-sales-2020](http://www.canalys.com/newsroom/canalys-global-electric-vehicle-sales-2020).

Xu, M., David, J. M., & Kim, S. H. (2018). The Fourth Industrial Revolution: Opportunities and Challenges. *International Journal of Financial Research*, 9(2), 90.  
doi:10.5430/ijfr.v9n2p90