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| RESEARCH ASSIGNMENT – MOTORIZED VEHICLES | 1762 words |

**Introduction**

As one of the most ubiquitous technologies in the world, motor vehicles (cars, trucks, etc.) are historically documented to have unprecedented harmful impacts on the sustainability crisis. Its negative effects on the equity crisis have become increasingly visible to the general public as well. Automated vehicles (AVs) have been under development and are emerging as a popular alternative to human-operated vehicles with many benefits for society. This document recommends the complete switch from human-operated vehicles to automated vehicles. I will first examine the impacts of human-operated vehicles on both the sustainability and equity crises, then support my recommendation by exploring the impacts of AVs on the two crises, as well as the affected stakeholders.

**The impact of human-operated vehicles on the two crises**

Throughout history, the Industrial Revolution is widely regarded as one of the most significant events, bringing monumental developments to the through the world through science and technology. Among the many world-changing inventions introduced during the Revolution is the commercial automobile, the car. Today, the motorized vehicle is a ubiquitous technology, engrained in our society. With over 1 billion motorized vehicles in use as of 2011 [1], its impact on both the sustainability and equity crises is obvious and unavoidable.

Globally, transportation makes up for 15% of all greenhouse gas (GHG) emissions [2], emitting roughly 7.3 billion tonnes of carbon dioxide into the atmosphere in 2020. In particular, passenger cars were identified as the largest source of these emissions [3]. Even prior to the pollution created by cars on the road, energy consumption by the transportation industry for the production of motor vehicles also leaves a mark on the planet’s environment [4].

While a major aspect of the significance of Henry Ford’s automobile was its affordability for the general public, cars are still considered as a relatively expensive piece of technology to purchase for private ownership. As a result, passenger cars, and therefore transportation, is often less accessible to low-income or underprivileged individuals and families. Furthermore, transportation is often difficult to access for underserved populations such as the youth, elderly, and people with disabilities.

In light of these persisting issues, I recommend all automobile companies to start developing self-driving automated vehicles and replace all human-operated vehicles as soon as possible. This line of action will provide major benefits for both the sustainability and equity crises, and while there are still drawbacks for certain stakeholders, the net benefits experienced are consistently projected to outweigh the losses.

**Why we should completely switch to automated vehicles**

The switch to automated vehicles has both advantages and disadvantages with respect to the sustainability and equity crises, as well as unintended effects that impact stakeholders. In this section I discuss these pros, cons, their limitations, and why I believe completely switching to AVs is an ideal choice. To give reasoning or to allow understanding for people who have a differing set of ethical values/beliefs which guide their logic and reasoning, I support utilitarian beliefs and my ethical values are influenced by the largely liberal society I am a member of.

Effects on the sustainability crisis

Extensive research has been conducted on the effects of AVs on the environment, and while there are often some harmful impacts projected, most studies find overwhelming support for large reductions in GHG emissions and energy consumption. An analysis conducted in 2014 by Austin Brown, Jeffrey Gonder, and Brittany Repac [5] outlines potential effects of AVs on energy consumption and quantifies them by quantifying their impact on three categories: the change in use, energy, and fuel intensity. Among a long list, I will discuss a few notable/interesting effects.

First, the effect of significantly lighter and size-optimized vehicles is projected to reduce energy intensity by up to 50%. In a society with fully integrated AVs, collision-safety features and systems will become obsolete in motor vehicles, drastically decreasing vehicle weight and therefore energy usage [5]. However, a limitation to this is the reluctance to introduce these AVs with absent safety features while there are still human-operated vehicles on the road. The process of transitioning to fully automated vehicles without safety systems is a dangerous one and the longer the transition takes, the more accidents will occur. Therefore, in order to minimize these accidents the switch must be made as quickly as possible. Otherwise, it will be too dangerous for society or the switch simply won’t occur at all.

Another interesting effect is the encouragement of higher occupancy vehicles and on-demand mobility. With the rising popularity of digitalized ridesharing companies such as Uber and Lyft, AVs have great potential to synergize with them. The combination of shared vehicles has even more benefits, such as reduced vehicle ownership (less cars on the road), high efficiency, and low GHG emissions. Furthermore, shared vehicles will travel much greater distances than privately owned vehicles, and at a certain point, the fuelling costs will become greater than the capital costs, pushing the economy to switch to more cost efficient fuels [6]. These fuels, such as electric vehicles, are often much cleaner and have much lower emissions compared to the fuels used today [5].

Not surprisingly, AVs also go hand-in-hand with electric vehicles due to their already electrical control systems. Brown’s, Gonder’s, and Repac’s analysis predicts that the electrification of AVs has the potential to decrease fuel intensity by 75%. However, while this is an appealing prediction, it does not account for how the electricity is produced – production from fossil fuels would increase its harmful effects on the environment [5]. Electric vehicles themselves are becoming increasingly popular and there could be an entire other discussion on the beneficial and harmful impacts on sustainability of electric vehicles, but that lies outside the scope of this document.

Chart, waterfall chart

Description automatically generatedOther effects of AVs on energy consumption listed in the analysis include more efficient driving, traffic avoidance, and quicker/more efficient parking. They summarize the effects in a graph showing the increases and decreases in fuel, energy, and use intensity caused by each effect. The increases in fuel and energy intensity are largely a result of faster travel and more frequent and longer use of AVs due to their increased popularity. Yet even with these increases, the analysis still expects a reduction in energy consumption due to decreases caused by better efficiency and the projected popularization of electric vehicles [5].

*Figure 1. Summary of effects listed in Brown’s, Gonder’s, and Repac’s analysis of AV’s effects on energy consumption [5].*

Effects on Equity Crisis

The switch to AVs will also have significant impacts on the equity crisis. Without the need of a driver, AVs provide convenient and accessible transportation to underserved or underprivileged populations who are unable to drive. As discussed in the previous section, AVs lower fuel consumption and encourage higher occupancy vehicles such as carsharing/ridesharing. Beyond its benefits for the environment, this also reduces fuel costs and splits transportation costs between many users. This is extremely beneficial for demographics that tend to carpool or are unable to afford transportation, such as college students and low-income families [5][6]. Sustainability and equity are also closely tied together. As we have seen, the transportation industry has a large effect on the sustainability crisis, and AVs have the potential to significantly reduce the negative impacts transportation has had on the environment so far. Ultimately, increased sustainability leads to increased environmental equity – a real, yet often overlooked issue in society.

One major negative impact that the switch to AVs has on equity is the mass unemployment that would follow in the transportation industry. In 2019, nearly 3 million people U.S. were employed by the transportation sector for an occupation related to driving. Furthermore, because many of these driving jobs are considered low-skilled, finding new jobs will be very difficult for these workers and the cost required to educate and train them may be high [7]. While there is no denying this wave of unemployment that would occur, some argue that AVs will create jobs as well. Due to its premature state, the AV industry currently only has a need for occupations such as engineers, software developers, and technicians, but in the future, there will be opportunities in car maintenance, safety and testing, logistics, and fleet oversight as well [8].

Unintended Effects on Stakeholders

I have already discussed some of the primary stakeholders in the previous sections. The environment receives a large benefit from the switch to AVs due to the reduced GHG emissions and energy consumption. The general public also largely benefits from the switch due to more accessible, affordable, and convenient transportation and ultimately increased environmental equity. Contrarily, those employed by the transportation industry would be among the “losers” of this technological development, finding themselves rapidly unemployed. We now look at some of the unintended effects of the switch to AVs and their effects on stakeholders.

The synergy of AVs and on-demand mobility could result in not only smaller and fewer cars which helps improve traffic and travel times, but also a reduced need for parking space. Land use benefits is an unintended effect mentioned in Brown’s, Gonder’s, and Repac’s analysis that benefits both the general public as well as the government. With reduced need for parking space, land for parking can be repurposed into city revitalization projects, parks, or other businesses that might help boost a city’s economy [5].

As mentioned before, the popularization of AVs will likely lead to a decline in the private ownership of cars, significantly hurting more traditional car companies like Ford and Toyota. Without adapting to these changes, these companies would likely be in major financial trouble and potentially experience mass unemployment similar to those employed as drivers in the transportation industry [7][9].

**Conclusion**

Throughout this document I have discussed the pros and cons of automobile companies completely switching to the production of AVs and how different stakeholders are affected. There are predicted to be overwhelming benefits towards the general public, the government, and both the sustainability and equity crises. One limitation to this argument is that it is still highly uncertain which negative impacts on the sustainability crisis will manifest and to what degree. Therefore, it is still uncertain how great the net positive impact will be, but it is widely accepted that the net impact will be positive. Regarding the drawbacks of switching to AVs, nearly all of them prove to be only short term setbacks. Unemployment in the transportation industry will eventually be replaced by new jobs created by the popularization of AVs. In the long run, becoming a civilization with fully integrated automated vehicles will make huge strides towards improving sustainability and equity, increasing the overall quality of life for everyone.

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