

PS 385 – Final Research Paper

Autonomous Vehicles and the
Environment – An Unlikely Hero

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**Option #1: Technological innovation for a more sustainable global environment:
a political feasibility study**

If you choose Option #1, begin by selecting a technological innovation. The innovation may involve a new idea in the early stages of development; a newly developed technology being prepared for demonstration or implementation; a significant, environmentally conscious change to an existing technology; the revived use of an old technology; or a new way to manage, apply or integrate existing technologies.

Start with the assumption that if the technical and scientific claims made for the innovation are valid, it will further the cause of global environmental sustainability. (This means that you will need to make sure your information about the innovation comes from reliable sources.) Then conduct a political feasibility study for the implementation of the innovation.

Remember this is a paper about global environmental governance. Description of the technology involved should only be a small part of your paper. The purpose of the research is not a scientific analysis to determine whether the technology would work as predicted. Instead, **your guiding question is: If it can work as promised, how would the politics involved affect the possibility that it would be adopted and implemented in ways that would improve the global environment?**

Use the 5 points listed on the previous page as the outline for your paper (and presentation). Follow the instructions and requirements on the first page of this document.

Topic Statement: In recent years, the prospect of reaching a future where we won't have to drive is becoming more prominent by companies like Tesla, Honda and Toyota spearheading the project. This paper will be studying and addressing driverless cars, whether they can help the environment, and if they can, if it is a feasible strategy for the future.

The main actors of the technological innovation first and foremost are the multi-national companies who produce these cars. Another actor is the current financially able people who will spearhead this project by testing and reviewing these cars. A bigger and more industrially important actor is the transportation industry and, the workers and unions connected to this industry. What would be the truck driver's, their unions and boss's reactions to driverless trucks and what impacts might this have on the economy and the environment.

The greatest political challenge would initially come from those companies who would opt out against driverless cars and want to stop competitors from making them. The second greatest political challenge from possibly the trucking industry who would prefer to keep their jobs because if proven effective, driverless cars a superior technology to yet another "blue collar" job.

Back to the future made many predictions that turned out to be remarkably accurate. They predicted Cubs winning the World Series and Trump inspired character Biff going into politics. They had their own shortcomings as we don't have flying hoverboards and cars but we might have something better and more impactful, autonomous vehicles. Explaining what an autonomous vehicle is so easy that it does injustice to the complications and benefits it brings to the table. In this paper, I will be tackling the possible environmental and other impacts of self-driving vehicles and assessing whether it is a politically feasible solution to pollution and climate change.

Transportation is a huge part of 21st century living and we spend a lot of time and fossil fuel on it. According to BigThink (Montenegro 2015) 25% of US's energy goes towards transportation and US Environmental Protection Agency's report states that 25% greenhouse gasses emitted are directly related to transportation. At first it might be hard to link how greenhouse gas reduction might be linked to self-driving cars but that will become more obvious as we discover the advantages more deeply. Autonomous Vehicles can navigate without any human interaction using radar, computer vision and GPS. I will be discussing the benefits and disadvantages of driverless vehicles extensively as the conclusions we derive from the cost-benefit analysis significantly effects how feasible this technology is.

The most important benefit of autonomous vehicles is safety. According to Fagnant and Kockelman 2015 "More than 40% of fatal crashes involve alcohol, distraction, drug involvement and/or fatigue" and "Driver error is believed to be the main reason behind over 90 percent of all crashes". According to National Highway Traffic

Safety Administration's 2008 report on traffic accidents 300 billion dollars are spent annually in the US due to accidents. Self-Driving cars won't make the same mistakes that humans do. Google Spokesperson Jacquelyn Miller claims that they have only had "13 minor accidents in 1.8 million miles". Fagnant and Kockelman 2015 states that a 50% implementation rate Autonomous Vehicles would save 48.8 billion dollars and at 90% percent implementation an impressive 110 billion dollars just from preventing human caused traffic accidents. According to the same analysis it is also expected that number of crashes would be reduced by 4.2 million every year. It is obvious that self-driving cars can make driving a safer experience for all but how would this effect the environment. On an indirect way, the money saved from traffic accidents is can be used in many different aspects and one of this can be tackling Climate Change. Most importantly reduced number of crashes will reduce traffic congestion on highways and many areas. Although we are slowly developing technologies to reduce emission by the travel duration is still significantly increased due to congestion, and it also causes cars to travel at speeds which is not optimal for fuel consumption causing more greenhouse gasses emitted than if the car was travelling at a faster speed.

Autonomous vehicles won't only affect traffic jams through accidents but an automated highway is going to run much smoother than the current ones. This would be majorly due to smoother acceleration and braking as stated on the article on the Times magazine by Justin Worland. According to Jason Bordoff's article on Wall Street Journal we could save 15% in fuel by just utilizing the fact that AV's can maintain optimal speed and avoid idling and unnecessary stops. Again, according to Bordoff "driverless cars could improve fuel efficiency in the U.S. by more than 30% due to smoother traffic flows

and fewer accident-related congestions alone” It is also mentioned in Worland’s article that vehicles will be lighter due to reduction of safety material thus reducing the overall weight of the vehicle. AVs can also help traffic by increasing lane’s effective capacities according to Fagnant and Kockelman 2015. If a system called “cooperative adaptive cruise control” is implemented it is expected that if AVs make 90% of the market, they can increase the flow by 80%.

Driverless cars will also affect our travel behavior to the core. Uber has been heavily investing in AVs and it is expected that ride-sharing programs can continue to AVs. Self-Driving cars are also expected to help fuel savings through smart parking. If ride-sharing policies and smart parking policies are implement we can expect a 45% decrease in total number of cars if 90% of the cars on the road are AVs according to Fagnant and Kockelman 2015. Again, Fagnant and Kockelman 2015 states that one driverless car functioning as a ride-sharing driver can replace 13 other cars. With decreased traffic and possibly decreased number of cars 724 Million Gallons of fuel can be saved (Fagnant and Kockelman 2015).

After mentioning all the positives, it might be challenging to show that there are plenty of negatives but it is possible that AVs under certain circumstances can harm the environment more than they can help. The greatest factor in possible reduction is the possible behavioral impacts. This impact can also hurt the environment significantly. Since AVs are mainly at the testing stage we don’t certainly know how it will impact the behavior of large masses. The Time magazine article by Worland makes the case with automation, the cars will be more frequently utilized. Since drivers won’t need to spend time behind the wheel they can perform other tasks and spend their valuable time more

effectively. This can cause increased utilization and travel time. In Bordoff 2016 it is also mentioned that possible cost reduction in fuel can lead to people travelling for longer distances thus neutralizing the fuel saving done by mechanical improvements. There are very strict regulations for driver's licenses and this disqualifies a certain part of the population from owning cars. With self-driving cars, these people who are not fit to own a driver's licenses will be able to own cars. Although this is a great step towards social equality, it can be very harmful for the environment. Increased number of users combined with extra travelling time can neutralize a lot of positive effects brought by technological advancement.

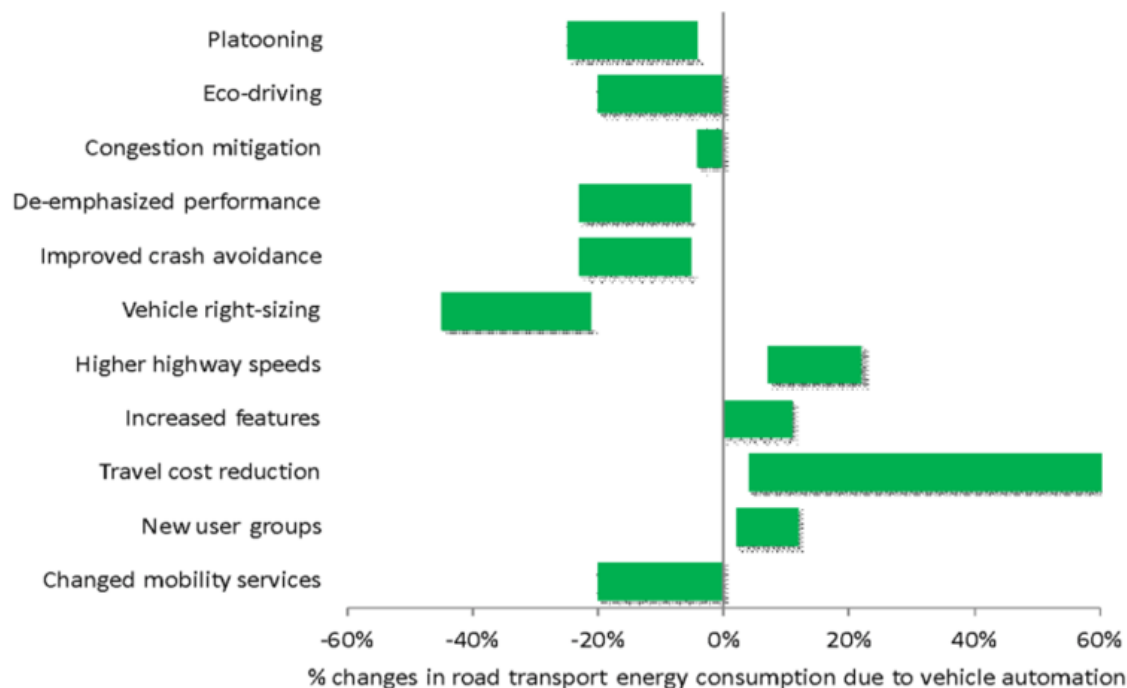


Figure 1: Projections on change of energy consumption (Wadud 2016)

Apart from new users and behavioral impacts the main negative impacts of self-driving cars can also possibly harm the environment by increasing the travel speed on

highways. As the image on the previous page shows there is a great degree of uncertainty on the impact of this innovation on the environment. US Department of Energy suggest that the AVs can decrease the energy consumption by 90% or increase it by 200%. This wide range shows the extreme importance of the way this innovation is implemented. Implemented the right way it can reduce 25% of gasses emitted significantly, or else it can worsen climate change to a degree beyond are repair (if we are not at that stage already). If this technology is implemented, it needs to be implemented so that positive impacts are maximized. Certain policies that can push for that include but are not limited to ride-sharing bonuses, tax breaks, industrial usage and public transport usage. This leads me to the second part of this paper which is the actors and likelihood of implementing AVs in such a way that it will be beneficial to the environment.

The first main actor in the implementation of AVs are the developers. The current pioneer developers Tesla and Google's parent company Alphabet. These are both firms that are either new to the car making business or are starting with these cars. We can also see this trend with Bosch and Delphi Automotive who are using other company's cars to develop their own technologies. There are also well established car companies such as Nissan, Audi and Mercedes that are developing their own driverless cars. On a manufacturer's perspective, there currently is no reason to hold back on this development. The companies aim should be to beat each other to the punch as it is possible that AVs can decrease the total number of vehicles on the road thus the first company that produces a commercially successful AV will most likely get the lion share

of the customers. This will drive the innovation and development to be much more rigorous.

The second group of actors in this are the users. On Fagnant and Kockelman 2015, they put the estimated price of current AV's on 100 thousand dollars. As mentioned in the paper this is way above the prices of cars that are purchased the most which ranges from 16000 to 27000 dollars. Right now, not only are driverless cars limited in numbers they are also are not accessible to many users. The estimates have it that the costs can fall to a range of 25000 and 50000 dollars in the next years as the process becomes less experimental and moves towards mass production and possibly around 10000 dollars in ten years. (Fagnant and Kockelman 2015).

When talking about users it is also important to mention that certain successful aspects of AV development is slowly getting implemented in our cars. Cars who have cruise control, auto braking and self-parking has become more and more popular in recent years and they are moving from being luxury additions to fundamental aspects. The public reaction to these additions have so far been positive.

Another positive aspect of these vehicles are the possible fuel savings that can encourage users to opt for these cars. The increase in safety will surely be a primary reason for some users to pick these cars. The last aspect of this that needs to be mentioned is the behavioral change that it will cause in the users. Driving is an enjoyable activity to many users but we need to remember that cars are recent part of our lives. Before cars there were widespread we used other types of transportation and as superior technologies arrived we slowly replaced them. Increased safety, comfort

and reduced fuel consumptions are a definite positive for many users and as the prices fall for AVs with time, we can see it become everyone's tool rather than a luxury.

Another actor in the implementation of AVs are the governments of the countries and cities. So far licensing for driverless cars have been a problematic issue in the US as there has been multiple different laws passed according on different states. There are wide differences on laws on AVs in Nevada compared to Florida (Fagnant and Kockelman 2015). The city governments must ensure that cities are not drawn too far out as AVs can encourage longer travel times. If this causes cities to get bigger and more widespread this can neutralize the positive aspects of AVs by increasing the average drive distance.

Of course, one of the biggest effects of self-driving cars will be on the Transportation Sector. Hopkins, Strasser, Hopkins and Jerry 1993 states that transportation sector accounts for approximately 20 percent of US's gross national product, or 2.5 percent of the US workforce (Hayes 2011). Being one of the only jobs that does not require a college degree that with decent incomes the jobs like truck, bus and taxi drivers are a very important part of the service sector. So far facts show that computers will be better drivers than humans, but what other motivations does the industry that will make them change their vehicles to AVs. Study done by Hopkins, Strasser, Hopkins and Jerry on the effectiveness and customer satisfaction the current transportation industry on 1993 shows that "service quality carriers provide is not the same as the service quality that shippers expect from them". It is very important for these businesses to make sure that their service quality is superior to their competitors. As stated on Hayes 2011, an AV truck does not need to stop for breaks and can keep

going 24/7. Hayes predicts that in the extreme scenario that self-driving cars cost triple the amount of money paid upfront for the truck it would still be faster and more profitable than a human driver. This is perhaps why companies like Walmart has already started utilizing driverless trucks. It seems like so far, the AVs can bring a better outcome for companies and customers by making the industry more efficient but there is a big part of this equation that we are neglecting, the workers.

Taxi, truck and even uber drivers are decent jobs that could be obtained without a college degree. So far, all predictions suggest that these jobs will be exterminated by AVs and there does not seem to be a job that will replace them at the moment. The AV industry may require more Computer Scientists which is a job that requires rigorous education and funds for college but it won't bring a blue-collar job back. We can certainly say that the workers in the transportation sector will be absolutely against integration of driverless vehicles and the strength of their unions might play a big part in the implementation of these technologies.

Another important actor involved with transportation is the insurance sector. Autonomous vehicles will reduce the number of accidents dramatically but they will not eliminate it. Although significantly less there will still be accidents and who to blame for them will be extremely complicated. Currently there are three primary causes, driver fault, vehicle defects and unavoidable natural conditions (Marchant and Lindor 2012). Most of the times the accidents are driver's fault (Marchant and Lindor 2012) but with the integration of self-driving cars this will change to be mostly the fault of either natural conditions or the manufacturers. With the decreasing number of accidents, we might predict that insurance industry will become obsolete but as stated by Marchant and

Lindor 2012 we can see a shift from insurers protecting drivers to insurers protecting the companies. We can see the industry transform to a different aspect without a significant job loss. With possible ethical dilemmas that will be caused by programmed driving, lawmakers and insurers can have very tough time battling this one out.

Last important actor is the Environmental NGOs and so far, it has been hard to find statements by NGOs on driverless cars and we can say that it is too early for them to take sides. There is a huge degree of uncertainty with the environmental impacts of AVs and there are other pressing issues currently that might have caused a future technology that is in the early stages of testing to be neglected so far. One thing that can be predicted for sure is that ideological alignment of these NGOs will decide whether they will be in favor or against it.

From the mixed reactions that this innovation is expected to receive from the outlined main actors we can predict that this will be a case of different sides using their powers to exert and change to the implementation and the laws surrounding it. As stated on Falkner 2007 different sides of this argument will use lobbying while also trying to create a different public perception on the effects of AVs. It is quite possible that the advocates of AVs will argue that this technology while making us all safer, will also bring social justice by providing services to people who are disadvantaged while also potentially aiding the environment. The critics will argue that the effects are extremely uncertain and will cause a loss of a lot of jobs. One of the biggest things that will affect the implementation of AVs is how the states around the world will adapt to this technology. As mentioned previously, different states in US have different regulations regarding driverless cars where 3 states have legislations in place and 10

states have policies currently pending. If we are aiming maximize the environmental and safety benefits of these vehicles there needs to be a various regulations and certain incentives for shorter driving distances and ridesharing. For countries with stronger transportation sector unions we might see the development being restricted or being directed at different aspects that will help transportation sector workers to keep their jobs. Not only will state sovereignty and the job market of the government will decide how soon this technology gets implemented it will also decide how beneficial or harmful to the environment it will be.

We also need to analyze how this technology will be received in different schools of thought. If we use the analysis from Chapter 6 of Clapp and Dauvergne 2005, we can assume that Market Liberals and Institutionalists will be mainly focused on the brute data and Bio-Environmentalists and Social Greens will prefer to focus on case studies. It is most likely that Market Liberals will be mainly in favor of this technology is a technical innovation that can potentially help the society and environment. Institutionalists are likely to be in favor as well but would possibly suggest more regulations to make sure that the environmental potential is not turned into a disadvantage. Taking into account their focus on change of consumer behavior it is also possible that bio-environmentalist will also not be strongly against this. If current trends of driving behavior are retained AVs will be a major help for the environment so it is possible that they will support but will have very strict conditions on the implementation. The most interesting part comes with Social – Green as there could be possible ideological divide. This technology for the next few years will be very expensive and will only be available to those who are very wealthy and some Social Greens might see these vehicles as

another toy for the rich that can potentially be very harmful for the environment. On the other hand this technology if implemented in an affordable way can help a lot of disadvantaged parts of the population who cannot drive the vehicles that we use today. I still think that it is too early to suggest the exact reception for this technology but if it is implemented in an environmentally conscious way I don't see any school of thought completely opposing the idea.

As it comes to the political feasibility of implementation, I would say that it is not a case of if it will be implemented but when it will be implemented. As looking at the global level political considerations with the possible reduction in cost of oil consumption in cars it is possible to see oil exporting countries opposing the idea at first. Yet again, since there is a chance that AVs can encourage urban sprawl, they can also be an increasing factor in fuel consumption so I would say that it won't be a huge international battle but the regional and local level politics will play an extremely significant part in the implementation.

When we look at regional and national level considerations the biggest factor will be how many people are currently employed in the transportation sector and will the states do any kind of deal with current employees so they can keep their jobs while the transformation is performed. Depending on the strength of unions we can see certain states implementing these technologies sooner than the other ones. Countries with politically powerful transportation companies can also see the first implementation of AVs first.

Other than the factors mentioned on regional levels I would expect this policy to be supported on local levels as well. The improved safety of roads, reduced traffic and

larger access for everyone is something that most of the population will support. The local governments won't need to worry with changing the roads significantly as most of the technology is being adapted to fit in with the roads we have right now.

Fighting against technological innovation is like swimming upstream in a river. We can do it for a short while but at the end the river will have its way. Just like hundred thousand horses don't roam New York like they used to in 19th century (Hayes 2011) we might see in the next ten years that driving a car becoming a leisure activity like riding a horse. With the potentially saving 21700 lives every year (Fagnant and Kockelman 2015) and helping people who don't have the luxury of driving cars it will be very hard to fight against this technology in the purpose maintaining livelihood of transportation sector. AVs have a great potential to make the world we live in safer and fairer together while also making us more productive. Since it has a potential to either harm or aid to environment we need to make sure that in these early stages it is implemented the right way to help our planet. As it comes to the likeliness of implementation, if these cars maintain or improve the current safety record that they have it is very likely to be implemented in next 10 years. If they find a way to aid the transportation workers while doing so I expect this to be much sooner. A big uncertainty is not whether this technology will be implemented but will it be implemented in a way that can help the environment. I would say that completely depends on how soon we start taking this incoming technology seriously. If environmental organizations invest and start lobbying for ridesharing, smart highways and driving distance restrictions, we might be thanking a very unlikely hero for maintaining or ozone layer in 2100.

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Author's Fun Notes: I came up with the intro while listening to the soundtrack of Back to the Future and the title while listening to the soundtrack of Lord of The Rings (because Tolkien is very good at making unlikely heroes). The funniest part for me was while I was writing the negatives I was listening to the Terminator soundtrack and I thought of the possibility of SkyNet controlling all the cars but didn't put that in the paper because it was irrelevant and I didn't have any solid sources.