

The Regulation of AI: An Investigation on the Development of AI and its Effects on the Transportation Industry

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Abstract

In August of 2017, companies Google and Facebook announced to invest \$150 million dollars into a Toronto based AI institute, making it one of the largest investments in Artificial Intelligence. With companies, and even governments, investing millions into Artificial Intelligence, it is no doubt that the growth of AI ought to be exponential. As companies get closer to introducing their autonomous capable semi-trucks, it is clear there exists a lack of regulations that can potentially regulate the extent to which companies can use Artificial Intelligence to affect the job outlook in the transportation industry. In this study, the major companies involved in the development of Autonomous technologies were researched and analyzed. With a set criterion for the choice to ensure credibility and viability, companies' (Tesla, Google, GM and Mercedes Benz) autonomous programs were selected as part of secondary data analysis research. The variables research and development budgets and production units set the stage for the quantitative data while, the risks, tech innovation, and industry trends accounted for the qualitative form of data. Upon the collection and analysis of the data from the companies' annual reports, it was noted that Tesla and Mercedes Benz would be the future industry leaders of autonomous technologies on the roads, with budgets of \$ 3.8 billion and \$ 4.6 billion respectively. Google and GM do seem behind in terms of budgets and production due to the fact that their department is currently focused on different parts of the transportation industry. With this data mind, it would be in the best interests of the lawmakers to focus on finding solutions towards reducing the number of units being produced and the corresponding budgets of the companies to maximize efficiency in transportation while also maintaining ethical standards.

Keywords: Autonomous technologies; Transportation industry; Artificial intelligence; Tech giants

Introduction

With the rise of better and more efficient handheld technologies, Artificial Intelligence is becoming a big part of the lives of the general public. The popularity of Artificial Intelligence has prompted many tech giants like Google, Tesla and Facebook to invest heavily into the further development of the technology in hopes of creating an autonomous and more user-friendly world. This can be seen in Sam Shad's article, Google and Mark Zuckerberg's Investment Fund are Backing a \$ 150 Million AI Institute in Toronto, in which he stated how in a recent endeavour in Toronto, Google and Facebook have pledged over \$ 80 million into the Vector Institute in Ontario, Canada in hopes of helping the institute, "lead the research and shape the future of this field by putting neural network technologies to work in ways that will improve health care, strengthen our economy and unlock new fields of scientific advancement" [1-4] and while the tech giants are focused on improving the technologies in the West, research institutes across the world are planning on investing or have invested large sums into the development of AI. As seen in the case of India, where the state government of Karnataka has pledged on creating the Center of Excellence for Data Science and Artificial Intelligence, investing of up to 6 million dollars into the center calling it a "logical next step required to provide the right fillip to areas of data sciences and artificial intelligence and give a head-start to, not just the state, but India as a destination to develop global product solutions"(35,000 Jobs, 2017). While the competition to develop on and improve AI technologies around the world can be helpful, ensuring that new discoveries are made from previous experiences, to what extent can the general public let the development of technology go to.

Literature Review

Along with the better development of the technology, the perception

of AI among the tech companies involved in the development of AI is vital to understanding the future plans of the companies. According to the article, Elon Musk's Billion-Dollar Crusade To Stop The A.I. Apocalypse, Elon Musk, CEO at Tesla and SpaceX, claims that a world where highly developed AI takes over all jobs and potentially over the government is very possible which can lead to "human extinction and technology will likely play a part in this" and thus there is a need for an escape plan [3]. In contrast, Mark Zuckerberg has a much more positive outlook on the subject claiming, "AI will have much less dystopian applications, and will be responsible for saving lives through disease diagnosis and by powering driverless cars" [4]. While each of the billionaire visionaries has their own sets of arguments, the true understanding of the problem doesn't lie in the wild accusations or the unreasonable assumption of AI taking over the world and enslaving the population, but rather in the recent developments in AI technologies and the plans that tech giants have in mind.

Understanding the goals as well as the fears of the companies developing AI technologies can aid the public's understanding of the future of AI. According to Kai-Fu Lee, a journalist at the New York Times, the general public perceives Artificial Intelligence, and subordinating technologies, as a threat to the very existence of humanity. While this might sound interesting in one way or another,

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“self-aware computer programs” that can engage in “common-sense reasoning, attain knowledge, or understand emotions” may not arise for “hundreds of years, if ever” [2]. Lee claims that the real threat that AI possess is the technology’s potential of bringing about a “wide-scale decimation of jobs” mostly in the blue collared jobs of industries [2]. This is evident in Apple’s recent endeavor in which the company, in attempts to improve efficiency, ordered its factories to replace “60,000 factory workers with robots” [4]. With an investment of over 633 million dollars made into creating such machines, the company claims that “It’s cheaper to buy a \$ 35,000 robotic arm than it is to hire an employee who is inefficient” [4]. In a similar turn of events, Andrew Lewandowski, head of Uber’s autonomous operations, a veteran of Google’s self-driving program, and one of the co-founders of Otto, claims that in the next 10 years, the “robot taxi” technology, that would be able to self- program its routes, would become “so cheap and easy to use that it would make little sense for anyone to actually own a car” [5]. As evident from the current investments of the companies, it is becoming evident the companies are planning to maximize their profits with the use of efficient robots that can work much more quickly and efficiently than traditional blue collared workers. As the threat of Tech companies taking over blue collared jobs through their advanced Artificial Intelligence technologies becomes evident, the focus of the government should be on putting the companies working on developing AI technologies in check.

With the growing threat of Artificial Intelligence becoming evident with each passing day, regulations to control the development of Artificial Intelligence technologies is becoming necessary. While some might state that, “regulations of Artificial Intelligence hinder the advances in the field as people with limited technological knowledge are the one behind the creation of the laws”. Others have a much different approach to the technology. According to Oren Etzioni in his article, How to Regulate Artificial Intelligence, “the growth of Artificial Intelligence must be regulated in the interests of caution” [6]. Etzioni believes that the regulation of Artificial Intelligence technologies should happen on the basis of “three laws of robotics” [6]. First introduced by American writer Isaac Asimov in 1942, the laws state that “a robot may not injure a human being, or allow a human to come to harm.” another being that, “a robot should obey the orders of a human being, except when such orders would conflict with the previous law,” and the last one being, “a robot must protect its existence as long as such protection does not conflict with the other two laws” [6]. While the mentioned above define more of a doomsday situation, a modified version of such laws that complies with today’s threat of mass unemployment in the transportation and other subordinating industries would be much more beneficial. As the companies work towards maximizing their profits by minimizing their costs as seen with “the technology, media and transportation industry (having) the highest expectations for AI to accelerate new product and service offerings of all industries tracked in the study, projecting a 52% point increase in the next five years”, precautionary steps that benefit today’s job market are vital [7].

In terms of the transportation industry, the American Trucking Association (ATA) predicts that out of the 3.5 million truck drivers in the United States, “the trucking industry will lose 38% of its workforce to autonomous trucks” (“Reports, Trends & Statistics” (n.d.)). What makes the situation even worse is the fact according to Figure 1 presented by the ATA, the trucking industry is already in a phase where the semi trucks have complete autonomous capabilities and are just two decades away from having a full autonomous take over.

With the reach and capabilities of autonomous trucks reaching

higher levels without any stoppage, it is clear that a gap exists in the form of the lack of regulations present that can potentially regulate the extent to which companies can use Artificial Intelligence to affect the job outlook in the transportation industry.

Methods

The research of artificial intelligence development and its effects on the transportation was done with the use of the secondary data analysis research method. Secondary data analysis method was chosen specifically for this research because of few reasons. First, since this research does not involve any forms of experimentation and focuses on developing a conclusion by the analyzation of the information provided by the various manufacturers. Secondly, for the research to be credible, the data needed to be from a primary source, therefore the data presented in this research comes from the annual financial reports of the manufacturers along with their respective AI program description pages. Lastly, many variables are being used to synthesize the data and when cross-checked, secondary data analysis is the research method that involves the synthesis of the data through the analyzation of various documents. The styling of this research paper is derived from the various research studies present on the topics of Artificial Intelligence. Being in the scientific field, most of the research papers found adopt the APA style of formatting to ensure that paper maintains a formal and standard style. This can be noticed in the conventions of this research paper starting from the style of the title page, running header, page numbers and the citations presented throughout.

The first step in carrying out this research was to figure out which companies to focus on to be reviewed and examined. There are hundreds of companies that have discussed implementing artificial intelligence in the transportation industry, but given the expensive and slow development process of autonomous capabilities, this research is only going to focus on the companies with a workable product and/or considerable budget of over \$ 1.5 billion to fund their respective autonomous programs. These overarching variables were used to provide a realistic number of programs to analyze, as being in a respectable stage of development (i.e., testing and development) or having a sustainable budget ensures that a company can produce a mass market product in the near future. For this research in particular, the companies being focused are presented in Table 1 below.

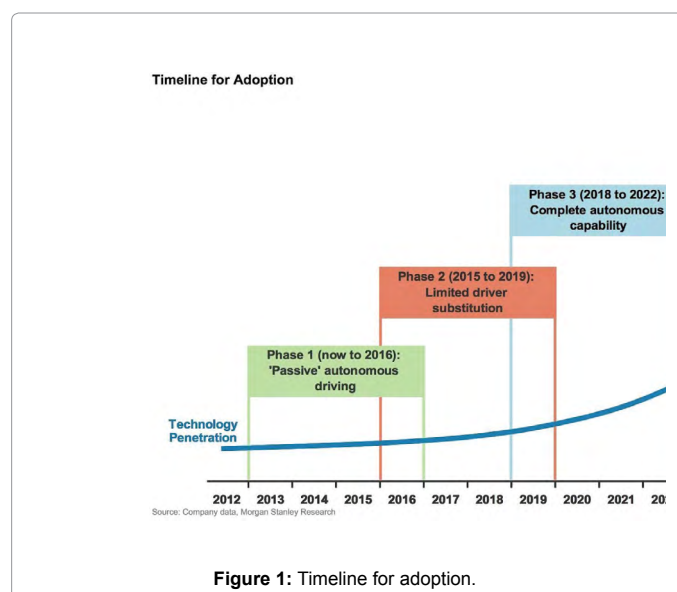


Figure 1: Timeline for adoption.

The budget from these four companies, Tesla, General Motors, Google and Mercedes Benz (Daimler AG), their program development, along with their release timing of their semi trucks is also provided in the table.

To analyze the data extracted from these companies few defining variables were needed. For this particular research, R&D Budgets, new technological innovations, risks in development and use of their respective Artificial Intelligence platform and the current industry trends. For R&D budgets, the trend in either the increase or decrease of the said budgets provide a better understanding of how much a company is invested into development of their particular AI platforms. A company's new technological innovations aids to the competition of the overall market; an analyzation of the innovations can provide an insight into what the public can expect from a certain manufacturer and how the said technology can aid in commerce. The knowledge of production units is crucial in understanding the reach that AI would have in the sense of raw number of drivers being replaced. A raw number of orders being a known fact aids law makers in having precise measures on what the cap would be for the number of drivers to be replaced and further what numbers would be the most suitable to ensure that the regulations put in place maintain the balance between efficiency from AI and jobs for truck drivers. With the knowledge of the risks involved with the development of the AI platform, the policymakers would have a better understanding of what to lookout for while using the technology in the near future. This information can be instrumental in developing regulations that ensure the safety of consumers by reducing the possibility of risks leading to failures in the working of the technology. Lastly, the analyzation of industry trends can be instrumental in justifying the steps companies are taking to ensure that they have the upper hand in the competition. Such information would help policymakers understand the steps companies are taking and how the information is going translate into the complication of the artificial Intelligence and the production of the respective technologies.

After deciding on the companies that would be analyzed, and the variables through which they would be analyzed, the next step involves the collection of credible and relevant data. To maintain the consistency and credibility between the variables and data it is crucial that the data is coming directly from the companies themselves and is based on a set principles decided on by a governmental organization. The only place where both consistency and credibility could have been maintained was if the data was obtained from the annual reports of the companies. The annual reports of companies has been regulated by the Securities and Exchange Commission (SEC) since 1934 and ensures that annual reports are consistent across the platform. A place where differences were present, however, were the descriptions of the respective AI platforms that the companies have adopted. While some companies elaborated on the experience of the technology, other companies focused on providing direct facts and explanations.

To counter this inconsistency, variables like in cabin experience and how the individual AI technology solutions differed were left out. This ensures that the data being used is same for all companies and doesn't give an unfair advantage or disadvantage to a certain company.

While the SEC having no regulation on how the data is presented or formatted, companies often arrange the data according to their whims and fancies some presenting the data in just factual form while others so far as to putting the data in colorful infographics. This might cause a bit of difficulty in finding the needed information, but a bit of investigation of the document will yield the information that would be needed for the further analysis of the data.

Results and Data Analysis

As expressed in Table 2 below, the data collected from the annual data reports was rather intricate because of the sheer amount of information being presented in said reports. To effectively analyze the data, according to secondary data analysis standards, the first step was to divide the data on section-by-section basis. This would ensure that no part of the data collected is left out and that individual attention is paid to all parts of the data. Furthermore, the in-depth analysis of each aspect of the data will be then beneficial in developing governmental regulations as each specific regulation can be specialized for one aspect of the data, and would ensure that the regulations yield the highest efficiency by forming a hybrid of autonomous and man-based systems.

The first aspect in terms of analysis can be attributed to the research and development budgets of the companies. As discussed in the methods section, the research and developments are a crucial in understanding the development of a technology as it shows the how invested a specific company is into developing their autonomous technologies. Figure 2 below illustrates the individual R&D budgets in a graphical form.

As seen in Figure 2, the research and development budgets of the companies reveal a surprising story. While it can be inferred that Mercedes Benz has a high budgets due to its heightened culture of technological development, the low budget of GM is a strange revelation. The heightened budget of Tesla, at \$3.18 billion can be attributed to the fact that Tesla is a company truly focused on developing revolutionary AI technologies that will accelerate the world into the Autonomous age. As one can previously recall, Tesla is one of the fastest and only developers of AI technologies that has publicly released their autonomous software (Autopilot) and is in the constant phase of collecting data from its consumers and further refining their software. Lastly, it can be seen that Google has a significantly low budget compared to the likes of both Mercedes and Tesla, this is because of the fact that Google's Waymo technology is based rather on providing current vehicle with autonomous capabilities.

Company	Respective development and budgets
Tesla	Autopilot-Released Budget-\$3.18 billion Status-Release Q2 2019
General Motors	Cruise Automation -Testing and finalization Budget-\$1.59 billion
	Status- Release Q4 2021
Google	Waymo - Testing and Finalization Budget-1.81 billion
	Status- Release 2022
Mercedes Benz (Daimler AG)	Mercedes Semi Auto - Finalization Budget-4.6 billion
	Status-Release Q2 2019

Table 1: Companies and their development.

Variables	Tesla	General Motors	Google	Mercedes Benz (Daimler AG)
R&D Budgets	\$3.18 billion	\$1.59 billion	\$1.81 billion	\$ 4.6 billion
Tech Innovation	Autopilot	Cruise Automation	Waymo	Mercedes Semi Auto
Production Units (per year)	100,000 units	52,000 units	N/a	250,000
Risks	1. Production delays 2.Experimental Product with cases of crash 3.Skeptical customer base might not prefer autopilot	1.Customer Base Hardware and software still in basic development.	1.Advanced tech but possibility of loss in remote areas 2.Competition might present a better product.	1.Newly created tech with more potential for error while driving 2.Mapping technology is still incomplete.
Industry Trends	Focus towards improving the previously developed technology and attacking new markets.	Focus has always been towards the transportation sector with projected rise in autonomous vehicles (trucks and ships).	New to the transportation market with focus towards licensing the technology to current truck developers.	Also new to the autonomous industry with plans on integrating autonomous technology into its own product line.

Table 2: Variables and data.

Beyond the research and development budgets of the companies, another key factor in the creation of governmental regulations is the predicted units that the company is producing in the coming years. Figure 3 below illustrates the predicted annual production units of each specific manufacturer.

As evident in Figure 3, the per annum unit production lies in accurately with the companies' subordinating research and development budgets. In the case of both Tesla and Mercedes Benz, the predicted production units are far superior to those of GM and Google. The biggest reason for that is the higher budgets that the companies have garnered and their overall commitment towards putting their autonomous technologies on the road as soon as possible. One might notice that the production units for Google is zero. As previously discussed, Google's focus is towards providing updated software for the pre-existing semi-trucks. This can be attributed to the fact that Google is more of a software based company and does not have much experience in terms of sheer producing semi-trucks. What is different, however, is not what Google is implementing, but rather what path GM is taking with its Cruise automation technology. While the automated software is rated one of the "absolute best" in terms of safety and overall intelligence, the budget and production units tell a different tale [8]. One reason to explain this phenomenon might be the fact that GM is a company more focused towards developing their autonomous technologies in their automobiles first. GM's automobile department is of a greater percentage than its semi department, this might explain why GM is considerably behind in its development compared to its competition. Overall the per annum predicted production units do aid in the understanding of the commitment of the automotive manufacturers and further provide concise numerical values to be used to set up regulations.

A common trend can be noticed when focus is shifted towards risks and the common industry trends. As observed in Table 2, one of the most prevalent issues arising is the sceptical customer base. With years of movies like Terminator, I, robot, and Ex Machina, a negative of Artificial Intelligence has been set in the minds of public. The fear of AI is what makes the public skeptical of the outcome of Artificial Intelligence being implemented into tradition man-worked jobs. Another risk that arises with Artificial Intelligence is in terms of safety. No matter how developed AI becomes, there would always remain a need of man behind the wheel to ensure the smoothness in the work of autonomous driving. Another facet to consider is the issue of production delays. With specialized technologies as the ones being

Research & Development Budgets of Companies

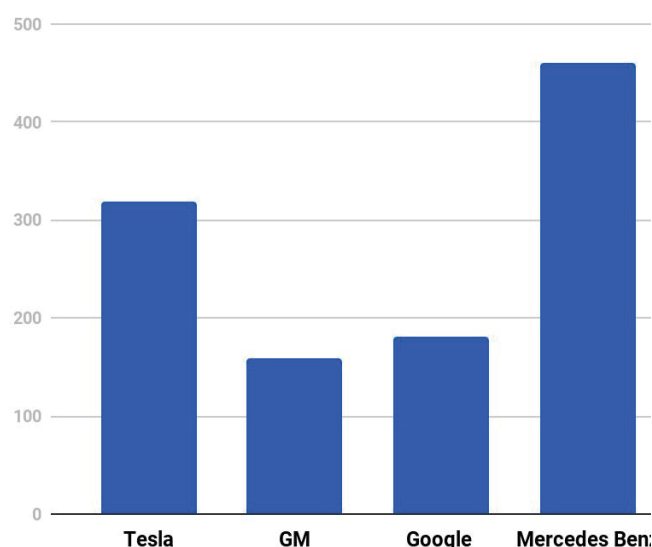


Figure 2: R&D budgets.

Predicted Unit production

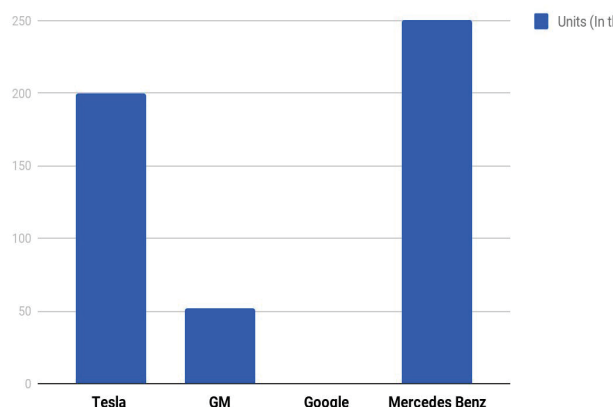


Figure 3: Per annum production units.

developed here requires specialization in factories and production lines. This process can often take a considerable amount of time and money. The fact that these companies are not yet specialized in terms of their factory development can help predict the delays that the companies will experience and the further profits they would lose through the process. This might prompt the manufacturers to promote their technologies more aggressively to make up for these lost profits by mass producing semi units. In terms of industry trends, the manufacturers seem pretty consistent with each company promoting new and improved technologies by the day. This constant trend ensures that the final product produced by these manufacturers would be up to par in terms of technological advancement as well as safety [9-15].

Discussion

Based upon the data above, it can be inferred that Tesla and Mercedes Benz would be the future industry leaders of autonomous technologies on the roads. With budgets of \$ 3.8 billion and \$ 4.6 billion respectively, they are bound to becoming largest producers of autonomous trucks in the United States and possibly the world. An interesting prospect might be Google's approach to autonomous innovation. By introducing Artificial Intelligence to current trucking companies, they can reduce costs and maximize their production of the software. This can be compared to their previous endeavours with Android mobile operating system in which they implemented a similar style of producing the software that other manufacturers can use to develop more affordable autonomous semis. In terms of GM, there might be change in the future as GM specializes its production line and shifts its focus towards its semi truck industry [16-18].

In terms of developing governmental regulations for the semi truck industry, the two of the most important variables to consider will be the R&D budgets and the production units. The implementation of AI in trucks would mean that a certain amount of jobs would be replaced by autonomous vehicles. Having the amount of money being put into the development of the autonomous software helps lawmakers determine how safe the technology would be and how many drivers would be put in place to ensure safety on the road. On the other hand, the per annum production units give lawmakers an approximate understanding of how many jobs are being replaced based on the amount of units that are being put forth on the roads. While, the money and the per facta based on the tech innovation and risks are also a key in determining what manufacturers would prevail in the real world. With this data mind, it would be in the best interests of the lawmakers to focus on finding solutions towards reducing the number of units being produced and the corresponding budgets of the companies.

Since part of the data collected is a projection and not for a fact, there still remains a lack of total surety on how many jobs will be replaced and how much the industry will profit. In terms of Google and their unique approach, it still cannot be predicted if they will prevail as a mass produced technology, or if Tesla and Mercedes would lead with their high budgets and production sizes. Another fact to consider is that the companies addressed throughout the research currently are in fact the current leaders, but a different automotive manufacturer might just overtake these top tier companies as the autonomous technology matures and garners the trust of the public. On the other hand, the automation of world has many implications attached to the cause. As the world moves towards automation, there would be an initial backlash from the workers, wherein the role of the federal government would be questioned. The idea of governmental regulations can soften the blow from the workers as the government can use as a line-of-

defense. In a more positive sense, the prices of goods can be lowered to a great degree as the efficiency of transportation would increase and the probability of human error would decrease. This is due to the fact that as the number of human workers are decreased, shipping companies can ensure a 24/7 system of transportation leading to faster and more accurate delivering system.

Conclusions

In an overall stance, Artificial Intelligence is still a technology that is still in development and has not reached its true potential. However, with the information currently present and the division of perspectives between Musk and Zuckerberg gives the public an insight into what Artificial might become. The division between the two experts can mean that the need for regulations will arise as a point of agreement in order to ensure the growth of AI, but rather in a regulated fashion. This research wants to aid such cause. With the need for regulations arising, this research can be a key to understanding the threat that Artificial Intelligence presents to truck drivers in the transportation industry. In terms of the need for regulations, it seems to be clear that with the current budgets of AI developing companies, and their predicted launch dates that the rate of development is near exponential. Regulations that are imposed on the companies would only ensure that the mass production of autonomous technologies does not rapidly cause a surge in job loss, and lead to an increased dependence on government for unemployment. As the data analysis presenting possible variables (i.e., Budgets and Production Units) to be considered while developing said regulations, lawmakers can ensure that the jobs of truck drivers can be saved even with the autonomous technologies developing. In the sense of efficiency, a balance of 60 to 40 between manual truck drivers and autonomous vehicles is the only way to maximize efficiency while also maintaining ethical standards by giving the drivers an upper hand.

As discussed previously, AI and more specifically autonomous driving is a fairly new technology that has grown just in recent years. This brings in the need for further research into the future development of the AI to ensure that the companies are controlled, and remain on the right track. Specifically pertaining to this research, further research on the effect of autonomous technologies on other means of transportation can give an insight into the future of autonomous vehicles in the transportation industry. Furthermore, replicating this particular research, but with more variables, like cost per unit, comfort, and safety, can produce a more accurate result as to how the product would sell in the market. With this, researchers are encouraged to delve deeper into the realm of Artificial Intelligence to ensure a more technological, yet job friendly world.

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