Autonomous driving technology (ADT): questions for marketing and society

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ABSTRACT

The impact of autonomous driving technology (ADT) is only in it's infancy at this point in time, with a significant number of future implications for business, marketing and society. This case study begins to explore a range of these implications in areas such as consumer behavior, environmental concerns, data systems / hacking, ethics / morals and several others. It is suggested that students, either individually or in groups, should pick one of the section headings or areas in this case for further research, and then present their findings.

Keywords: Self-driving technology, autonomous driving technology, marketing, case study
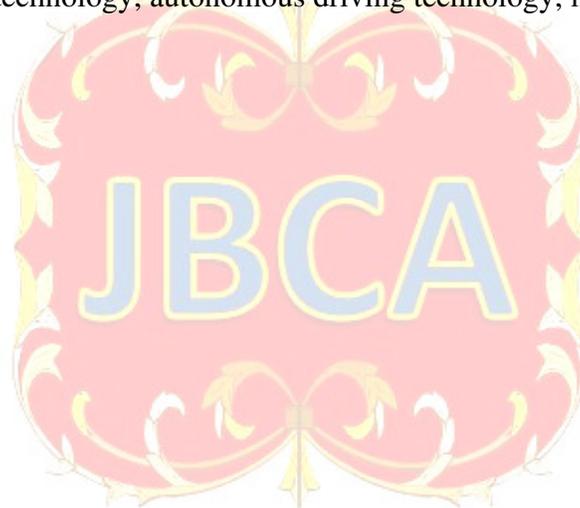
INTRODUCTION

In the near future it is suggested that the world might expect to see a huge transformation and implementation of self-driving vehicles (autonomous driving technology, or ADT) into our lives. Various estimates suggest that globally we can expect to see 10 million self-driving cars on the road by 2025, with one in four cars being self-driving by 2030.   While this prediction is potentially significant (and perhaps optimistic), it is also important to consider the behavioral, economic and marketing implications of this technology for a variety of reasons.   The purpose of this manuscript is to further explore these issues, and to set the stage for future research endeavors related to autonomous driving technology or (ADT)

CONSUMER BEHAVIOR AND ADT

From a behavioral viewpoint ADT is conceptually similar to the literature related to diffusion of innovation and the eventual acceptance or failure of various technologies (i.e., continuous, dynamically continuous and discontinuous forms of innovation). ADT appears to be a scalable form of technology (i.e., levels 0 - 5 of ADT exist, as established by the Society of Automotive Engineers (SAE 2014)) which may enhance the likelihood that in some of the lower levels or forms ADT, the specific technologies will be more fully embraced by consumers vs. higher levels of ADT. On the other hand, are consumers willing to relinquish control and trust to ADT completely (Lusch, Brown and Brunswick 1992)? Are there particular economic benefits associated with ADT (i.e., not having to purchase a car, owning a portion or share of an automobile, or just using an ADT enabled vehicle on demand, periodically)? Are the psychic benefits associated with driving slowly becoming less and less important over time (i.e., in other words, do fewer and fewer people actually enjoy driving as a form of recreational behavior)? Are there time-associated factors which will influence the adoption of ADT (i.e., can work, or other non-work activities be accomplished while riding in a fully-autonomous vehicle)? Will fewer resources be necessary to own and operate a vehicle given the advent of ADT (i.e., maintaining your own car vs. subscribing to an ADT-based transportation plan not unlike having a Netflix subscription)? Additionally, what specific factors will have a larger or more significant influence on whether or not higher levels (i.e., Society of Automotive Engineers Levels of Automation -- levels 4 and 5 in particular) of ADT are widely embraced over time (i.e., consumers who share very specific traits and characteristics which involve the previously-discussed IM/EM model components)? Many aspects of the IM/EM model (Lusch, Brown and Brunswick 1992) appear to have relevance to research related to adoption of ADT. Meanwhile, in the U.S. investigations into ADT and driver behavior continue to occur (Krisher 2021), with many expressing concerns about the reliability of the current technology in avoiding accidents and/or causing accidents.

ENVIRONMENT AND ADT

Environmental factors might be a significant influencing factor over consumer and business behavior in certain parts of the world, and specifically when thinking about the reliability of ADT. For example, blowing snow can render sensors which are critical to ADT virtually useless, and under other conditions, road debris, dust, leaves and other items could also compromise the technology. Coupled with existing automotive technology, such as anti-lock

brakes, traction control etc., will ADT be sufficiently safe in extreme conditions involving snow and ice? Can ADT handle difficult driving conditions more effectively than an experienced driver? (Ross 2014).

Given a different connotation of the term environment, will ADT be perceived as being more environmentally friendly or responsible, and in turn be adopted more quickly by specific segments of the population. This would seem to depend upon how salient these environmental concerns are to consumers and businesses, as well as perceptions of the environmental benefits associated with ADT.

Pollution, climate change, and saving our planet are important influences in many societies today. Green marketing and other forms of environmentally responsible behavior are increasingly the norm, both in terms of businesses and consumer behavior. It would be interesting to further analyze whether or not ADT is perceived as being environmentally friendly, vs. whether or not (in reality) the technology is actually safer for the environment (Fagnant and Kockelman 2015). Will ADT-guided vehicles pollute less than those driven by humans?

DATA SYSTEMS AND INTEGRITY

Another different set of factors influencing the adoption of this technology would relate to the integrity of the data systems serving as the backbone of ADT, and whether or not hackers will be able to seize control of vehicles (whether the vehicle is in motion or not). In the U.S. the Automotive Information Sharing and Analysis Center has been formed by industry players in an attempt to share information about potential vulnerabilities and cyber attacks. Even the mass media has started to recognize the significance of this issue; back in 2014 a non-self-driving Jeep Cherokee was hacked by security researchers in a real world test that resulted in the technological disabling of the vehicle's engine functions, air conditioning, locks and radio. As a result, Fiat Chrysler recalled 1.4 million vehicles in order to remedy the security issue. Moreover, Ford Motor Company recently announced they envision launching a car in the near future with no steering wheel; what happens if ADT fails, or data systems are compromised? How can a car be navigated without a steering wheel? What back up systems would be in place? Will humans still be ultimately responsible for monitoring ADT technology and systems on a real-time basis, possibly negating some of the perceived benefits of this technology?

MORALITY OF DECISION-MAKING AND ADT

An even more complex set of possible influencing factors would involve the morality of certain decision-making scenarios drivers face under very specific conditions (Lin 2015); in other words, can ADT make decisions that would reflect the morals of the driver. For instance, say that a car (being driven by a human) is in heavy traffic, and encounters a lost dog wandering aimlessly (in traffic) on the road. Does the driver hit another car to avoid hitting the dog (and run the risk of injuring themselves and others, perhaps severely) or does the driver hit the dog, possibly killing the animal, in order to avoid damage to themselves and other humans? A myriad of possible scenarios exist where drivers would face these types of decisions; how would ADT handle these scenarios? Will artificial intelligence (AI) be a source of information and data which can be interpreted via ADT to make morality-based decisions for specific individuals?

SOCIALLY RESPONSIBLE BEHAVIORS AND ADT

On a related topic, will ADT result in safer roads and driving conditions? Will it be legal to drink alcohol while being in a car driving itself completely in autonomous mode? Will fewer drunk driving accidents be a result (or accidents related to drugged-drivers)? Will ADT encourage more / riskier behaviors involving drugs and alcohol? Changes in laws and regulations related to automobiles will also be likely given the advent of full-blown (i.e.,SAE level 5) ADT over time. Will driving records (i.e,, for the holders of a driving license) be changed or altered by states and governments with less human involvement in driving? Will licenses for driving be necessary, or at least at the same level? Will driving infractions ("tickets") be a thing of the past?

From a social responsibility viewpoint, might ADT provide an opportunity to improve the quality of decision-making (Khan, Bacchus and Erwin 2012) for those drivers who consume alcohol? Drinking and driving is a major social concern in many countries, and unfortunately continues to be a problematic behavior. Does ADT have the potential to significantly reduce / prevent drunk driving, crashes and in turn save a lot of lives in the long run (i.e., should breath analysis technology, or other cognitive and motor skills tests be incorporated into ADT, ensuring that at levels 1 and 2 the driver is fit to control the vehicle)? Should alcohol marketers utilize these driverless cars as an opportunity to promote their products (i.e., the official car (or truck) of Jack Daniels whisky)? Similarly, would bars, restaurants, concerts, sporting events and other similar venues capitalize on promoting alcohol at events because of these self-driving vehicles. Forms of entertainment like concerts, music festivals, sports games, and other entertainment options like going to restaurants and bars would create new avenues of marketing to promote alcohol consumption at these events while having a safe and alternative ride home.

EMERGENCY VEHICLES AND PUBLIC SAFETY SERVICES

How will emergency vehicles, such as ambulances, fire trucks, and even police vehicles be impacted by ADT? For example, how will autonomous driving technology be programmed to deal with emergency vehicles (i.e., response times in particular when emergency vehicles are approaching)? Will this allow for faster response times? Will police and emergency vehicles have the ability to override the ADT systems of other vehicles?

LEGAL AND INSURANCE-RELATED ISSUES

Another collateral issue would be insurance coverage (Browning 2014); who or what is being covered, the owner of the car vs. the car, and who is responsible for accidents – the owner of the car vs. the owner of the technology controlling the car? What if more than 2 ADT cars are involved, who is responsible (from a legal and financial viewpoint)?

An interesting question relates to whether or not ADT will eliminate or at least significantly reduce the aspect of human error while driving. Throughout the U.S., for example, significant legislation and signage reminds drivers to "buckle up" and to not engage in texting and other forms of distracted driving, do not drink and drive, etc... It is estimated that around 90% of crashes and vehicle deaths, are caused by human error. By eliminating (or at least reducing the influence of) the human in the driving equation (Subit, Vezin, Laporte and Sandoz 2017) there would appear to be significantly lower risks of injury, or death while traveling in

self-driving vehicles. Perhaps automobile manufacturers will position ADT as the safest form of transportation, and the most responsible way to overcome human error while driving. From the opposite viewpoint, will there be backlash or pushback on the lack of relevant skills for humans (i.e., how many people know how to properly drive a standard transmission vehicle now, vs. 40 years ago).

BROAD MARKETING IMPLICATIONS

Clearly ADT will have huge effects on virtually all industries in many different ways, and may have both positive and negative implications on marketing because it will create entirely new and untouched markets to pursue in the future. The different industries and avenues that could be affected from a marketing perspective include a broad array of firms, including car companies (and all of the new technology that will be needed in ADT-enabled cars), delivery services / trucking companies, public transportation, social media, entertainment, alcohol-based beverages, insurance firms, various industrial and automotive technology manufacturers, as well as many others. Given the current rate of technological advancement, the coming years will surely be an exciting and interesting time for this new technological advancement.

As many of the existing automobile companies like Tesla, Toyota, BMW, Volvo, Nissan and many others have started the process of creating and releasing a driver less car, so have many other non-automotive based companies including Google. While many of these companies have shared expected release dates it is unclear who will be the first to capitalize on the market first. What will be interesting is too see what company will introduce the first large scale marketing campaign for their high level ADT vehicles. Outside of the individual car manufacturers and companies designing these vehicles will be the service companies (i.e., car rental agencies for example, Uber, etc.) with thousands of driverless cars who are competing for a large portion of the market to stay competitive.

One of the single largest industries or services that ADT will impact is in the delivery and transportation of goods for just about any purpose. From the shipping of products bought online and shipped to homes, to the products shipped to stores and placed on shelves at stores, self-driving vehicles may have an enormous impact upon marketing and the economy. Marketing logistics could undergo a huge transformation in this particular service area; car and truck manufacturers could sell massive quantities of ADT-enabled vehicles to firms such as UPS, Fedex, and governmental mail services providers.

Forms of promotion related to public transportation (billboards, outdoor signage, etc.) are aimed at masses of people, similar to digital forms of mass email and the use of social media targeting specific consumers. As these new technologically advanced cars and means of transportation are developed, it is expected that many opportunities would exist related to in-vehicle forms of promotion and various influences on consumer decision-making (Litman 2014). The potential exists to not just produce these cars for the masses, but in turn they can be more specific to the target market that correlates with the individual that is inside the vehicle. By ensuring that the in-vehicle advertising and marketing is focused, and designed to provide each unique individual something they need, companies can connect and create brand recognition with peoples desired or wanted needs. Since these individuals would not be driving and have time to do other things they might be on social media, listen to music and podcasts, or watch movies and TV shows. These autonomous cars will allow for companies like Spotify, Pandora, Amazon, Netflix, Facebook, Twitter, and many others to influence consumers. For example,

might Spotify offer its customers the option to pay an extra $2 dollars a month to listen to add free music in the cars or Netflix could do a similar option that would allow customers to watch their movies and shows on a TV screen in the car instead of on their phones or laptops for an additional fee.

Taking this a step further, will the fully ADT-enabled car become the equivalent of the smartphone in the future, replacing a variety of existing communication and computer technologies? Will the ADT-enabled car serve as a mobile server or port (of sorts), and would be used for computing and communication purposes while travelling, while parked at work (using wireless technology) and similarly while parked at home?

Venturing into a relate area, would it be possible for manufacturer's of ADT-enabled cars to develop virtual "personalities" for these cars, where the technology and features of ADT-systems would reflect the desires of the owner. For example, and not unlike the car called "Kitt" from the 1980's television series "Knight Rider" starring David Hasselhoff, might ADT-enabled cars be initially programmed with certain characteristics (voice or sound, phrasing, decision-heuristics), and then over time would adapt even further to the owner via deep learning. Multiple drivers could easily develop multiple personalities for a single car, or personalities could vary based upon when, where, how a car is being used by a single driver. Today some car owners literally develop a "name" for their cars, so ADT-enabled technology might allow for extended applications of this phenomenon.

URBAN PLANNING CONSIDERATIONS

The impact ADT will have on urban areas is interesting to consider. Once these driverless cars are made available and implemented, will traffic conditions and traffic flow in large cities improve, or perhaps will conditions become worse (Legrain, Eluru and El-Geneidy 2015)? Will the cost of transportation be impacted positively (i.e., will prices go down)? Will there be more or fewer vehicles on the roads? Will roads be used more fully on a 24/7 basis? Will the impact of ADT be positively related to major tourist attractions in major cities (i.e., driving across the Golden Gate Bridge in San Francisco, California, for example, would become easier).

TRANSPORTATION IMPLICATIONS FOR B2C, B2B, C2C

Similarly, will transportation to and from major airports be positively impacted? Traveling to the airport for many people can be a complex, time consuming, and expensive task. Will ADT streamline this process, even allowing for the autonomous vehicle to drive itself back home and park in a driveway or garage until needed for pick up after a return flight? Will future airport design be impacted (drop off /pick up points) and the need for parking (short term and long term) would also seem to be potentially impacted.

Will the business models for Uber and Lyft be impacted by ADT? In the future driverless cars could be used to generate income on a 24/7 basis, turning car ownership into the possibility for significant incremental income. How will personal safety issues be dealt with for passengers, though?

How will traditional car dealerships be impacted by ADT? Might the role of the dealership be shifted to more of a service-function, with the dealership engaging in ongoing service contract activities based upon ADT enabled cars that are no longer owned but customers

now purchase a subscription (analogous to a Netflix subscription) to the vehicle (and the dealer provides constant maintenance services)?

Drive-through dining and deliveries were once remarkable inventions, but in the future their impact will continue to evolve given ADT. With the rise of self-driving vehicles does the car become the delivery service provider? While riding in a fully-enabled ADT vehicle, will consumers be able to order from Starbucks using their mobile app, and quickly go through an express drive-through lane to pick up the speciality coffee they already order and paid for online? Eventually marketplaces will be available in transit and upon request for a variety of forms of products (both goods and services). These services will also be able to impact an untouched and more difficult target market to reach which are the elderly, disabled, and children. The elderly and disabled who may not be able to drive could get back the feeling of independence as they are able to go about their usual or desired errands without taking public transportation or needing the assistance of others (Yang and Coughlin 2014). Parents as we know it today are very busy individuals and sometimes multi-tasking simply does not work; ADT could target parents so they can have their self-driving vehicle pickup their child or children from school or practice so they can finish work, or if at home finish cleaning, cooking, or simply not have to leave the house. Personal safety issues would seem to be quite relevant here, especially involving the transportation of children (i.e., can ADT vehicles be carjacked, for example?).

In the B2B market, ADT will impact not only delivery companies such as UPS, Fedex and the postal service, but also industries such as agriculture, mining, logging, and others. For example, heavy equipment manufacturer Caterpillar is already investing significant dollars in remote-control technology used with enormous haul trucks used in large open pit mines in Australia, where truck operators (who are driving these huge trucks remotely) are physically located many miles from the actual trucks themselves. Are ADT haul trucks going to be a reality in the near future? Will governments allow ADT long-haul trucks on public highways (i.e., will these be safer forms of transportation, benefitting all possible stakeholders)?

In the end if these self-driving vehicles are successfully created and implemented, in our daily lives every single industry in the world will be impacted and undergo major technological changes that will potentially be both positive and negative. Every year wireless companies spend millions collecting data from cell towers to verify coverage, capacity, and signal strength. These companies will be able to save money by not using actual drivers to survey each cell site. Municipal vehicles will no longer need to be constantly driving around and doing surveillance but can simply sit behind a desk and watch the camera inside of their driverless vehicle as it travels its designated sector or area. If this technology can be transformed into the construction and farming industries we are looking at completely innovative ways of doing business. Farmers who didn't have to drive around in the tractor for hours every day would be able to engage in other activities related to their agricultural operations, and therefore be able to achieve significant productivity gains.

It seems that one of the most significant or major negative concerns / impacts that are currently being debated globally relates to technologies such as ADT and how these technologies might replace the human worker. If technology replaces the role of humans in work, what will humans then do? Some believe there will always be work functions for humans (i.e., who will develop, implement, maintain, and improve these technologies over time – humans), while others have gone so far as to suggest guaranteed income for all citizens (i.e., the government should provide annual monies for all citizens, regardless of whether they are working or not).

CONCLUSION

It is quite apparent that ADT, in some form, is here to stay, and as a result will have significant implications for society and for marketers. The potential for change as a result of the implementation of ADT is significant, and therefore the implications related to marketing will also be significant and far-reaching. Future research in the areas cited earlier in this manuscript will be necessary in order to guide business and government decision-making in the future.

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