



NAUTO STRATEGY REPORT

New product development: using behavioural
science to enter the autonomous vehicle
market

Group: Fr4G03

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Executive Summary

The Issue with Nauto's current market position

- Commercially autonomous vehicles render Nauto's flagship product obsolete.
- Nauto runs the risk of being driven out of the market by the arrival of fully autonomous vehicles in the future.

Identified Gap in the Autonomous Vehicle Market

- Currently, autonomous vehicles navigate by predicting the trajectories of other vehicles, cyclists, and pedestrians.
- Trajectory-based technology cannot predict whether a human intends to change their motion, which creates a fundamental safety issue.
- Nauto currently incorporates human behaviour into its AI driving behaviour platform to reduce road traffic collisions.
- Nauto has an opportunity to utilize its experience with AI and human behaviour to create a product which can predict how people in the vicinity of the vehicle intend to move in the future.

Recommended Strategy for Nauto

- Develop a new product by 2025 which can predict how people are likely to move around based on their body language communication.
- Develop, test, and sell the product in regions with favourable autonomous technology regulations, such as California, Arizona, and the UK.
- Promote product safety via digital media to increase customer awareness and trust in the product. Aim to collectively have 100,000 followers by product launch.
- Expand Nauto's research capabilities by hiring 75 more staff by 2022 and seeking an additional \$500 million in investment over the next 5 years.
- Look to partner with Perceptive Automata to improve resource efficiency, development speed, and remove direct competition from the market.

Introduction

Nauto's flagship product is its "Driver Behaviour Learning Platform". The platform consists of a camera and an alert system that is retrofitted to a vehicle. The camera observes both the driver and the road, and the alert system uses AI technology to identify lapses in the driver's attention span and assess the risk of an imminent impact. If the system believes a collision is about to occur, it will alert the driver to take immediate action. As of December 2019, Nauto's product is currently deployed in over 400 fleets worldwide and has estimated to save over \$127 million by helping to avoid potential collisions (Nauto, ©2019).

Over the last decade, many of the large tech giants and automotive manufacturers have been investing substantial capital in the development of fully autonomous vehicles. An estimated \$80 billion has been invested collectively in the development of the technology so far. (Kerry. C.F, Karsten. J, 2017). The ongoing development of autonomous technology presents an ever-growing threat to Nauto as autonomous vehicles will render Nauto's flagship product obsolete. This presents a significant strategic challenge to Nauto regarding its future position in the market. Does Nauto keep its current position in the market, or should Nauto reposition itself to help develop autonomous vehicle technology?

The biggest challenge facing the autonomous vehicle industry is that of product safety. Currently, autonomous technology works by predicting the trajectory of objects in space based on their current motion, the vehicle then uses this information to navigate. The fundamental flaw with this approach is that it is a reactive system that cannot pre-emptively predict what a nearby human intends to do next, which is vital in an environment where changes are driven by human decision. This leads to erratic driving as the AI is often surprised by seemingly unpredictable human behaviour. This is because the AI does not consider the vast amount of behavioural information that humans give off while moving around. Humans silently communicate through body language about their intentions. This allows humans to pre-emptively predict what other humans likely to do next and navigate each other with ease; a trajectory-based AI cannot do this.

Nauto has an opportunity to provide a solution to this issue by leveraging its existing experience of using AI to assess human behaviour. With this experience, Nauto has the potential to break into the autonomous technology market by creating a new type of product. Rather than acting reactively to changes in the external environment, the AI would pre-emptively predict what a human is likely to do next based on their behaviour, and then make navigational decisions on the likelihood of certain scenarios. A gap currently exists in the market, and a product such as this is potentially the key to commercially viable autonomous vehicles. It is therefore recommended that Nauto takes this opportunity to reposition itself as an autonomous technology developer to safeguard against the future threat of autonomous vehicles.

External challenges facing the autonomous vehicle technology

Political & Legal

Product safety regulations are the greatest concern for autonomous vehicle technology developers. The Department for Transport has made available a detailed review of regulations surrounding automated vehicle technologies. The report states that UK, regulatory framework is not an obstacle so long as a qualified test driver is at the wheel, and the vehicle meets road safety regulations. It goes on to say that Germany and Sweden are the only other countries in Europe to complete their legislation and so the UK is a “premium testing environment” for developing the technologies (The Department for Transport, 2015).

An article written by Jack Karsten and Darrell West of The Brookings Institution assesses the state of regulatory laws in the US. According to the article, Arizona, California, and Nevada have allowed testing of automated vehicles without the requirement of a test driver. Furthermore, fully automated passenger shuttles (no steering wheel or peddles) have been launched in Las Vegas, Nevada, and San Ramon, California. In states that do require a vehicle operator, the definition varies. In Tennessee for instance, the autonomous driving system (ADS) is the vehicle operator, whereas in Texas, the vehicle operator must be a human. In Georgia, the vehicle operator is defined as a human that turns on or off the ADS, meaning the operator can be a remote operator. The article then highlights the potential for privacy protection regulations in the future due to the amount of data the automated technologies collect, and the issue of who owns that data (Karsten.J, West.D, 2018).

An article written by Brendan Mcaleer of The Drive reports that recently, Google, Ford, Volvo, UBER, and Lyft joined forces as a lobbying group named “The Self-Driving Coalition for Safer Streets”. The purpose of which is to influence automated technology regulation to create a favourable environment for innovation and testing (Macleer. B, 2016).

Economic

Autonomous vehicle technology, by its nature, is currently an expensive option for a car. Therefore, it requires a strong economic situation so that the technology is available to a large market.

Randal K. Quarles of The Federal Reserve carried out an assessment of the U.S economy in 2018. The report states as of 2018, that the overall condition of the economy is “in a good spot”. Unemployment rates have dropped to 4.1% from a peak of 10% during the global financial crisis in 2008. The unemployment rate is currently below the natural rate which has caused wages to increase. Also, consumer confidence is back to pre-crisis levels because of rising household wealth. Finally, global growth is 4% and this has supported U.S economic growth. (Quarles. R.K, 2018).

A 2019 assessment of the UK economy was carried out by PwC. The report states that as of 2019, the UK economy growth is at 1.2%, below the long-term average of 2%. A projection into 2020 predicts further decline to just 1% which assumes an orderly Brexit. A disorderly Brexit and global economic risks could cause further decline. The report also says that while real earnings have grown, business investment has declined, again, due to Brexit uncertainty. Brexit uncertainty has also forced the Bank of England to maintain low interest rates. Finally, employment has also declined slightly from a previous high (PwC, 2019).

The International Monetary Fund has produced a World Economic Outlook which assess the state of the overall global economy. The report states that the subdued global economy is a result of the escalating trade war between the U.S and China. U.S sanctions, Brexit uncertainty, and the effect of “geopolitical tensions” on energy prices further contribute to the slump. The global growth is 3.2% as of 2019 and is forecast to grow slightly in 2020 to 3.5%. Lastly, firms and households are withholding spending which is contributing to a decline in investment and spending (International Monetary Fund, 2019).

Social

The largest sociological issue is that of public trust in the safety of the technology. In recent years there have been several fatalities involving automated car technology; see here for a list (Wikipedia, (©2019)). The most prominent case involved an American woman who was struck and killed by an UBER owned automated car. The software failed to predict that the woman would cross the car’s path, and as a result did not consider the woman to be a hazard (Levin. S, Carrie. J, (2018)). The aftermath of this was a large shift in public opinion regarding automated vehicle technology.

A survey performed by OpenText in 2018 showed that the public perception of autonomous cars had dropped in the wake of the UBER fatality (Hobbs. A, (2018)). This was compared to a previous 2017 OpenText survey which predated the fatality. The comparison showed that the number of respondents that thought autonomous cars would outnumber conventional cars in the next 10 to 15 years halved, from over 66% to just 31%, and 52% also said they would never buy or rent an autonomous car. The percentage of respondents that said they would feel comfortable in an autonomous vehicle had also dropped from 24% to 19%.

Technological

Predicting human behaviour is currently the biggest technological challenge facing the arrival of fully autonomous vehicles. An article written by Sam Anthony (co-founder of Perceptive Automata, a company dedicated to improving autonomous car technology with human behavioural science) says that the problem with the current physics-based driving systems, which try to predict trajectories of objects and people, fail to pick up on the vast amount of

silent communication (such as body language) that humans use to navigate around each other safely. (Anthony. S, (2018)).

This realisation of the automotive industry, that integrating sensory data with artificial intelligence is not sophisticated enough to solve the autonomous vehicle problem, has led to many of the top software and automotive companies resetting their expectations about when truly autonomous vehicles will become available. This has also resulted in many of the top companies partnering up to solve the problem, such as Ford & Volkswagen (Business Times. (The), 2019)), and BMW & Daimler (Mercedes manufacturer) (Reid. D, (2019)).

Potential Industry Challenges facing Nauto

Competitive rivalry

As of 2017, collective investment in autonomous vehicle technology is reported to be over \$80 billion (Kerry. C.F, Karsten. J, 2017). A research brief provided by CB Insights lists 40 of the largest corporations currently working on autonomous technologies. Companies such as Amazon, Audi, and Waymo are among these. Furthermore, many of these are now teaming up to develop the technology. The development of autonomous technologies within the automotive industry is extremely competitive and will realistically require a unique product to be successful.

One particular company is developing a unique solution to solve the issues blocking fully autonomous vehicles. As mentioned previously, Perceptive Automata is a company that is dedicated to improving autonomous car technology with human behavioural science (Perceptive Automata, ©2019). The company currently occupies a unique position in the market, and shares similarities with Nauto regarding the use of reading human behaviour to influence AI decisions. If Nauto decides to enter this market, then Perceptive Automata will likely be in direct competition with Nauto. Perceptive Automata is still a start-up with limited investment however. According to Pitchbook, the company's latest investment amounts to approximately \$16 million (Pitchbook, ©2019). Therefore, if Nauto does enter the market, Perceptive Automata does not pose the same level of threat as a company like Google might.

Overall, the threat of competition is very high and requires a unique idea to break into the autonomous technology market and survive. Competitive advantages must be independent of capital investment so that the large firms cannot simply move into the market gap and take over.

Threat of New Entry

The largest barrier to entry is the difficulty associated with developing safe autonomous technologies. As mentioned, many of the large companies have invested large amounts of time and capital and have yet to see a return on investment. Any company looking to enter the market must either have a new approach that has a realistic chance of working, or a commitment to potentially invest large amounts of resources on research and development.

For software developers in particular, access to data collection via vehicles in operation is a must for research. If the developer is not able to collect the data themselves using something like a retrofit product, then realistically a partnership with an automotive manufacturer is necessary to gain access to the data.

In general, only medium sized or larger companies, or new start-ups with significant capital investment have the potential to enter the market. However, as shown in the previous section, there are a significant amount of large companies already invested in autonomous technologies. The threat of more companies moving into the market is reasonably low as a result.

Bargaining Power of Suppliers

The development of autonomous technologies relies only on a supply of data collected by road vehicles to use for research. The two major types of companies that are interested in autonomous technologies are software companies, and automotive manufacturers. From the perspective of a software developer, access to large amounts of data realistically requires a partnership with an automotive manufacturer that can supply it, unless the developer has some way to collect the data themselves via a retrofit product or a test fleet. The manufacturer is the supplier here then. However, the manufacturer is also the customer since they have a great interest in accelerating the development of autonomous technologies to stay ahead of their competition. Since the manufacturer is invested in the technology, they have an interest in supplying high quality data as cheaply as possible. Therefore, the bargaining power of the supplier is low here. However, the bargaining power may rise if the product is sold to more than one manufacturer, as the product will help the manufacturer's competition. This may force the developer into an exclusive deal with the manufacturer to establish a partnership.

Bargaining Power of Buyers

The bargaining power of the customer mainly depends on the safety of an autonomous product, and to a lesser extent, the usefulness of the product. Customers therefore have a great deal of bargaining power as technology developers must convince the public that their

product is safe. Even if the technology is unique and desired, if the product is viewed as unsafe, even if it is safe in reality, then customers may simply refuse to buy it.

Threat of Substitutes

Autonomous vehicle technology fills a unique purpose, that is to transport a person directly from point A to point B over long distances without a pilot. There is currently no known technology or product in development that could serve the same purpose. Hence, the threat of replacement technology is extremely low.

Nauto's Strategy

Nauto currently has a substantial amount of experience in using AI to increase road safety. By retrofitting a product package of a camera and software into a vehicle, the product can read the behaviour of the driver and alert the driver when the product senses the driver is not paying attention to events on the road.

As of December 2019, Nauto has processed over 456 million video miles using AI to detect decreases in drivers' attention at the wheel and has detected almost 82 million high-risk driving events as a result (Nauto, ©2019). Nauto should look to expand on this capability and develop a new product package which will use AI to identify high-risk behaviours of pedestrians in the vicinity of the vehicle, such a pedestrian body language and cues to predict intentions. This will further help to decrease road traffic accidents. Also, this technology will open up new customer base who are developing fully autonomous cars; the product will provide a solution to the current safety issues faced by the industry.

Nauto should look to develop and sell the product to automotive manufacturers primarily in regions where regulation is favourable to autonomous vehicles and the economy is strong. California, Nevada, and the UK are then the most favourable places to begin with. Since trust in technology is generally higher among younger people, autonomous technology is better targeted to that market, specifically middle earners or higher. Promotion of the benefits and safety of the product should primarily be communicated through digital platforms such as social media and also advertisements. Once the product is more established, and the safety has been well demonstrated, promotion should be expanded towards the older generations with a medium to high household wealth. These steps will help to increase the value of the product and improve the bargaining power of Nauto in relation to autonomous technology developers. Nauto should continuously develop a relationship with its existing followers with regular product updates and increase its social media following to 100,000 followers across all platforms by product launch.

One of the main threats to the new product is competition. Many big players such as Google currently occupy the autonomous software industry and have the capability to imitate the concept of introducing human behaviour in their products if they so wish. Currently, the competition surrounding software integrated with behavioural science is low; only Perceptive Automata is a direct competitor. There is a temporary competitive advantage that exists to become the leader in this approach to autonomous software. This advantage should be leveraged to vigorously promote the benefits of the product concept to attract additional investment before new players enter the market. Currently Nauto has attracted over \$150 million of investment in the previous two years (Craft, ©2019). Nauto should aim to attract an additional \$500 million investment by 2024 to develop a working prototype, and by 2025 the product should be ready to bring to market. To meet this objective Nauto should look to expand by hiring an additional 75 employees by 2022.

As mentioned previously, many of the top automotive manufacturers are joining forces to tackle the problem of fully autonomous vehicles. Establishing a mutually beneficial partnership with Perceptive Automata to develop the product will not only effectively remove Nauto's direct competition, but also greatly improve the innovative progress of both entities and strengthen the existing temporary competitive advantage. This will improve the speed at which a sustainable competitive advantage can be established.

Strategic Objectives

- Develop a working prototype of the product by 2024.
- Have the finished product ready to sell on the market by 2025.
- Seek out \$500 million investment from both government and private sources by 2024.
- Hire an additional 75 employees by 2022 to improve Nautos' research capabilities.
- Invest a minimum of \$25 million in research and development of the product in 2020.
- Build up the Nauto brand on social media to increase public trust in the safety of its autonomous technology. Aim for 100,000 combined followers on Facebook and Twitter by 2025.
- Spend a minimum on \$1 million per year on advertisement and promotion of product safety.
- Look to establish a mutually beneficial partnership with Perceptive Automata to improve resource efficiency and increase the speed of development of the product

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