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MARKET POTENTIAL FOR AUTONOMOUS TRUCKS

AN EXTENSIVE STUDY IN THE
MIDDLE OF A TECHNOLOGY SHIFT

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The industry of transportation is facing one of its biggest technology shifts in centuries when autonomous vehicles are approaching a state of operational readiness. Short distance delivery in fenced or restricted areas, such as ports, logistics centers, and manufacturing sites are predicted to be among the first use cases for autonomous trucks.

Introduction and Background

Technology shifts have throughout history had major impacts on companies and their business models. Not only can it provide opportunities for new value-creating processes, but it may also be a lethal threat to existing business models.

Innovations are the catalysts of technology shifts, and therefore innovation has become an area of great importance for companies to survive over time (Tongur & Engwall, 2014).

Autonomous technology represents a technology shift that is present today, transforming operations in different industries and questions the established ways of doing business (Groover, 2020). Several sectors have already enjoyed the increased productivity, safety, and economic benefits that the technology can offer (Chui, 2017). However, the technology is also facing resistance. For instance, automation is criticized for reducing job opportunities for the people and also for creating ethical challenges (Nouzil et al 2017).

The transportation industry is one area where the development of autonomous technologies is exposed to society through the development of autonomous vehicles (Uzialko 2019). Several competitors race towards developing completely autonomous vehicles intended for transportation of people or transportation of freight and containers. All companies share one challenge, to find ways to exploit the technology behind autonomous solutions in a legal and profitable way (Boutan, 2020).

Purpose and Theoretical Context

The purpose of this study was to identify, describe and analyse technology shifts and needs within the industry of transportation. Furthermore, to assess the market potential and to explore how a first mover can exploit autonomous solutions. The research strategy chosen in this thesis to meet the purpose was a hybrid between a descriptive strategy and an exploratory strategy with an abductive approach. Furthermore, a combination of a quantitative and qualitative approach was used. The research process included a literature review followed by a case study. The case company, that due to competitive reasons will be referred to as The Case Company, was chosen due to their forefront position in the development of autonomous trucks for first-mile delivery.

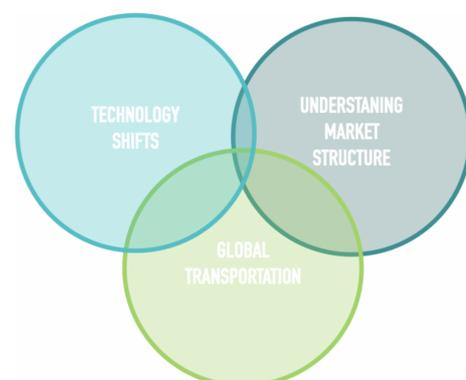


Figure 1.1 - The Theoretical Framework

To illustrate the different theoretical components used in this study, a theoretical framework was developed, consisting of three main building blocks, see Figure 1.1. The framework takes off in the first block, *Technology Shifts*, and the creation of technology.

Included in this block are innovation theory and technology strategy to understand the catalysts of technology shifts and how companies have to work proactively. The fact that new markets, just as technology, are created continuously takes us to the next block, *Understanding Market Structure*. It is crucial for companies to create a comprehension for different markets, their size, and development over time. The last building block is the transportation industry, a sector that has experienced several technology cycles and now stands in the middle of the next one.

The theoretical framework is illustrated below in *Figure 1.2*. It takes the form of a truck representing the transportation industry. The truck is driven forwards by technology shifts, represented by the wheel, constantly moving and challenging the industry standard. In the nave of the wheel, we have the understanding of the market structure.

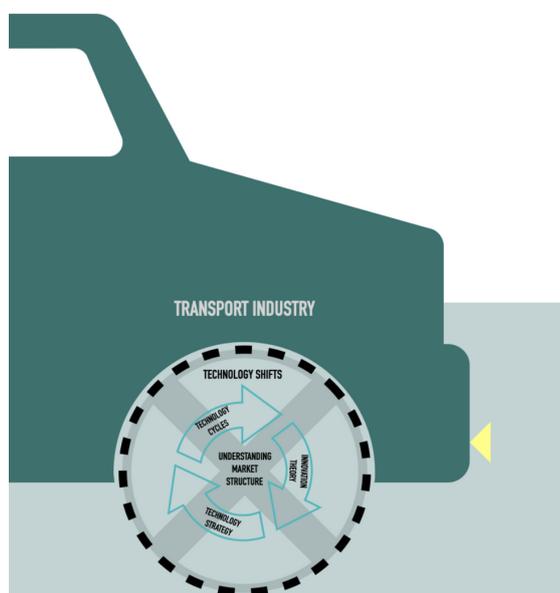


Figure 1.2 - Theoretical Framework Illustration

The Technology Shift

Autonomous technology is used to different extents in different segments but all in all, it is believed to be roughly 1/3 up the technology S-curve. There are already applications running today and the product performance development pace is rapid and believed to continue to increase.

The entrance of autonomous trucks in the transportation industry has created a technological discontinuity and companies fight to create the dominant design. Therefore, the technology cycle for autonomous trucks is considered to be in an era of ferment and is believed to stay so until a wide implementation is present. The Case Company is considered to be in a good position to compete since they have explicit strategies for acquiring, managing, and exploiting new technologies, all being cornerstones in a sound technology strategy.

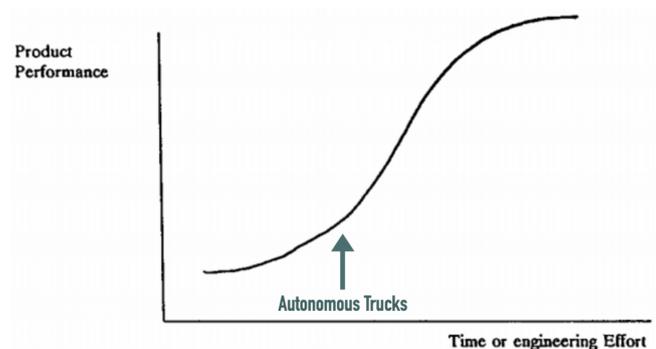


Figure 1.3 - The S-Curve

Understanding Market Structure

Ports

Ports are with repetitive, standardized container transportations and operations partly within fenced areas, suitable for autonomous trucks. The drivers for the total available market within ports are the number of containers handled in the world's ports, times the cost for the share of the total container transport that is considered interesting for autonomous trucks. With a global throughput of 811 million TEUs in 2019 (UNCTAD, 2020), the total available market was estimated but will due to competitive reasons not be stated in this article. By setting a lower limit on a port's throughput, as well as the GNI-level in the country, a number of ports could be selected as interesting. For the interesting ports, a share of the container throughput was extracted as targetable for the autonomous trucks. Train container transportations shares and containers with destinations requiring transportation on public, heavy traffic roads are examples of factors limiting the Total Available Market to the Serviceable Available Market.

Logistics Centers

Logistic centers can be divided into two main groups, centers dominated by road freight and air freight. Both can at first glance be believed to be suitable for autonomous solutions with high levels of standardized operations and transports. However, the centers dominated by truck freight were in this Thesis assessed as having low potential use of autonomous trucks, mostly because a vast majority of the operations that are repetitive takes place inside. On the contrary, logistic centers dominated by air freight were assessed to be suitable with repetitive, standardized transportations of freight between the airports and the warehouse, all within a fenced area. Both the Total Available Market and the Serviceable Available Market were estimated but will not be stated due to competitive reasons.

Manufacturing Companies

Manufacturing companies are a broad term and the variation in how they operate is great. On one side of the spectrum, we have companies with large facilities and a substantial transport volume between different buildings. Here, autonomous trucks come in handy.

On the other side of the spectrum, we have smaller facilities concentrated in one building with inside transportation exclusively, hence the use of autonomous trucks is limited. Due to the lack of standardization in this segment compared to the other two segments, no Total Available Market size has been estimated. Instead, the market value for specific companies was estimated.

Conclusion

The technology cycle in the industry of transportation is slowly shifting focus towards another era of rapid development. There are already applications of autonomous trucks operating in segments including mining and quarries and it is probably just a matter of time before the technology is more widely implemented. Although the legislation is impeding now, the interest expressed by the companies examined in this Master Thesis has been high and a substantial market value has been found in two out of three segments.

Three recommendations were given at the end of the study. The first one was to eliminate the illusion that the prerequisites needed to be perfect for autonomous trucks to be implemented.

The second recommendation was to focus on relevant customer drivers and mitigate identified obstacles. High tech companies need to avoid communicating only in abstract technology terms and thereby forgetting the customer outcomes.

The last recommendation was to not allow the legislations of today, limit the opportunities of the future. Emphasizing what parts of the customer's operations can be autonomous in the future when the legislations open up, creates an extra incentive for the customer in the long run.

References

Boutan, E. (2020, June 12). Autonomous driving market overview. *The Startup - Medium*. Available at: <https://medium.com/swlh/autonomous-driving-market-overview-b8c71d81c072> [2020-12-09]

Tongur, S & Engwall, M (2014). The business model dilemma of technology shifts. *Technovation*, 34(9), 525-535. doi:10.1016/j.technovation.2014.02.006

Groover, M. (2020, October 22). Automation. *Encyclopedia Britannica*. Available at: <https://www.britannica.com/technology/automation> [2020-12-09]

Chui, M et al. (2017). Human + Machine: A New Era of Automation in Manufacturing. McKinsey & Company. Available at: <https://www.mckinsey.com/business-functions/operations/our-insights/human-plus-machine-a-new-era-of-automation-in-manufacturing> [2020-11-12].

Nouzil, I et al. (2017). IOP Conf. Ser.: Mater. Sci. Eng. 244 012020. Available at: https://www.researchgate.net/publication/320439290_Social_aspects_of_automation_Some_critical_insights/fulltext/59e5678b458515250246fe4e/Social-aspects-of-automation-Some-critical-insights.pdf [2020-12-05]

UNCTAD. (2020). Review of Maritime Transport 2020. Available at: <https://unctad.org/webflyer/review-maritime-transport-2020> [2021-02-25].

Uzialko, A. (2019, February 26). Workplace automation is everywhere and it's not just about robots. *Business News Daily*. Available at: <https://www.businessnewsdaily.com/9835-automation-tech-workforce.html> [2021-01-12].