HOW TO GAIN ACCEPTANCE FROM THE ROAD TRANSPORTATION SECTOR FOR CONNECTED & AUTOMATED TRANSPORT?

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Abstract

Autonomous driving is receiving more and more attention, but still remains an ambiguous concept in the industry This paper contains the first results of a research that aimed to study the commercial feasibility of Connected & Automated Transport (CAT) for the future users of an automated corridor. The research focuses on the needs, demands and cross-compliances of transport companies for Connected & Automated Transport in order to determine the Value Proposition of CAT. Furthermore, this research concentrates on creating the first drafts of possible CAT implementations on an automated corridor in 2030 by analysing the expected future CAT-technologies. This research concludes with an oversight of the predicted costs and benefits of this future CAT application.

1 . Introduction

The mission of the Automotive Center of Expertise (ACE Mobility) is to keep the Dutch Automotive sector strong, agile and future proof in order to overcome the primary mobility challenges. A number of mobility challenges exist in the freight transportation sector: there is a long-haul driver shortage of 21% and an increasing traffic congestion caused by the increase of 65% of the number of freight trucks on the road in the past five years (IRU, 2020). The automotive industry is willing to eliminate the mobility problems by implementing smart mobility

innovations. One of these innovations concerns Connected & Automated Transport (self-driving trucks) which enables a truck to drive completely by itself without the use of a human truck driver. Connected & Automated Transport (CAT) should ensure that goods arrive at their destination faster, cheaper and more sustainably. The technology of automated trucks is available, but testing and implementation still lags behind the desirable transitions progress.

The IMIAT project (Innovation-hub Mobility on Implementation Automated Transport) launched a plan to realise self-driving goods transport on a Dutch motorway. The ambition of IMIAT is to create a 100% automated corridor by the year of 2030 which enables participating companies to transport 20% of their daily freight autonomously across one of the "Tulip corridors" (figure 1). In order to achieve this, ACE works together with technology companies, government, authorities, knowledge institutions and transport companies to find a number of relevant participants who support the ambition of IMIAT. One of those intended participants are the future users of the automated corridor. To involve those transport companies, the IMIAT project wants to inform the transportation industry about the possibilities and the way they may be able to capture value from this CAT - innovation. Furthermore, they want to inform the transport sector about the commercial feasibility of this innovation, so the transport companies might consider implementing CAT innovations in the foreseeable future. Therefore, the objective of this research is creating public support within the Dutch logistics industry for the possibilities and the commercial feasibility of Connected & Automated Transport.

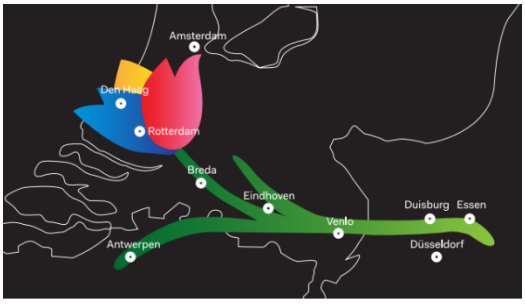


Figure 1: The Tulip corridor

The desired result is at least five 'trendsetting' logistic companies who will be using the automated corridor in 2030. With these participating transport companies, IMIAT will be able to make a contribution to the ambition of the Netherlands to be, in ten years' time, the European leader in autonomous road transport.

2. Research design

This exploratory and qualitative research aims to answer the following research question:

"With which use case scenario, concerning Connected & Automated Transport, are the actors of the Dutch logistic industry able to create and capture value from the CAT innovation within 10 years from now?"

The research is divided into three flows of information, through which partial conclusions regarding the three information streams are used to answer the research question.

The first flow of information concerns a stakeholder analysis in order to examine the wishes, needs, cross-compliances and the motives of the logistics industry. The data collecting started by organizing group interviews with three transport companies who are already participators of IMIAT. The main purpose of these focus group meetings was to draw upon the feelings of the respondent, their beliefs, experiences and reactions on implementing CAT innovations. Based on the results of the focus group, ten individual interviews have been conducted with transport companies and mobility experts. The results of the interviews were analyzed by using the theory of Mendelow Stakeholders Matrix (Mendelow, 1981), to identify the key transport companies for IMIAT. Furthermore, the theory of the Value Proposition Canvas (Osterwalder, 2014) is used to determine the Value Proposition of CAT for the transport companies.

The second flow of information establishes several best practice simulations for the implementation of CAT in 2030, by providing the expected technological and societal applications of automated driving. The analysis started with collecting data from existing resources. Based on desk research, the researcher was able to determine and classify the several CAT technologies and CAT vehicles into the different levels of Technology Readiness (TRL) (John Mankins, 1995). Furthermore, additional data was collected by organizing five individual interviews with mobility academics and technology experts from knowledge institutions and Universities of Applied Science. Based on the results of desk research and the individual interviews, the researcher was able to create four draft scenarios for implementation of CAT on a corridor in 2030.

The last flow of information concerns the business model of CAT in 2030; to identify the possible costs and benefits of CAT. The analysis started with performing a group discussion with five members of the IMIAT project team. Based on the findings of this discussion, the researcher quantified the possible costs and benefits by making an expected Total Costs of Ownership for transport companies when using CAT. To conclude the research, the results of the three flows of information have merged by formulating the required actions and investments for the transport companies for implementing CAT innovations in the future.

3. Results

3.1 First flow of information: stakeholder analysis

Figure 2 represents the way the course of events take place within the transportation sector. Every transport operation starts with a shipper, a provider of goods, who wants to move goods or materials from a source storage to another destination within a specific time. For this purpose, the shipper makes an agreement with a carrier; a transport order. This transport order is a document on the basis of which an agreement between the shipper and the carrier is concluded (Palluch, 2018). It primarily specifies the requirements of the road transport. Carriers are able to accept the offers made in those transport orders, with the aim of transferring the goods to the desired location. After analyzing the transport orders and the relationship between the shipper and the carrier, the following can be said:

- The majority of transportation service agreements between the provider of goods and the provider of transportation service has a maximum duration of 1-2 years.
- 90% of the transport orders requirements are based on the lowest costs of transportation.
- Sustainable ways of transportation become an important requirement for shippers (Logistiek, 2019).

The abovementioned relationship between the shipper and the carrier affects the capability and the innovative power of transport companies. Due to the short duration and cost driven agreements with the shippers, most of the transport companies are not able to invest in major innovations which require a long-term vision of 5-10 years. This research claims that shippers are much more powerful in terms of implementing major innovations like CAT. They have the financial assets and a network of transportation companies which they can address to focus on major innovations like CAT. When a long-term agreement between shipper and carrier is guaranteed, the carrier will be able to invest in major innovations like CAT, because they can earn the investment back by transporting the goods of the shipper the coming years (Zwart, 2019).
As well as shippers, only large Party Logistics, so called 3PL companies, 4PL companies and 5PL companies can be relevant participants of IMIAT. The characteristics of these large companies are that they are internationally oriented, they have more than five hundred employees and 250 vehicles and they have their own strategic and R&D department (Logistiek , 2020). These companies mostly have a long-term vision of 5-10 years and work with sub-contracted transport companies. Therefore, these companies have similar financial assets and networks of transportation companies, which they can address to focus on major innovations. The most suitable 3PL-5PL transport companies focus on long-haul transportation of goods via different transport modalities (Zwart, 2019). They transport their goods via the East and the South-East corridor in Noord Brabant, they have transportation hubs located within 1,6 kilometer (First & Last Mile) from the foreseen automated corridor and they have long lasting agreements with their shippers (Focusgroup1, 2021).
The results of the individual interviews with these companies are that they want to strive for a sustainable, undisturbed, reliable and flexible flow of transport, which they can use 24/7. The CAT-innovations need to contribute to efficiency improvement and only the truck is allowed to be automated. Moreover, the logistic providers do not want to invest in new trailers and they claim that they want an automated truck which is able to haul cargo with universal and different types of trailers. Furthermore, they demand that also the First & Last mile will be automated, the CAT innovation will not reduce the current level of transportation flexibility and there must be a significant reduction in the number of required long haul drivers.

The above-mentioned results and the outcome of the Value Proposition focus group, have resulted into the following Connected & Automated Transport Value Proposition for transport companies:

> *"Connected & Automated Transport innovations enable transport companies to strive for the improvement of speed, flexibility and reliability of the operational activities of transportation with the result of an increased transportation cost efficiency and effectiveness.*

In addition to the first results, this research claims that the radical CAT innovation enhances negative effects of passive innovation resistance among transport companies. Passive resistance refers to the company tendency to reject the innovation even prior to evaluate the innovation (Heidenreich, 2013). Passive resistance stems from the fact that the final product or the final implementation of the innovation does not exist yet. The intended target group is not able to imagine the proposed final product of the innovation and the transport companies will try to maintain the status quo (Heidenreich, 2013). 20 of the 35 contacted transport companies were not willing to speak with the researcher, because they consider self-driving trucks as an innovation that will not be

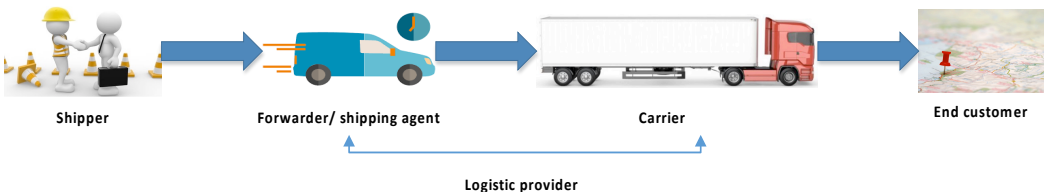


Figure 2: The supply chain of transportation.

feasible for transporting goods in 2030. At first, the interviewed business developers from the transport companies named the standard prejudices of automated driving and they were constantly comparing the CAT-innovation with traditional trucks.
In order to reduce the passive resistance among these companies, the researcher has made four drafts of implementation scenarios in 2030 on which the questions of the interview were based. By showing the interviewees an implementation draft, they were not trying to maintain the status quo anymore. The researcher was now able to measure the active innovation resistance of the interviewees which refers to the conscious form of resistance that comes from functional and psychological barriers following an evaluation of the innovation (Heidenreich, 2013). The way innovations are introduced is an important aspect when trying to convince transport companies to participate. IMIAT will keep this in mind in the future.

3.2 Second flow of information: best practice 2030

The analysis of the second flow of information, the best practice in 2030, have resulted into an overview of the possible best-practice situations in 2030 in a corridor. Figure 3 shows an example of one of the four designed implementation drafts of the automated corridor in 2030. It can be stated that driving with autonomous trucks is possible, but only in confined and less complex situations e.g. highways. In all other scenarios no autonomous truck (SAE level 5) will be driving on public roads in the next few decades (Meyer, 2020), (ERTRAC, 2019). One of the main reasons is that an automated truck will not be able to interact constantly with the other road users and will not be able to make the right decision in every situation. Nonetheless, driving with highly automated trucks (SAE level 3 and 4) in a controlled and closed environment should be possible in 2030 (Gruyer, 2021). These SAE level 3 or 4 trucks will be able to drive completely automated between two transportation hubs on a corridor, separately from the other road users. Mixed traffic is not possible so far, because the trucks cannot interact with the constantly changing circumstances caused by the other road users (Zhu & H.M.Zhang, 2018).

The first drafts of implementations consist trucks driving in a truck platoon with half a meter distance between them and they will drive at a speed limited at 80 km / h (figure 3). The trucks are not able to drive completely automated due to specific maneuvers e.g. entering and leaving the corridor. In order to create a completely automated corridor, there are a number of human (SAE level 3) actions required when entering and leaving the corridor and in order to drive in the First and Last mile. These human actions may be carried out by a truck driver located in the cabin of the truck or by a tele-operator who will remote control the vehicle and will be located in a control room. The external operator drives the vehicle using a live-stream video and he will take control of the vehicle when the truck is not able to perform the task.

3.3 Third flow of information: business model CAT

The last flow of information concerns the costs and the benefits of Connected and Automated Transport. Figure 4 represents an overview of the expected societal benefits and the benefits for transport companies. Furthermore, this research states that CAT innovations will help decrease the efficiency and effectiveness losses of transport. The current efficiency and effectiveness losses of transportation are measured by three different parameters: availability, performance and quality losses (Villarreal, 2012). Current losses of availability are rest- and breaktimes of truckdrivers, unplanned maintenance and breakdowns of trucks, which can be reduced using CAT. Furthermore, performance losses can be reduced by reducing the number of transported empty trailers and the speed losses of the transportation. The transport companies stated that IMIAT needs to integrate the CAT innovations with a digitalized planning system, in order to prevent empty trailers. The last parameter, quality, can be improved due to a reliable transportation flow and due to a higher efficiency of the transportation. So a transport company is able to transport more goods with less assets and people. This will lead to a decrease of the percentage of unfulfilled promises and demand.
Because of the predicted benefits, there will be a shift of certain costs of a transport company. First of all, according to Rieck, “the energy costs and labour costs will reduce with respectively 50% and 90%”. The assumptions made in this calculation are that the future CAT truck will be electric and that the number of required long-haul drivers on the corridors will decrease with 90%, because a tele-operator is able to control up to ten trucks and he will be alert and ready to take control of the truck (Degerman, 2020).

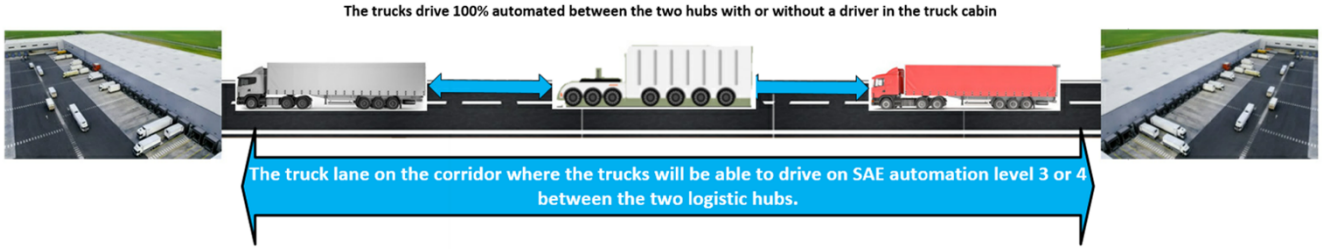
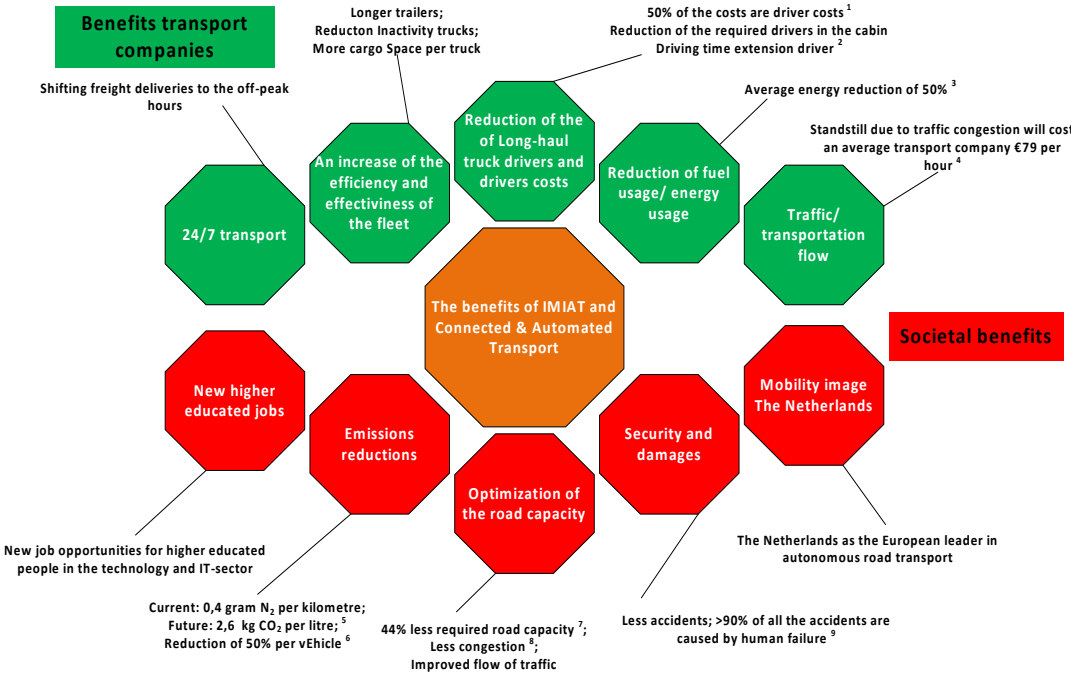


Figure 3: One of the four possible best practices for implementation in 2030.

Further expectations are that truck and tyre maintenance will decrease. The costs and benefits analysis are not based on proven facts yet, because it is not possible to make exact predictions of the expected costs and benefits of CAT. The discussed costs and benefits are the prediction of seven mobility and economic experts. IMIAT must prove these assumptions in the future.



1: (Rieck, 2017) 2: (TNO, 2018) 3: (Rieck 2, 2021) 4: (Panteia, 2020) 5: (Euro. Comm., 2019) 6: (Euro. Comm., 2019) 7: (Robbert Janssen, 2015) 8: (ERTRAC, 2019) 9: (McKinsey, 2016)

Figure 4: the benefits of Connected & Automated Transport

4. Conclusion

The conclusion of this research is that IMIAT has created a use case scenario, via which they are able to realise a continuous and reliable transportation flow with highly automated trucks (SAE 3 and 4). These SAE 3 or 4 trucks will drive completely automated within the two transport hubs while on a corridor (SAE level 4) and will be driving separated from the other road users. The First and Last Mile will still need human control (SAE level 3). The future users of autonomous trucks, the large 3PL-5PL transport companies and shippers, strive for improvement of speed, flexibility and reliability of the freight transport. Thus, the logistic provider will capture value for itself by reducing the three main efficiency losses of transportation: availability, quality and performance losses. The logistic provider will be able to capture value from Connected & Automated Transport innovations by reducing the number of required long-haul drivers and by reducing the following five efficiency parameters: truck drivers rest-break, breakdowns, speed loss, empty trailers and the percentage of unfulfilled promises and demand.

5. Recommendations

Furthermore, the researcher would like to state a few recommendations for the follow up of the project: IMIAT needs to get in touch with shippers, because they can play an important role in realising CAT innovations. These companies have the power to motivate and move smaller logistic providers to invest in Connected & Automated Transport.
With regard to participating in CAT innovation projects, the main motive should not be focussing on just reducing costs, but much more on realising an improvement of the efficiency and effectiveness losses of transportation and the mobility system. Furthermore, the researcher recommends investigating the possibilities of integrating CAT innovations with digitalised planning systems, in order to fulfil the wish of reducing the number of empty transported trailers. Moreover, IMIAT should combine the CAT innovation with sustainable power train innovations for automated trucks. Updates and more information about the IMIAT project can be found on the IMIAT webpage: click here for more information.

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