Autonomous vehicle integration in the Netherlands

This research investigates five autonomous shuttle projects in the Netherlands

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By

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REFLECTION

In September 2017 I started the master MBE. During the master’s period, I already was thinking about the graduation project. In September 2018, I was struggling with myself, since I found it hard to determine my main field of interest. After the pitch presentations during the graduation laboratory course, I figured out my field of interest was urban area (re)development in combination with smart mobility. Consequently, I went searching for an interesting knowledge gap and I came across the subject of autonomous vehicles. I realized that the combination of smart infrastructure and urban area (re) development was in an early stage yet. However, in my opinion, incorporating (smart) infrastructure into the designs of (re)redevelopments is crucial when aiming for a future-proof plan. Therefore, I decided to focus on the implementation of autonomous vehicles in urban areas.

RESEARCH AIM AND RELEVANCE

At the start of my graduation process, it was stated that the main research question of the research was:

“In what way can the implementation of automated vehicles in different types of urban areas be managed by municipalities?”

From this question can be determined that the main focus group are municipalities, or policymakers. However, during the research process, I figured out that not only municipalities or policymakers are able to steer or manage the implementation of autonomous vehicles, but also knowledgeable private parties who have experience with this relatively new technology are crucial in the implementation process. Moreover, the focus on different types of the urban area had been encouraged by the graduation mentors. Unfortunately, during the research it became clear there are too little implementation projects yet, which probably resulted in unrepresentative research when concluding about the relationship between different types of urban areas.

The main aim of the graduation research, stated in the P1 report, was to inform both municipalities and other stakeholders involved in urban area development about the current development of autonomous vehicles. Moreover, the research aimed to add to the scientific knowledge in the field of autonomous vehicle integration. Thus, this research aimed to add to both scientific and practical knowledge.

When reflecting on the end product of this graduation process, I consider the performed qualitative research as the first step towards the development of more knowledge concerning the real-life implementation of autonomous vehicles. Currently, the integration of (smart) infrastructure or other technical developments is limited in the Management in the Built Environment master Track. This master thesis, therefore, might serve as inspiration to incorporate future proof infrastructure in the development of new teaching material. As in my opinion, the development of urban areas includes the development of future-proof infrastructure. Moreover, I hope this master thesis will encourage students from our department — and our faculty — to highlight the importance of infrastructure and mobility.
On the global scale, the information about former or future real-life autonomous vehicle implementation projects is limited as well. Therefore, I consider the practical relevance relating to the larger scale quite limited. I do not think this master thesis contributes to the implementation of AV on the international scale. But still, I hope this master thesis will stimulate future researchers to analyse AV implementation cases around the world. In order to apply the formulated knowledge to other countries in the world, the scope probably should be limited.

The master thesis is of practical relevance for actors concerned with future implementation project in the Netherlands. However, this master thesis merely focuses on answering the ‘how’ question, while answering the ‘why’ question in this field is of significant importance as well. The reason behind the implementation of autonomous vehicles in implemented in the case study analysis, however, these statements could not be confirmed by theoretical knowledge. The purpose of implementing autonomous vehicles mostly determines the main challenges already, for instance, when implementing AVs to transport ageing people, the communication might be of higher importance compared to the implementation of AVs to transport students. For this, a consideration of ‘why’ AVs are being implemented is essential.

**RESEARCH METHOD**

The qualitative research method was used to obtain in-depth information about different pilot projects in the Netherlands. Prior to the research interviews, four interviews were conducted in an early stage of the research. When reflecting on this, I am satisfied on how these interviews helped me to get used with this qualitative form of research. I am still a bit nervous in the first minute of the interviews, however, the nerves are significantly less compared to the very first interview. After conducting all four interviews, it was decided to structure the other interviews based on the shaping places theory of Adams and Tiesdell. After conducting the first interview, I experienced many questions were quite vague and the structure of shaping places resulted in an unnatural flow of the conversation. Moreover, during the research, I did not see the added value of incorporating the theory of the shaping places book. It was a pity that I did not synthesize the analyze framework on beforehand, since this could have been used as an ideal structure for the interviewees. However, there should be noted that this framework is synthesized with the data from the interviews.

When I started analyzing the results of the interviews, Aksel recommended to use a computer programme for analyzing qualitative data, NVivo. I am always open for learning new software skills, so I downloaded the trial version and went on practicing. However, when I got slightly used to the software, I figured out the number of interviews was too low to result in significant results with NVivo. Eventually, I decided to analyse the interviews by hand.

As a result of both the literature review and the results from the interviews, an analysis framework was synthesized. This framework was used to analyse the case studies. This framework helped to define the scope and the boundaries of this research. However, when using such a framework it might be a risk to only focus on the elements of the framework, while other aspects might be important as well. Therefore, I added other aspects to the analysis framework while analyzing the results of the interviews. I aimed to be as objective as possible in creating and filling in this framework. There might be limitations when using this framework for other AV implementation projects. Therefore, this master
thesis might galvanize future researchers to broaden the analysis framework as the technology develops.

**RESEARCH PROCESS**

Generally, the graduation process went satisfying, since the planning made in advance corresponded with the executing of the research. In advance of my own research projects, I had some talks with former graduate students from different faculties. The conclusion of these talks was that many students got delayed because the interviewees did not respond as quick as they expected.

Since I really wanted to finish my research as planned, I scheduled the interviews quite early. This gave me the opportunity to reflect on the research topic and therefore to reformulate the research question. Also, these interviews were excellent to gather the contact information of the other interviewees needed. The expected time needed to gather and analyse the results was not really confirming with the actual time. Despite that, the research was finished well before the deadline.

On beforehand and during the graduation process, I struggled with the structure of the thesis. I wanted to have a proper structure already halfway of the graduation process. My second mentor, Javier, explained that the structure would follow when you exactly know the story to tell. This was a bit frustrating for me, because I usually plan everything upfront. Despite that, I waited, and the structure indeed followed.

I consider myself to have worked in an independent and professional manner. The guidance from both mentors helped me to think from different perspectives when I got stuck. Furthermore, I appreciate the enthusiasm during each conversation. This really helped to keep me motivated during the entire process. Moreover, the mentors comforted me when I got some nerves right before the presentations. I am aware that I still have much to learn in this research field, but I am confident that I made a large step already.

**PERSONAL STUDY TARGETS**

Before the start of the graduation process, I developed three personal study targets related to self-development, namely: to keep a motivated attitude during the whole process, to gain knowledge about a different field within the master track Management in the Built Environment, and to get in touch with interviewees more easily.

Reflecting on these study targets, I am happy to say all goals haven been achieved. However, during the process there was only one disappointment regarding the motivated attitude shortly before the p4 application. In the graduation manual it was stated that every student needs to comply the rule for application of having all ECTs. I followed the elective course Written English for Technologists during my graduation process, since this was recommended by other master students. However, because of the TU holidays and the sickness of the tutor, three lectures were scheduled later the year. This resulted in a delay to obtain the grade before the P4 application. Many emails and communication between me and the Board of Commissioners followed, which luckily resulted in exemption from the strict application rule. This situation resulted in somehow stressed period of the graduation process. Nevertheless, I continued my research and I tried to stay as positive as possible.