Accessible mobility:

Developing a mobility hub network in the municipality of Venlo

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Colophon

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Preface

Hereby I present to you my Master's Thesis to complete my Master *Spatial Planning*, with a specialization in *Urban and Regional Mobility*. The subject of this thesis is about a new concept in the world of mobility, of which many different ideas exist. However, *mobility hubs* do not have a definitive image and strategy which is related to them. This research has therefore been conducted, in order to develop a strategy for a network of mobility hubs in the municipality of Venlo.

In order to do this research, I followed an internship at the municipality of Venlo. I am very grateful for the opportunity they have given me, and I look back to my internship with great pride and joy. I want to thank my supervisors, Dieter Schepers, from the municipality, and Frits Verhees, from the university, for their great supervision during the writing process. Whenever I had questions, I could ask, and would be helped almost immediately.

Furthermore, I want to thank all colleagues at the municipality of Venlo. They gave me an internship period I will never forget. Moreover, they were one of my primary sources in doing this research, due to their available knowledge in the subject of mobility and transport. Whenever I had questions about their proceedings and knowledge, they were eager to share it with me.

Lastly, I want to thank my family and friends for their unwavering support, especially in times when my motivation was lowest. They were all a great support, not only during the Master's period, but also during the Bachelor, especially when keeping the COVID-19 lockdowns in mind.

With finishing this thesis, there comes an end to my time as a student in Nijmegen. A period which passed by really fast, and in which I learned a lot about myself as a person.

I hope you enjoy reading my Master's thesis,

Guido van Wijlick

Belfeld, August 2022

Summary

Mobility hubs are a rising subject throughout the world of mobility. However, definitions regarding mobility hubs vary a lot. This means that there are differences between the different strategies for developing a network of mobility hubs. This research has aimed to create a strategy for developing a network of mobility hubs for the case of the municipality of Venlo. In order to do so, this research has looked at the concept of transport/mobility poverty. Moreover, this research has also looked at Practice Theory (Reckwitz, 2002; Shove et al., 2012) in order to understand the daily action of commuting. Based on these two concepts, the strategy for development of a network of mobility hubs is based. In order to do so, it is important to understand the meaning, materials and competences of individuals. In better understanding these, a more including strategy for the development of mobility hubs has been developed. In this, transport poverty is a part of both the materials as well as the competences of individuals.

As a first step, this research has mapped out the currently existing mobility networks in the municipality of Venlo. These include the cycling network, the main road network, the public transport network and the available shared mobility for its inhabitants. These networks were put in QGIS, in which they were later referred to with the goal of discovering parts in the municipality in which the access to transport was lowest.

Alongside these mobility networks, general information about the inhabitants of the municipality has been looked at. Combining this general information with the knowledge about access to mobility networks, a recommendation for potential mobility hub locations has been offered.

Based on the potential, a participatory planning game has been played with colleagues at the municipality of Venlo. Based on the results of this game, the transport modalities for the mobility hubs were arranged. Moreover, rules of thumb were formed, that can be applied to all mobility hubs.

Then, a chapter was dedicated to the potential problems and bottlenecks that should be kept in mind when an organization aims to develop a network of mobility hubs. These problems include general problems for mobility hubs, but also the market parties and problems internal to the organization. Another problem is on the field of citizen participation, with the concepts of NIMBY and social in- or exclusion. The last problem remains the problem of transport poverty, which is further elaborated upon in this chapter.

This report ends with an advice to the municipality of Venlo, with a recommended strategy for the development of a network mobility hubs. Thereby, it elaborates on the way that the network would be implemented best. Moreover, it gives an explanation about the practice of daily travelling, which needed to be understood to better develop a network of mobility hubs.

Lastly, a critical reflection on the findings of this research has been given. This is followed up by recommendations for further research into this subject.

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Overview of Images

1. Introduction

Mobility hubs are a rising subject throughout the Netherlands. More and more municipalities, regions and provinces are looking at potential ways to utilize mobility hubs. However, for a lot of these governmental instances it is unclear what a good strategy is for the development of mobility hubs, let alone a network of them. For some municipalities, mobility hubs are proving to be a solution to the nuisance of straying vehicles that the free-floating shared mobility carries with it (Omroep West, 2022). A similar situation also holds true for the municipality of Venlo, where the research problem of this Masters' thesis is commissioned by. This research aims to provide the municipality of Venlo with counsel and recommendations with regards to developing a network of mobility hubs.

1.1. Problem Statement

The municipality of Venlo has requested an advisory report for the development of a network of mobility hubs. Some of the employees of the municipality already had some ideas about what a mobility hub should entail, and are requesting this research to give a more complete and all-including definition of a mobility hub. Furthermore, the municipality has requested for this research to provide them with potential locations for mobility hubs throughout the municipality, and the characteristics around these locations.

From conversations with colleagues, it has become clear that the municipality of Venlo is dealing with parking problems, especially in the around the city center, but also in some other neighborhoods. As a new primary policy on solving the parking problems in the city, the municipality aims on the principle of the 4 B's: Beïnvloeden, Benutten, Beprijzen en Bebouwen (Influencing, Utilizing, Taxing, Building) (Gemeente Venlo, n.d.). For this principle, the Influencing part entail measures that aim to change the behavior of citizens. The Utilizing B aims at a more efficient use of infrastructure that is currently available. The third B, Taxing, is aimed at putting a price on certain parking amenities or facilities, either by using licenses or higher hourly tariffs. The municipality is very reluctant to use the fourth and final B, which stands for Building. This B means that when no other options are possible, new parking infrastructure will be built. The municipality is very reluctant with this, because of the lack of public space, and the many ways in which it could be used (Gemeente Venlo, n.d.). When a network of mobility hubs is being developed, there is made use of the B's of both Influencing and Utilizing. Mobility hubs aim to stimulate people in using shared cars, as opposed to their own car. Also, mobility hubs can be placed in already existing parking lots, which is an efficient use of public space.

Moreover, the municipality of Venlo is part of the collaboration Trendsportal. Trendsportal is a regional collaboration of all the municipalities in the North of Limburg. One of the ambitions of both Venlo and Trendsportal are to become the most sustainable region by 2040. The use of electric vehicles could offer a potential solution to this ambition.

1.2. Research Aim

The goal of this research is to gain an insight in the characteristics of mobility hubs. This includes important aspects such as the characteristics of potential locations, as well as their best suited modalities. This research will be done for the municipality of Venlo, which gets a complete map as an end result of this research. This map will include potential hub locations, alongside with its characteristics and the transport modalities that suit these characteristics. Furthermore, this research gains insight in other factors that are relevant to the development of a network mobility hubs, by comparing the existing literature with the current situation in the municipality of Venlo.

1.3. Research Questions

In order to achieve the aim of this research, the following main research question has been formulated: *What are the conditions and characteristics of potential hub locations in order to develop a mobility hub network in the municipality of Venlo?* Relevant information from earlier research will be given in the Theoretical Framework. Then, in order to answer the main question, multiple sub-questions have been formulated. These sub-questions are:

1. What does the current mobility network of the municipality of Venlo entail?
2. What are potential locations and their characteristics for mobility hubs in the municipality of Venlo?
3. What are the characteristics of the target population in the area of potential mobility hub locations?
4. Which transport modalities and facilities accommodate the target groups of the potential mobility hub locations?
5. To what extent is the development of a mobility hub network obstructed by potential hindrances?

These sub-question will be answered in the results chapter, and will thereby form the basis for the conclusions and the answering of the main research question, thus completing the research aim.

1.4. Reading Guide

In the following chapter, the societal relevance and the scientific relevance will be given. After that, a chapter will follow in which relevant theories and scientific articles will be critically reviewed, and used as a theoretical basis for the remainder of this research. This chapter will also include the conceptual model used for this research. Subsequently, a chapter about the research strategy, data collection and analysis and research philosophy can be found. Thereafter is the chapter that contains the results of this research, as well as answers to the sub-questions of this research. The chapter after that will give the conclusions of this research, as well as answer the main research question. This chapter also includes a final advise to the municipality. The final chapter contains the discussion, a critical reflection on the writing process, as well as recommendations for future research.

2. Relevances

2.1. Societal Relevance

This research is socially relevant for multiple reasons. First of all, this research looks at the possibilities for the development of mobility hubs. These possibilities are being based on characteristics of the local population in the area of mobility hubs. In using this method, there can be looked at what the best facilities and transport modalities are for the development of a mobility hub.

Also, because this research contributes to the development of a network of mobility hubs in the municipality of Venlo, the potential benefits of mobility hubs may also become noticeable. The first and foremost benefit that inhabitants of the municipality might notice, is an in increased accessibility and mobility. Naturally, this is the main reason that a mobility hub is being developed. However, the development of a mobility hub network has more benefits than the increased mobility and accessibility. Economic activity in the area around a mobility hub can also get a boost (Bras & Bollinger, 2018). Especially larger mobility hubs attract more commuters towards their area, which leads to an increase in activity, and thus a potential economic growth (Bras & Bollinger, 2018).

However, not every mobility hub is built with the same intention. Mobility hubs in urban areas are built with the intention to increase the livability and sustainability in urban areas, whilst mobility hubs in rural areas are built with the intention to improve the accessibility and inclusion of a certain area (Witte et al., 2021).

Furthermore, this research can give a supporting role for policymakers. While this research is commissioned by the municipality of Venlo, policymakers of other municipalities can still learn from this research. The same method will also be used for this research, and was used by Witte et al. (2021) as well. They reference to an already implemented network of mobility hubs in Groningen-Drenthe. On that note, it can also be mentioned that this research might help for the future development other mobility hub networks.

2.2. Scientific Relevance

This research is especially relevant regarding the characteristics and conditions that support the development of mobility hubs. Many researches have already been conducted on the different types of mobility hubs, and what they should entail (Bras & Bollinger, 2018; Bell, 2019; Witte et al., 2021). A large scale research on the different types of mobility hubs has also been conducted by Geurs and Münzel (2022). The research of Geurs and Münzel (2022) is very inclusive on the subject of different types of mobility hubs. However, the Geurs and Münzel (2022) research is lacking in the area of which facilities and transport modalities fit to each target population. This research can add onto this less common knowledge of the characteristics of the mobility hubs' target population. This way, this research can also help as a future reference for easier decisions on mobility hub types or modalities and facilities.

Another important aspect to mention is that definitions of the term mobility hub are also easily found, but not uniliteral. Most of the important definitions are put into a table (Geurs & Münzel, 2022). The definition of a mobility hub in this research will be based on the idea of the province of Limburg, and may therefor differ from any earlier given definitions. The definition that will be given in this research may be more all-encompassing than other, current definitions. That is because multiple definitions and approaches to mobility hubs will be looked at. In doing so, a more extensive definition of mobility hubs can be given.

On the field of the different scale levels of mobility hubs, multiple researches have been conducted as well (Bell, 2019; Urban Design Studio, 2016). However, there is no uniliteral division on the mobility hub levels. In this research, the scale level of mobility hubs will be based on the scale given by the province of Limburg. Firstly, this makes it a more uniliteral scale for the entire province. Secondly, it may add a more commonly used scale level for mobility hubs, which can be used in more areas than just the province of Limburg or the municipality of Venlo.

Researches on the possible facilities or travel modalities should or could be included in mobility hubs has been conducted as well. Most of these facilities are being described by Bell (2019). The research of Bell (2019) usually divides the facilities based on the scale level of the mobility hub, but not on the characteristics of the nearby area. Other researches have also given the different types of transport modalities, but not the conditions and characteristics where the choices for each modality type is based on (San Diego Forward, n.d.). This research will add onto the current knowledge of these conditions and characteristics, which help in the process of deciding which facilities and transport modalities will be implemented.

3. Theoretical Framework

3.1. Critical Review

Relevant literature for this research has been extensively written. This research aims towards using existing theories and literature for the development of mobility hubs, in the specific case of the municipality of Venlo. For most of the research process, relevant literature, theories and ideas can be found. The first part of the research, explaining the current mobility system, can be largely supported by the available knowledge provided by the municipality of Venlo and the province of Limburg. Literature about which transport modalities and facilities a mobility hub should entail, can also easily be found. The previously conducted research of Geurs and Münzel (2022) extensively summarizes the definitions of mobility hubs, as well as showing their facilities and transport modalities in a clear and organized matter, sorted by author (Geurs & Münzel, 2022). The Geurs and Münzel research is sufficiently encompassing on most of the important aspects for the development of a mobility hub strategy. However, more sources are also available (Koedood, 2020; San Diego Forward, n.d.; Bras & Bollinger, 2018), or are mentioned in Geurs and Münzel, like Witte et al. (2021) or Bell (2019).

However, there is lacking literature on the field of decision-making about which transport modalities and facilities should be provided into hubs, and what specific choices should be based on. Furthermore, not much research has been conducted on the market of mobility hubs, and who is responsible for the maintenance.

3.2. Relevant Literature

The definitions of a mobility hub are not unliteral. The variety between the definitions is so large, that Geurs and Münzel (2022) have conducted a research, in which all definitions and characteristics of a mobility hub are given. However, the Geurs and Münzel research is severely lacking in explaining why certain facilities or transport modalities need to be placed at specific types of hubs. Another definition of a mobility hub that is relevant for this research is the following definition: A mobility hub is a changing point between different transport modalities, which alongside its mobility task, also should function as a focus point for land development (Witte et al., 2021). Yet another definition of a mobility hub is that a mobility hub is a recognizable, physical place within the urban sphere, which provides functions and services based on its location, which also favor the nearby neighborhood (Koedood, 2020). San Diego Forward (n.d.) has given a definition of a mobility hub as well: mobility hubs are locations of good connectivity with sufficient travel options. In mobility hubs, an integrated combination of walking, cycling, public transport and shared transport should be found, with the goal to make a faster and more frequent journey to an individual's desired destination (San Diego Forward, n.d.). A visual presentation of the idea of a mobility hub is also given in Figure 1. By looking at multiple relevant definitions of a mobility hub, a more complete and inclusive description of the concept of mobility hubs can be given. Furthermore, by basing the definition on multiple sources, the internal validity of this research will be improved (Van Thiel, 2014; Vennix, 2016).

Figure 1: Idea of a mobility hub. Source: San Diego Forward, n.d.

Mobility hubs can also be subdivided into multiple types, based on their scale levels (Bell, 2019). According to Bell, mobility hubs can be subdivided into four levels. The first level is a large, central mobility hub, in which travelers usually change between different modes of transport. For this type of mobility hub, the destinations can be local, regional, national or even international (Bell, 2019). A lot of social and cultural activities can be found in the vicinity of these hubs as well.
Bell (2019) describes the features and facilities of the second level of a mobility hub as mostly the same as the first level of mobility hub. The main difference between the two is the amount of travelers. In the first level of hub, the amount of travels and commutes in the hub is consistently high, whilst the travels and commutes on the second level of mobility hub are more likely to fluctuate, based on the circumstances (Bell, 2019).

	Type	Beschrijving / *Voorbeeld*
1	Stedelijke hub	**OV knooppunten trein in de stad (Intercity, Voorstadstations)** Binnenstedelijk hoogwaardig OV-knooppunt, ontsloten met slimme first- en last mile oplossingen en katalysator voor ruimtelijke ontwikkelingen.
2	Stadsrand hub	**P+R knooppunten randen van de stad (ook snelweghubs)** Transferia, carpoolplaatsen met handige voorzieningen waar personen overstappen van auto op deelfiets, collectief natransport, bedrijfsbusje of HOV.
3	Regionale hub	**Overstappunt op spoor of HOV in de regio** Buiten stedelijke gebieden overstappen van auto of fiets op spoor of HOV. Combinatie met vraaggestuurd en flexibel vervoer mogelijk.
4	Lokale hub	**Wijkhub in dorp/stad, Hub aan de rand van een dorp** Kleinschaligere opstap locaties in landelijk gebied en kleinere (stads)wijken. Overstap van auto of fiets op (H)OV, aanbod van deelmobiliteit. Bundeling voorzieningen op dorps of (stads)wijk niveau. Vaak in samenhang met stedelijke (her)ontwikkeling en benutten van bestaande voorzieningen.

Figure 2: Mobility hub types. Source: Studio Bereikbaar, 2020

The third level of a mobility hub serves as a connection between the public and private transport network. Furthermore, it serves as a transfer location for local inhabitants towards the higher levels of mobility hubs. Around level 3 mobility hubs, it is less likely that shops and other cultural or social activities can be encountered (Bell, 2019).
The fourth and lowest level of a mobility hub can usually be found in rural areas, but they are not undetectable in urban areas as well. Level 4 mobility hubs usually serve as an entrance point to the public transport network for people who do not have access to a private car (Bell, 2019). By having knowledge beforehand on the subject of mobility hub levels, it can help in understanding the divisions made by the province, as well as critically reflecting on the levels made by the province. Bell (2019) has given one of the many ways in which the scale levels of mobility hubs can be subdivided. Another manner in which mobility hubs can be subdivided can be seen in Figure 2.

Another important aspect to discuss is why mobility hubs are important and relevant. By doing so, it becomes clearer why they are being developed and implemented more and more. The first and foremost reason why mobility hubs and their networks are being implemented, is to improve the connectivity and accessibility of the people near them (Bras & Bollinger, 2018). However, corresponding with the definition given by Witte et al. (2021), mobility hubs serve as a central point for land and real estate development. Due to the increasing amounts of traffic in the area, the area around the mobility hub becomes a good place for economic activity. This leads to more shops, and more wealth and economic prosperity in the area around the hub (Bras & Bollinger, 2018). When the development of mobility hubs is properly monitored, it can lead to an increased quality of the surrounding public space (Bras & Bollinger, 2018).

For a proper development of mobility hubs, it is also important to know which transport modalities can and should be provided by mobility hubs. One of the first transport modalities that come to mind when talking about mobility hubs is public transport. This includes modalities as trains, (trolley-)busses or trams. Next to public transport, there is also the matter of private transport. Not all mobility hub types are suited for private transport, but it is an important aspect to take into account (Bell, 2019). However, each mobility hub should be accessible for the use of active mobility (Bell, 2019). Active mobility is mobility that is characterized by human effort, as opposed to machinal effort (ITDP, n.d.). Two of the main advantages of large scale use of active mobility are an increased

health (Koszowski et al., 2018), as well as less needed public space for the transportation of the same amount of people (Meekes, 2021). The most common transport modalities of active mobility are walking and cycling. Another type of transport modalities relate to the concept of smart mobility. Smart mobility consist out of different transport modalities, that are being supported by extensive use of currently existing systems, transport connections and digital technology (Finck et al., 2021). This way, a sustainable and efficient transport system can be developed. Mobility as a Service (MaaS) is one of the main pillars within the concept of smart mobility, but newer forms of transport also fall under the scope of smart mobility (Harbers, 2016). The main idea of MaaS is that multiple types of mobility can be disposed to the customer, as soon as the customer requests it (Hensher et al., 2021). By making use of MaaS, less vehicles are required to transport the same amount of people, which leads to a gain in available public space (Hensher et al., 2021). The main downside that should be mentioned by MaaS is that it only works on a larger scale; when it is not implemented in a large scale or system-based, it has less chance of succeeding.

3.3. Practice Theory

In order to better understand the way in which mobility hubs and their respective networks will function, there will be looked at the practice theory (Reckwitz, 2002). In practice theory, a practice can be described as everyday actions that are routinized (Reckwitz, 2002). They are a pattern which consist out of single or mostly multiple unique actions that reproduce the practice (Reckwitz, 2002). Practices get undertaken and done by 'carriers', which is a bodily and mental agent. This makes an individual not only a carrier of patterns of bodily behavior, but also of certain routinized ways of understanding, knowing how and desiring (Reckwitz, 2002).

Practices consist out of four elements: body, mind, things and knowledge. The first of these elements, the body, is the way in which we learn our own body and physical shape how to act in a specific social practice (Reckwitz, 2002). It is thereby important to notice that the body is not a tool for the agent to 'act', but rather that the routinized practices are bodily performances themselves (Reckwitz, 2002). The second element is the mind. In Practice Theory, the mind is best explained as the knowledge that is connected to the routinized practices, your routinized way of understanding the world. These are the goals of your bodily performance, which you know, potentially unconsciously (Reckwitz, 2002). The third element of practices are the things. These consist out of the materials, the tools or the equipment you need in order to execute your practice (Reckwitz, 2002). The fourth and final element of practices is the knowledge. Simply said, knowledge refers to particular way of 'understanding the world', which includes an understanding of (abstract) objects, of humans and of oneself (Reckwitz, 2002). In my own interpretation can the knowledge factor of practice theory be best described as the emphatic capacity of an individual, the knowledge in understanding how one feels in a certain situation.

Building on the foundations of practice theory from Reckwitz (2002) are the ideas of Shove et al. (2012). Shove et al. (2012) describe three further elements of practices, which are all interdependently related: materials, competences and meanings (Shove et al., 2012, p. 24). Materials include the objects, infrastructures and tools we have at our disposal, as well as our human body (Shove et al., 2012). This encompasses the concepts of *body* and *things* of Reckwitz (2002). Competences are the practical knowledge an agent possesses, as well as the skills the agent has to execute the practice (Shove et al., 2012). The competences are related to the concept of *knowledge* (Reckwitz, 2002). The final concept of Shove et al. (2012) is the concept of meanings. These are the agent's symbolic meanings, values and ideas (Ryghaug & Toftaker, 2014). Meanings are related to the concept *mind* of Reckwitz (2002).

3.4. Conceptual Framework

For this research, it is important to know about the practice of travelling of individuals. The future network of mobility hubs can be based on the daily travelling practices of citizens of the municipality of Venlo. Because this research aims to develop the mobility hub network based on characteristics of their potential locations, as well as the characteristics of the local population around these potential locations, the practice theory of Reckwitz (2002) is a good fit. Based on the research aim, the following conceptual model has been set up, which can be found in Figure 3.

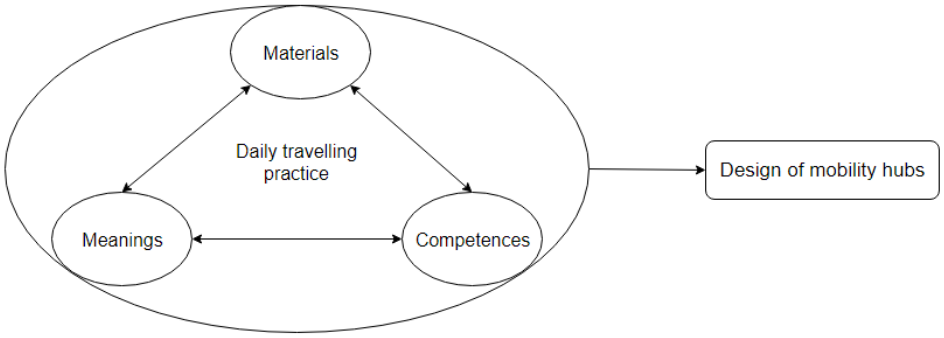

Figure 3: Conceptual model. Source: author's own

This bit aims to further elaborate on the conceptual model of this research. Firstly, the conceptual model is based on Shove et al. (2012). In this conceptual model, the practice of daily travelling is being explained with the help of the concepts meanings, competences and materials. For the case of this research, can the *meanings* be described as the social pressure on the way an agent travels to their working place. Certain working places have a high value for commuting in a car, while other companies value the use of a bike more. The idea of which vehicle is socially accepted in your life is an important part of meaning. The *competences* can be described as your (in)ability to use a certain type of transport modality. Moreover, the ability to access shared mobility or public transport trough certain MaaS applications can also be considered as a part of the competences. Lastly, there is the concept of *materials*. These include the travel options already available to the individual. This can include a private car, or shared scooters around the corner. All of these factors are interrelated and influence each other, as well as the practice of daily travelling. The practice of daily travelling is the idea of going from home to work or school and back home, on a daily basis. When the daily travelling practice of potential mobility hub users is understood, the design of mobility hubs can be adjusted to better accommodate the needs and preferences of their users.

4. Methodology

4.1. Research Strategy

This research is designed and will be conducted in a deductive manner. Deductive research aims to test the generalized theories onto a specific case (Van Thiel, 2014; Vennix, 2016). Because a lot of relevant literature is already present (Bell, 2019; Geurs & Münzel, 2022), this research aims to test the existing theories onto a new case. This research does not have the aim to redevelop all the ideas currently existing around mobility hubs, but aims to make use of the current ideas in order to develop a proper mobility hub network.

Due to the fact that this research aims to apply generalized rules to the specific case of the municipality of Venlo, it can be stated that this research is a case study. The main description of a case study is that a case study is a versatile form of qualitative inquiry most suitable for a comprehensive, holistic, and in-depth investigation of a complex issue (phenomena, events, situation, organization, program, individual or group)in context, where the boundary between the context and the issue is unclear and contains many variables (Mills et al., 2017). Case study research usually aims to understand phenomena in the real world, and questions that usually come with case study research are usually 'how' and 'why' questions. A less common occurrence in case study research are questions starting out with 'what' (Mills et al., 2017; Yin, 2014). However, in this research, questions starting with 'what' are the most common. Furthermore, case study research looks at contemporary phenomena within a real life context (Yin, 2014).

One of the main downsides of conducting case study research, is the large amount of variables that can be researched, which leads to the researcher being 'drowned' in the large amount of not necessarily relevant information (Yin, 2014; Vennix, 2016). In order to prevent the 'drowning' into too many variables, this research aims to operationalize the most important characteristics, based on already existing literature, policies and development plans.

Furthermore, this research makes use of the principle of triangulation (Vennix, 2016). Triangulation is the approach in which multiple sources of information are being used during the research (Vennix, 2016). In most cases, these angles of views are a literature study, observations and interviews (Vennix, 2016). For this research, these angles of views are literature studies of both existing scientific literature, as well as policy plans of the municipality of Venlo and policy plans of other governmental organizations. Also, conversations with colleagues at the municipality form a good source of information. These conversations can be either informal "in passing" or by questioning how their work is going. However, during team-meetings, there was time available for making notes, which leads to relevant information for this research being noted down for further use. Therefore, there has not been made use of formal interviews, that will be transcribed and analyzed, but all relevant information is noted down, with the dates of the meetings noted accordingly. The third form of obtaining information is a combination of observations as well as an experiment, by making use of the principle of participatory mapping. Participatory mapping in this research is used in combination with the idea of game theory (Lenferink et al., 2016).

Also, this research tries to take into account other, similar projects and ideas that have been conducted by other municipalities, cities or regions. These municipalities, cities or regions can be both national as well as international. Using similar researches from other governmental organizations can help in developing a better strategy, as well as preventing that, as the Dutch say it, 'the wheel does not get re-invented'.

Moreover, this research aims to gain an insight in the behavior or daily patterns of individuals, to base the development advice for a network of mobility hubs on. In order to gain this insight, there will be made use of the Practice Theory of Reckwitz (2002) and Shove et al. (2012). In this, the materials of the practice will be described in the first sub-question, which elaborates on the access to the different transport networks throughout the municipality. The competences will be described in the third sub-question, when talking about general information of citizens. Each citizen remains different, but due to the fact that the municipality does not want to create external expectations about a network of mobility hubs, this research had to be kept internally. Therefore, the competences of an individual are not taken into account in this research.

4.2. Data Collection

The first sub question of this research is: *What does the current mobility network of the municipality of Venlo entail?* To order to answer this question, there will be made us of a literature study and informal interviews. The literature study consists mostly out of policy plans form the municipality of Venlo, which can easily be accessed through the internship. These policy plans include the main road network, the bicycle network and the public transport network. The only part of the current mobility networks that is not yet covered by policy plans of the municipality is about shared mobility. However, in a conversation with a colleague, D. Schepers, who is the accountable employee for shared mobility, could the relevant information on shared mobility be obtained. Additionally, an interview with a teacher at the Fachhochschule Aachen had been conducted, about the positives and negatives of shared mobility. All of the currently found mobility networks will be placed in a QGIS data file, which gives a clearer overview of all the networks, and can aid in further decision making.

The second sub question of this research is: *What are potential locations and their characteristics for mobility hubs in the municipality of Venlo?* For answering this question, the most use has been made of policy plans of other governmental organizations, which have already implemented a mobility hub network. Another important source that will be used for the answering of this question is Van Heugten and Picavet (2021). Van Heugten & Picavet (2021) is an advisory report for the province of Limburg on mobility hub strategy. They also have a good typology of the different types of hubs, which is also used in this research. The advisory report also gives two guiding routes on which type of hub should be placed on a specific location. Moreover, for the eventual decision of a final hub location, observations through the neighborhood by walking have been conducted. One of the methods that can guide the decision making in the hub types can be found in Figure 4.

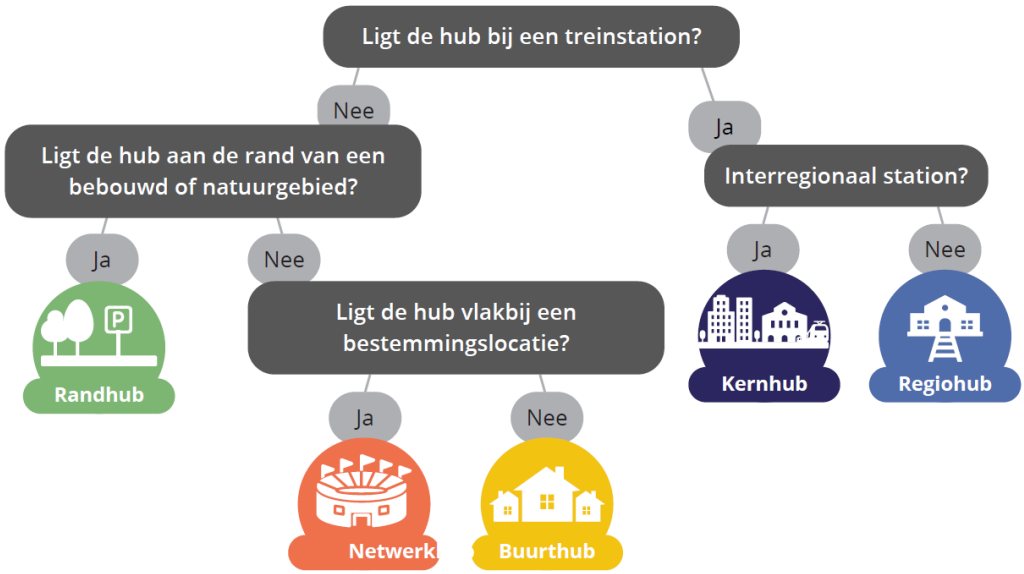

Figure 4: Decision tree for the type of hub (In Dutch). Source: Van Heugten & Picavet (2021)

To further obtain a proper view on the potential locations through the municipality, a division of communities and neighborhoods will be used based on the division of the CBS (CBS, n.d.). This method enables a view on the entire municipality on a smaller scale, which leads to more complete and better substantiated choices. This division on the neighborhood and community level will also be added to the QGIS file. Because of this small research scale will the eventual decisions of mobility hub types, facilities and transport modalities be decided more accurately.

In order to obtain a clear view on the problems and associated goals of the municipality for each community or neighborhood shall conversations or meetings with colleagues be conducted. Alongside the goals that are given in Figure 5, there will always be looked at potential pressure on the car parking capacity in the neighborhood or community. Data of the car parking pressure can be obtained via earlier conducted nightly measures of car parking pressure from the municipality. Apart from these source will data also be obtained from statistics. Sources for this are CBS, Venlo in Cijfers (Venlo in Numbers), Waar Staat Je Gemeente (Where stands your municipality) and Duurzaamheidsscore (Sustainability Score).

Doelstelling	Locatie	Type hub
Afvangen autoverkeer	Goed door auto te bereiken locatie	Randhub, regiohub
Verbeteren ketenreis	OV-knooppunt	Kernhub, regiohub
Modal shift naar duurzaam vervoer	Woongebied, bestemmingslocaties	Netwerkhub, buurthub
Bieden aanvullende vervoersopties	Bereikbare locatie aan rand woongebied	Buurthub, netwerkhub

Figure 5: Goals of a mobility hub (In Dutch). Source: Van Heugten & Picavet (2021)

When doing the analyses on the neighborhood or community level, there are two more factors that are important to take into account when deciding the potential locations of the mobility. The first one are the transport modalities that can be found in the vicinity (Van Heugten & Picavet, 2021). In this, the most prominent attention is given to the accessibility of the public transport networks. When a sufficient public transport connection is provided, then will chain journeys be enabled more (Van Heugten & Picavet, 2021). Furthermore is the access to the hub with cars important, but this is dependent on the scale (Van Heugten & Picavet, 2021). Because of the increasing attention for active mobility, as well as the ambition of the municipality of Venlo to become a vital city, it is also important to take the connection to the bicycle network into account. All these networks will have been given in the first sub question: *What does the current mobility network of the municipality of Venlo entail?* The second factor that is influential in deciding the locations of mobility hubs, and its type, are the nearby facilities and destinations (Van Heugten & Picavet, 2021). Lastly, it is important to obtain an overview of the hubs' potential users, and what their expected journeys will be (Van Heugten & Picavet, 2021).

The strategy of van Heugten and Picavet (2021) indicate that the best method is to first look at the goals in each neighborhood and community. Thereafter it is important to reckon with the currently existing networks in the respective neighborhoods or communities. Answering these questions is the catalyst to deciding potential hub locations in the municipality. As soon as the locations are decided can the type of hub be decided, based on the nearby facilities. The decision on the type of hubs can be supported by the flowchart than can be found in Figure 4.

One of the instruments that will be used to analyze the neighborhoods or communities well-orderedly is a SWOT-analysis. A SWOT-analysis looks at the strengths, weaknesses, opportunities and threats of a specific situation, and plays a supportive role in determining the effectiveness of the project (Sabbaghi & Vaidyanathan, 2004). An example of a SWOT-analysis, with a short explanation

of each of the sections, can be found in Figure 6. The strengths of the SWOT-analysis relate to the resources that are available inside the organization to answer the question of the project, as well as the characteristics that nihilate the threats (Sabbaghi & Vaidyanathan, 2004). Weaknesses are the characteristics of an organization or company, that prove to be a hindrance for the completion of the goal. For this research, there can be thought about the possibilities to provide shared mobility, or the concessions and permits given to market parties. Opportunities are characteristics from outside of the organization or company, that make it easier to reach the goals of the project (Sabbaghi & Vaidyanathan, 2004). Threats exist out of external circumstances that complicate the process of achieving the goal (Sabbaghi & Vaidyanathan, 2004). For this research there can be thought of facilities in a neighborhood that are (not) present.

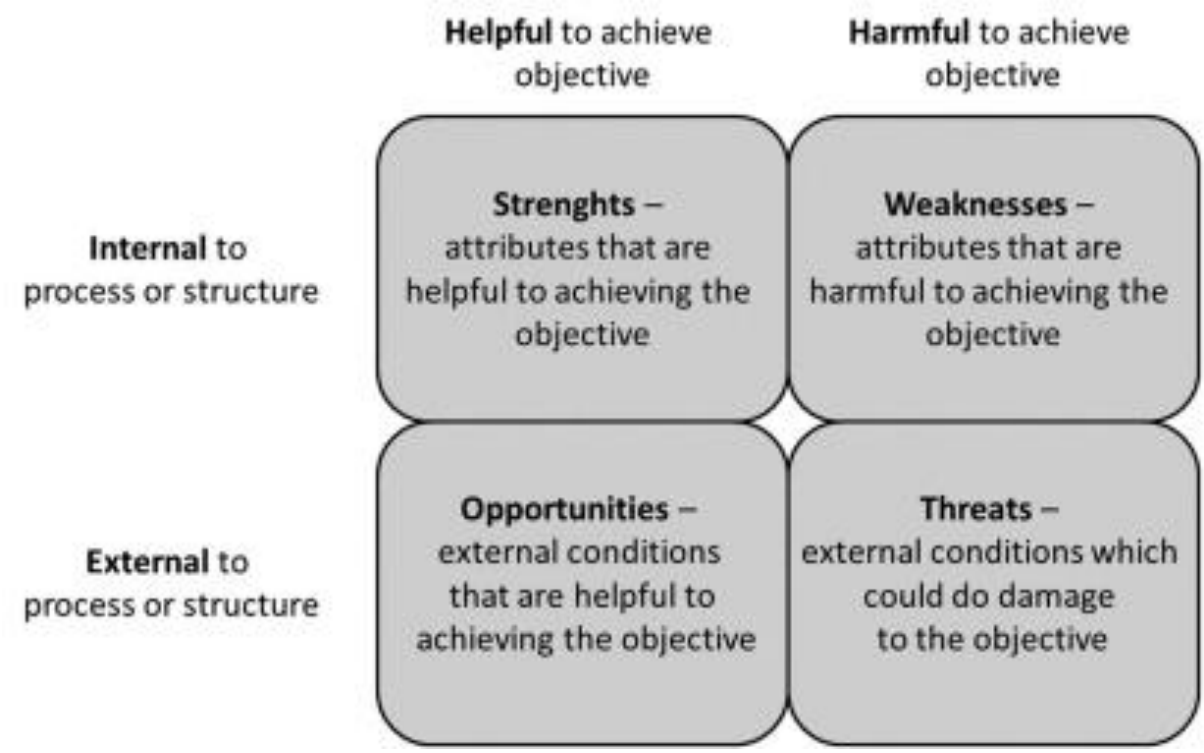

Figure 6: SWOT-analysis. Source: Leiber et al. (2018)

It is important to mention about the SWOT-analysis that it is a method to support certain decisions. However, a SWOT-analysis does not give definitive solutions for a problem or a project (Leiber et al., 2018). A benefit of SWOT-analysis is that it has very little costs. Also, it focuses primarily on the most important factors that are relevant for the research (Leiber et al., 2018). The biggest disadvantage of a SWOT-analysis is that it is not a profound method of research. Moreover, some elements of the analysis can be places in multiple sectors of the SWOT-analysis, which leads to fading boundaries between the analysis' sectors (Leiber et al., 2018).

Once all potential locations inside the municipality have been decided, the realization power of the municipality needs to be taken into account. More than 80 potential hub locations have been found from all the community-/neighborhood analyses. In consultation with colleagues from the municipality, there has been decided that the total amount of hubs should be around 30 hubs for the entire municipality (Schepers, D., personal communication, 21 April 2022). All of the initially chosen potential hub locations, that were not included in the final 30 locations, have been kept record of for eventual future use. In order to prevent an overlap between multiple hubs, will isochrone analyses be conducted via QGIS. The maximum walking distance that has been used to check for overlaps is 300 meters for network hubs (netwerkhubs) (Molster, 2016). For central hubs

(kernhubs), this walking distance that has been applied is 1500 meters, whilst the walking distance for regional hubs (regiohubs) has been considered to be 1000 meters. Because of the function of P+R hubs (randhubs), which is to intercept large amounts of incoming car traffic, no maximal walking distance is needed to be applied.

The third research question of this research was: *Which are the characteristics of the target population in the area of potential mobility hub locations?* Most of this research question is largely answered in the community- and neighborhood-analyses that have also been used for the second sub-question. By using this analysis, there will be created an insight in the average age of the inhabitants, the average income, the division of the age groups and the division of education level amongst the population. These already important characteristics can be further supplemented by knowledge from existing literature. The important numbers about the population have been obtained via AlleCijfers.nl (n.d.). In order to validate these numbers, they are all checked via the information that is provided by the CBS afterwards (CBS, n.d.). These numbers are found in the GIS attribute table of the map-layers for the municipalities, neighborhoods and communities of the CBS.

The fourth research question is: *Which transport modalities and facilities accommodate the target group of potential mobility hub locations?* There were multiple options for answering this research question. However, at this point, the municipality of Venlo is not publicly working on the realization of mobility hubs. When a method for answering this research question would be used that involves the input and opinions of inhabitants, it could create the wrong image that there will be realized mobility hubs on the shorter term than that the municipality has in mind. In order to prevent these expectations, methods such as surveys, participation-panels and other forms of citizen participation are falling out of the occasion.

As an alternative, there has been looked at the possibility of playing a ‘game’, with the idea in mind of participatory planning. However, due to the earlier given reason of publicity of this research in the municipality, this ‘game’ will be played internally with colleagues. Such a type of ‘game’ is and **abstraction** or simplification and consideration of (a real system of) the decision making process (Samsura, 2021). Playing a ‘game’ is an activity that consists out of **rules** and **goals**. The players of the ’game’ try to make decisions by deciding on strategies, inside the existing rules to achieve their goals (Samsura, 2021). One of the main critiques on playing these types of ‘games’ is that they are unrealistic. However, a ‘game’ can:

- Help us in understanding certain parts of the process of:
    - The interaction between the players/parties/stakeholders.
    - The relevant variables for the situation.
- Support the researcher in further fine-tuning the relevant variables.
- Easily be replicated.
- Be considered as scientific → It applies a systematic observation and measure to reach a certain goal (Samsura, 2021).

Samsura (2021) has given seven steps to successfully develop a participatory planning game:

1. Give and make a problem definition.
2. Describe the goal of the game.
3. Design and create the game.
4. Play a pilot session to test the game.
5. Decide and invite the relevant players to play your game
6. Play the game, in which you keep track of a logbook with the game’s progress.
7. Optionally conduct a data analysis and write a report on it.

At the time that these methods are being put to use, the potential locations for mobility hubs have already been decided. The main point of attention at this point shifts to the mobility hubs should be arranged. This includes questions such as ‘Should there be shared bikes’, ‘Is there decent enough

access to public transport' and 'Is there demand for shared scooters?' By playing this participatory planning game, the aim is to develop guidelines for the development of one specific mobility hub.

The goal of the participatory planning game is to discover and explain the factors that influence the use and arrangement of a mobility hub. Therefore, the aim is to obtain generalizable findings for the entire municipality. Once this game has proven successful, or the critiques have been properly changed, this game can also be used as a form of citizen participation.

The game shall be played as a negotiation game. Every player will take the role of either an expert, or will be given a player card, which imitates a potential inhabitant in the municipality. When playing as the expert, the players are free to play according to their knowledge. The players will play multiple rounds, whereby in every round they play a different situation. These situations are all real, but in some cases the true location in the municipality is kept a secret for the players.

Every situation that is being played, will contain certain characteristics from the neighborhood. These characteristics include the division by age, the total amount of inhabitants, the education levels, and the currently present facilities and stores in the area. This information is obtained with the methods form the second and third sub-question. When the location is known for the players, the name of the location will be given. When the location remains unknown, the location will be named unknown. General information about the access to certain mobility networks near the location, will also be given in the table. An example of the given information can be found in Figure 7.

Locatie	Station Blerick		
Inwonertal binnen loopafstand	**0-14**	1675	16,61%
	15-24	1152	11,42%
	25-44	2567	25,45%
	45-65	2607	25,85%
	65+	2085	20,67%
Gemiddeld inkomen wijk	€ 20.978,83		
Opleidingsniveau	**Laag opgeleid**	2990	40,30%
	Middelbaar opgeleid	3130	42,18%
	Hoog opgeleid	1300	17,52%
Overige informatie:	Overdag zijn alle parkeerplekken vol, maar het is een populair station om met de auto naartoe te komen		
	Treinen rijden naar Roermond, Nijmegen, Venlo en Schiphol (Eindhoven, Den Bosch, Utrecht, Amsterdam)		
	Er kan worden ontwikkeld aan de hand van de voorzieningen van het station Blerick		
	Het winkelcentrum van Blerick ligt binnen loopafstand		
	Er liggen twee verschillende bushaltes nagenoeg bij elkaar, met elk andere lijnen. Ideaal gezien wordt dit één bushalte bij het station		
	Het station ligt langs het fort Sint Michiel, waardoor er aan de noordzijde geen ruimte is voor een hub		
	De zuidzijde van het station is volgebouwd, waardoor er weinig ruimte is voor de bouw van een hub. Er zal dus met de huidige openbare ruimte gewerkt moeten worden.		

Figure 7: Information table participatory planning game. Source: author's own

Based on the given characteristics, the players will aim to arrange a mobility hub in the location. Every round will have a game-mat, on which there is limited space to place vehicles. This is of course a simulation, but it upholds the fact that public space is limited. The game-mat is a raster, which can be filled in with transport modalities. This raster will be made based on the surroundings of the location. If a location has a road going through the center of it, this road can be marked as invalid to place vehicles. This also holds true for trees, bushes or sidewalks. An example of a playing raster can be found in Figure 8.

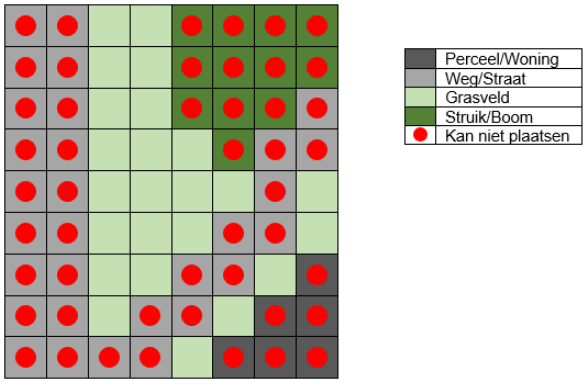

Figure 8: Example of a raster. Source: author's own

To fill in the raster, certain types of shared vehicles can be placed inside the raster. For this research, shared cars, bikes, scooters and steps were made available to place. However, the shared step was a frame-up, as they are currently prohibited in the Netherlands (Shepers, D., personal communication, May 2022). Examples of the available vehicles can be found in Figure 9.

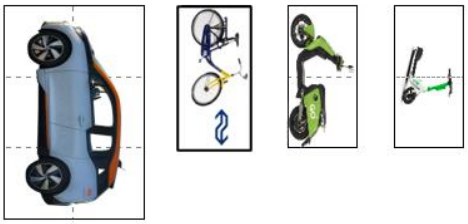

Figure 9: Examples of vehicles. Source: author's own

The game will be created to play a total amount of six rounds, divided into two groups. That means that results for twelve potential location throughout the municipality will be gathered. These results can supply this research with proper guidelines for the development for the rest of the mobility hubs in the municipality.

The problem that is being solved by playing the 'game' is the question about how mobility hubs should be arranged, and on which factors and characteristics that this is based on. There is literature available on how mobility hubs should be arranged and developed. This literature includes van Heugten and Picavet (2021), Studio Bereikbaar (2020) and Bell (2019). This 'game' would serve as a good test on the applicability of this literature on the specific case of Venlo.

The goal of the 'game' is to discover and explain the factors and characteristics that decide in which way a mobility hub is supposed to be arranged and developed. To achieve this goals, there is aimed at generalizing the results of the game to a broader application throughout the municipality. For eventual research that follows up on this research, this 'game' might also be used and played by inhabitants of a certain neighborhood or community, where the 'game' will also be aimed at.

The fifth sub-question is: *To what extent is the is the development of a mobility hub network obstructed by potential hindrances?* This sub-question will be answered with the aid of policy documents, as well as discussions and meetings with colleagues. Important sources in this are once again van Heugten & Picavet (2021), but also Studio Bereikbaar (2020). Furtermore, sources from the municipality of Venlo are being used to describe the internal struggles that need to be kept in mind. Lastly, some scientific literature has been used to further strengthen the findings, such as Boyle et al. (2019), Oude Alink (2021) and Martens (2016 and 2021).

4.3. Data Analysis

As stated above, this research will not be using surveys or other forms of active citizen participation. This is mostly due to the expectations that are being generated when doing so, whilst these expectations will not be met by the municipality in the forthcoming years. A lot of the relevant data therefore needs to be obtained without giving the wrong signal to the inhabitants. This means that a lot of literature study and known statistics need to be used. To validate the statistics, they are checked by using multiple sources for the same information. Furthermore, by obtaining the statistics on a smaller scale level, they assist in more specified decision making.

A lot of information will also be obtained in conversations with colleagues of the municipality. They are all knowledgeable of important matters that play in the municipality, as well as that they all have relevant knowledge on the subject of mobility. These conversations will not be transcribed, but there will be made notes of important information, with a date added to it. This way, internal information and knowledge of the municipality can be obtained, on different stages throughout the entire internship trajectory. The file with all these notes can be found in the attachments on Brightspace.

The results of the participatory planning game will be put together in an Excel file, to create a better and more clear insight in the findings. Because of the low amount of surveys conducted, the results struggle in reliability. To best tackle this problem, only the answers that were unanimously given are taken into account. Whilst it can still not be confirmed as reliable as ideally wished, it at least ensures consistency throughout all the answers. Alongside the surveys for the individual players, there were rounds played, which contain results. The results of these games have been photographed, with comments for the eventual transport modalities from the players. For the game round results also holds true, that findings were only given in the results if they were given on a consistent basis.

4.3.1. Validity and Reliability

The validity and reliability of a research is always important, but it is especially important in this research, due to its deductive nature. To ensure that the concepts regarding a strategy for mobility hubs is consistent, the concepts will be defined in consultation with the province of Limburg. Because the province of Limburg is also developing a strategy for mobility hubs, they will also have a strategy plan and explanation of concepts. When consulting the researchers of the province, it can be ensured that the concepts are on the same page. This leads to a more solid reliability, as multiple researches and strategies throughout the province will use the same concepts and measures.

However, there are some notes that can be given about the reliability. Firstly, the first three sub-questions will be answered with the use of literature research, or with other available data. This also holds true for the fifth sub-question. The fourth sub-question however, is answered with the use of a participatory planning game. A participatory planning game is a scientific method (Samsura, 2021). In this case, the participatory planning game simulated a citizen participation session, which talked about the arrangement of certain mobility hubs. Alongside the participatory planning game, surveys were also conducted amongst the players, to gain an insight in their way of thinking. The reliability becomes a problem at these surveys, due to the fact that there only were seven players. This is not beneficial for the reliability, because it remains unclear which answers are the systematic measurement mistakes. The results therefore only used findings that were given by all the surveys, to ensure that the reliability was the best possible.

The validity if this research is good as well. In order to achieve the aims of this research, multiple sub-questions have been worked out to help in answering this research's main question: *What are conditions and characteristics of potential mobility hub locations in the municipality of Venlo?* Each of the sub-questions helps in answering the main question or supports answers of other sub-questions.

Because this research tries to take other, previously conducted researched into account as well, the internal validity is strengthened. Most of the variables that will be measured, are based upon currently existing theories, ideas and concepts. As a consequence, the construct validity, and thus the internal validity of this research is strengthened. Furthermore, the content validity is also strengthened. Due to the references to other relevant researches, it can be ensured that all aspects for the development of mobility hubs will be measured.

Due to the deductive nature of this research the external validity of this research is not as large compared to other researches. A lot of information will be place- and time-dependent, and can therefore not easily be generalized. However, the findings can to some extent still be generalized, but that will not be possible for every case. Moreover, because this research is conducted in the manner of a case study, it may be questionable to which extent the results may be generalized. Case study research focuses on one specific case, in a specific time stamp in the real world (Mills et al., 2017; Vennix 2016; Yin, 2014). Generalizing the results of a case study might not always be possible,

as they may not be relevant for other cases, due to cultural, geographical, social or political differences (Pearson & Coomber, 2010). Therefore, findings of this research may not always be generalized or used in other researches, but this research can provide a 'nudge' in the right direction.

4.4. Research Philosophy

In this research, there will be made use of the positivist approach (Guba & Lincoln, 1994). This choice was made, because the positivist approach is the best approach in understanding why certain phenomena take place. Research conducted in a positivist approach contributes to discovering in what the 'true' state of affairs is (Guba & Lincoln, 1994). When conducting research using the positivist approach, it is assumed that the researcher and the 'object' are two different entities. However, these two entities should not intervene in one another or influence each other while doing research (Guba & Lincoln, 1994). If such interventions or influences were to take place, the validity of the research becomes endangered. Furthermore, prejudices, norms and values should thereby not in any way influence a research (Guba & Lincoln, 1994). When results and findings are becoming repetitive, it can be stated that these results are truths. The given methods and methodology in this research are written in the form of a question or a hypothesis, and will then be tested (Guba & Lincoln, 1994).

This research has chosen for the positivist approach, because this research tries to understand the current ideas, conditions and characteristics of mobility throughout the municipality of Venlo. Once those idea's, conditions and characteristics are understood, a development plan for a network of mobility hubs can be developed. Because this research aims to map out the reality for people before the recommendations and conclusions are given, the positivist approach is a goof philosophy to use for this research. Eventual conducted interviews for this research are unstructured in nature. Unstructured interviews provide the interviewee with the most opportunity to present their own thoughts, feelings and ideas (Vennix, 2016).

4.5 Operationalization of Concepts

4.5.1 Definition of a Mobility Hub

The province of Limburg gives the definition of a shared mobility hub. However, this research looks at a mobility hub as a broad concept, and not only on the field of shared mobility. Nonetheless, the definition remains the same, only the shared part is kept away. This makes the definition for a mobility hub in this research as follows: *A mobility hub is a geographical location where at least one form of (shared) mobility is provided, that is publicly accessible and can be used by everyone, while it is aimed at transferring between different types of transport modalities.* This definition is kept relatively broad, because there are many different types of mobility hubs (Van Heugten & Picavet, 2021).

4.5.2 Different types of Mobility Hubs

There has been made a distinction between five different types of mobility hubs. The different types of mobility hubs can be found in Table 1. A further explanation of each type of mobility hub can be found beneath the table.

Type (NL)	Type (Eng.)	Modalities	Reach	Example
Kernhub	Central hub	Shared cars Shared scooters Shared bikes Walking paths Train connections Bus connections	International National Interregional Regional Local	Station Venlo
Regiohub	Regional hub	Shared cars Shared scooters Shared bikes Train connections Bus connections	Interregional Regional Local	Station Tegelen
Randhub	P+R hub	Shared scooters Shared bikes Walking paths Bus connections	Regional Local	Canon office parking lot
Netwerkhub	Network hub	Shared cars Shared scooters Shared bikes Walking paths	(Regional) Local	Shared cars Nedinscoplein
Buurthub	Neighborhood hub	Shared vans Shared cars Shared Scooters Shared bikes	Local (Regional)	Unplug & Go point city center Venlo

Table 1: Different types of mobility hubs. Source: Van Heugten & Picavet (2021)

A central hub is the central point in the network of mobility hubs. Usually, central hubs can be found close to interregional train stations. A central hubs sees a lot of different travelers coming together. With the use of good informing and activating travelers, as well as the broad supply of transport modalities, is transferring between different transport modalities stimulated optimally. Central hubs are usually in places that are less accessible for cars. This means that central hubs are usually reached via other hubs, or by walking or biking from the surrounding area (Van Heugten & Picavet, 2021).

The goal of the regional hub is to broaden the transport options in more rural areas. The regional hubs mostly aims to support the chained journey, as well as offering a direct journey with shared mobility. Therefore, the connection with the regional hub and the public transport is really good. A regional hub is more accessible for car users than central hubs, which means that people use the car as well as shared mobility to go to the regional hub (Van Heugten & Picavet, 2021).

P+R hubs can be found at the edge of either the city or the city center. The have as job to offer users an alternative for the last mile instead of the car, to relieve some pressure on the road network near the center. Therefore they can be found at the edge of the city or the center, because those locations can be more easily accessed with a car (Van Heugten & Picavet, 2021).

Network hubs' definition can be mostly found in their name. They are part of the network, in which most travels are usually from point to point. In most cases, network hubs can be found near

destinations (Van Heugten & Picavet, 2021). In this research, they are also used as entrance points to the mobility hub network, taking over that function from the neighborhood hubs.

The goal of a neighborhood hub is to offer transport modalities to nearby citizens, as a supplement of their own transport modalities. The underlying thought is to stimulate citizens to use shared mobility as opposed to their own second transport modality. This way, they aim to make more public space available for other purposes (Van Heugten & Picavet, 2021).

Figure 10: Different types of mobility hubs (in Dutch). Source: Van Heugten & Picavet (2021)

5. Results

5.1. What does the current mobility network of the municipality of Venlo entail?

When the current mobility network of the municipality of Venlo is understood, it can give a clear primary insight in the materials that are available to citizens in all areas of the municipalities (Shove et al., 2012). In better understanding the materials available, it becomes clear why individuals travel in the way they do.

5.1.1. Cycling Network

The current policy plan of the municipality of Venlo has been made in accordance with the five goals that are also present in the vision on mobility of the municipality of Venlo. These five goals are:

1. Supporting the Environment- & Energy-transition.
2. Improving the spatial economic accessibility.
3. Appealing mobility system.
4. Improving the road safety.
5. Improving the general quality of life.

Alongside these goals, the cycling vision of the municipality also aims to intertwine with the mobility vision of the region North-Limburg. Hereby, the municipality aims to connect to the national Tour de Force plan on the field of cycling highways. The routes of the Tour the force can be found in Figure 11. From this vision it becomes clear that the region North-Limburg, and thereby the municipality of Venlo, aim to become the most climate friendly, most accessible and most safe region of the Netherlands by 2040.

The region has also set multiple sub-goals, which are relevant to both the cycling plan of the municipality, as well as the mobility hubs of this research. The region North-Limburg strives to active their inhabitants to cover all the short travels either by bike or by foot at the latest by 2040. Furthermore, the region aims to nullify all the heavy traffic accidents and deaths. Lastly, the region wants to have a high quality cycling network, in which all large working locations are equipped with services for bikes (Gemeente Venlo, 2021).

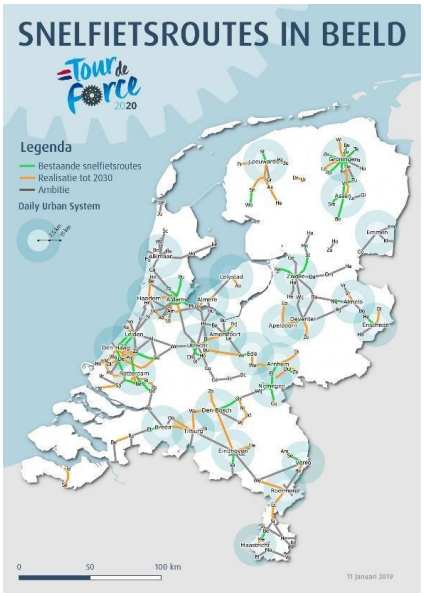

Figure 11: : Tour de Force routes. Source: Gemeente Venlo (2021)

Currently, the basis for the bicycle network is in order, but there are some remarks on the network, which are also relevant for the development of a mobility hub network. Firstly, it must be said that citizens prefer to cycle alongside a calm and beautiful route, as opposed to a busy arterial road. While this fact is mostly based on the personal preference of people, it should still be taken into account with developing mobility hubs as well. Secondly, it is noted that there is an increasing demand for secured bicycle stalls. This is an effect of the increased amounts of electric bicycles and speed-pedelecs. For the later part of accommodating the mobility hubs, it can be stated that secured bicycle stalls are a well requested facility (Gemeente Venlo, 2021).

In the past few years has the use of bicycles in the municipality of Venlo increased with 25% more bicycle users as opposed to 2000. The most important fact to note with this is that the electrical bicycle has made a large rise in users. The advance of electrical bicycles is considered to be a positive development. Citizens that possess an electric bicycle, travel twice the distance of citizens on normal

bikes. Due to the rise of the electric bicycle, people are more tempted to take the bicycle for their travels as opposed to the car. This is both a healthy development as well as a sustainable development, which mobility hubs can respond to (Gemeente Venlo, 2021). Furthermore, using and applying a proper bicycle network contributes to stimulating the use of active mobility. This increases the health of the bicycle networks users (Koszowski et al., 2018). However, on distances larger than 15 kilometers, the electrical bike loses its advantage to the car. However, the combination train-bike is becoming a more common occurrence (Gemeente Venlo, 2021).

At this moment, the municipality of Venlo has three different types of bicycle routes:

1. Bicycle highways
2. Primary bicycle routes
3. Recreative bicycle routes

All of these routes are connected to the provincial or the national network bicycle routes. At this moment, the municipality has some bicycle highways. The first bicycle highway starts in Reuver and ends in the center of Venlo, following the Meuse river. For this route, there are ambitions and plans to extend the route to the town of Arcen, in the north of the municipality (Gemeente Venlo, 2021). The second bicycle highway is the Greenport Bikeway. This route finds its origin at the Keulse Barrière, next to the German border, and ends at the Horst-Sevenum train station, going through the Greenport/Tradeport area. The third bicycle highway is a branch of the second one, which first goes towards Grubbenvorst, and then diverts towards Horst. The fifth bicycle highway goes from Californië towards Sevenum. The fifth and last bicycle highway starts of in the center of Venlo, and follows the Meuse river towards Baarlo (Gemeente Venlo, 2021). All of the current bicycle routes throughout the municipality of Venlo can be seen in Figure 12, which also includes the recreative network.

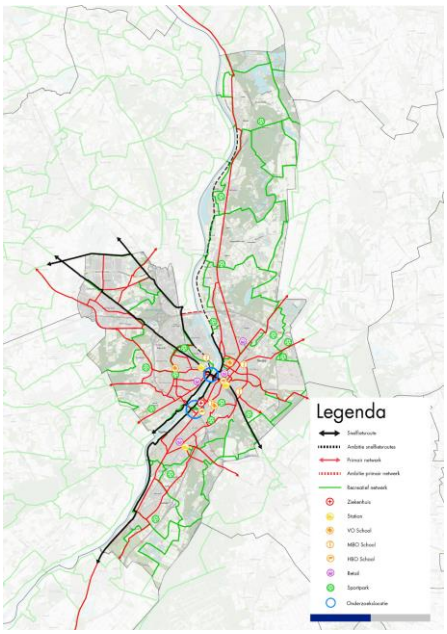

Figure 12: Venlo's ambition for the cycling network. Source: Gemeente Venlo (2021)

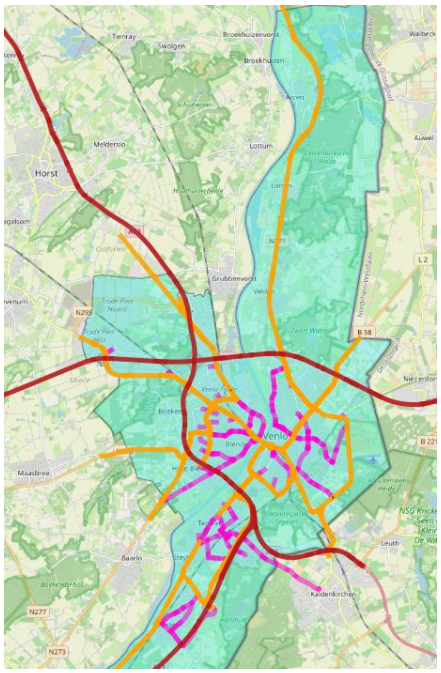

Figure 13: Main road network of the municipality. Source: author's own

5.1.2. Main Road Network

The most recent policy plan of the municipality regarding the road network is the GVVP – Deelnota Dynamisch Verkeersmanagement (DDVM) (Jacobs et al., 2013). From the DDVM, a few important aspects can be noted, which are also applicable to developing a network of mobility hubs.

The road network of the municipality of Venlo can be subdivided into three different categories:

1. Highways - Highway
2. Arterial roads - Primary main roads
3. Collector roads - Secondary main roads

A map of the current road network of the entire municipality can be found in Figure 13. Special attention should be given to the primary main road around the city center. This road, with an 'L' shape around the city center, is equipped with VRI and KAR at every traffic light (Jacobs et al., 2013).

The municipality of Venlo, but the city center in particular, has a problem on the field of parking. Due to the re-zoning of certain areas in the city center form shopping towards living, the population in the area has increased. This has leads to an increasing shortage on parking capacity in the area (Jacobs et al., 2012). Relieving existing pressure on the parking infrastructure in the center of Venlo is one of the goals that is taken into account with developing the network of mobility hubs.

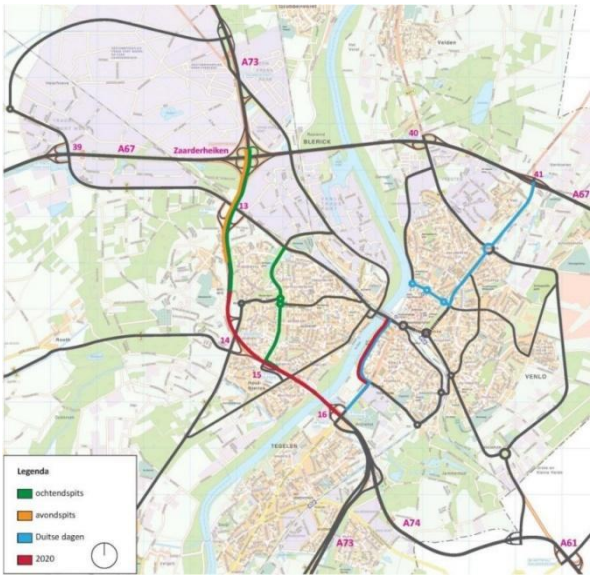

Figure 14: Projected bottlenecks road network. Source: Jacobs et al. (2012)

Moreover, there are different bottlenecks in the current road network of the municipality. These mostly pose a problem on the busiest days, when they lead to congestion and delays. Said bottlenecks can be found in Figure 14. This figure also mentions the projected bottlenecks for 2020. Based on the ideas of mobility hubs in the Brainport-region, around Eindhoven, it is considered to be an option to look at potential hub locations just before the bottlenecks, to relieve pressure from them (Studio Bereikbaar, 2020).

5.1.3. Public Transport Network

The public transport network in the municipality is for the most part exploited and used by Arriva. Arriva has a contract to provide the entire province of Limburg with public transport until 2031. This also includes the municipality of Venlo.

To get a proper insight in the travel options of the municipality, a clear overview of the public transport network is also required. One of the most important things to mention with the current public transport network is that the timetable is only in effect until December 2022, and is then subject for potential changes. An overview of the current bus and train routes of the municipality if Venlo can be found in Figure 15.

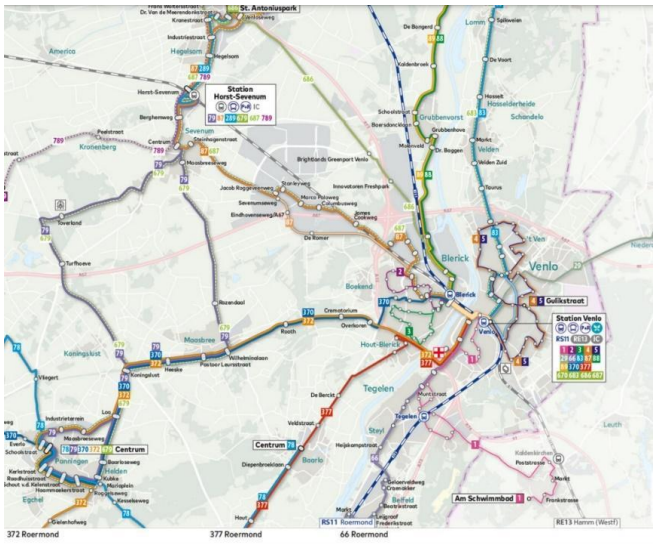

Figure 15: Public transport network for Venlo. Source: Arriva (2021)

To quickly summarize the public transport routes that are provided by Arriva, it can be said that the train line starts in Roermond and ends in Nijmegen. In the municipality, this train stops at the stations of Tegelen, Venlo and Blerick (Arriva, 2021). Within the municipality, there are five bus-lines present that provide the service of a city bus. Alongside providing these bus-lines within the city, does Arriva also provide 10 bus-lines that reach outside of the municipality (Arriva, 2021). Lastly, Arriva presents two shuttle-busses in the evening, which can be called when people want to use them (Arriva, 2021).

There are some other important public transport services that are not being provided by Arriva. The most important of these is the Intercity train from the station of Venlo towards Schiphol Airport. This train departs from the station of Venlo, and also stops at the stations of Blerick and Horst-Sevenum, which is the station where the Greenport Bikeway ends. Furthermore, there also is an hourly Intercity train towards Germany, where it passes the cities of Mönchengladbach, Düsseldorf and ends in Hamm.

5.1.4. Current forms of Shared Mobility

Shared mobility is a broad concept, under which a lot of different transport modalities can be classified. One of these possibilities is Mobility as a Service, abbreviated MaaS. MaaS is the idea that multiple forms of (shared) mobility are made available to the user, accessible by using one app or program (Hensher et al., 2021). Throughout the Netherlands, multiple MaaS pilots have been started, including in Limburg (Ministerie van Infrastructuur en Waterstaat, 2019). The main goal of the MaaS pilot in Limburg is to experiment with the concept of MaaS, but also in stimulating cross-border sustainable mobility (Ministerie van Infrastructuur en Waterstaat, 2019). For the province of Limburg, the pilot has been rewarded to Arriva, who developed the Glimble app. This pilot has started in July 2021, and is planned to be continued until December 2022 (Zuid Limburg Bereikbaar, n.d.).

Throughout the municipality, multiple types of shared mobility are available. At the train station of Venlo, the OV-fiets is available (Schepers, D., personal communication, 17-3-2022). At the train station, shared cars are also made available by GreenWheels (Schepers, D., personal communication, 17-3-2022).

On a higher scale level than the municipality, deals have also been made with regards to shared mobility. A public tender has been granted to Mobility Mixx, that will offer a package of (shared) mobility options for the entire region of North-Limburg, including the municipality of Venlo (Mobility Mixx, n.d.; Schepers, D., personal communication, 17-3-2022). This has been done in cooperation with Trendsportal, which is the regional collaboration of North-Limburg in the field of mobility.

There are also collaborations on an international scale in the field of shared mobility. This includes the Unplug & Go project form the SHAREURegio. The SHAREURegio is a collaboration between the Dutch municipalities of Roermond and Venlo, and the German Kreis Viersen and Stadt Mönchengladbach (SHAREURegio, n.d.). Currently, the fleet of shared vehicles from the Unplug & Go projects consists out of 27 cars, 7 of which are stalled in Germany, whilst 20 are stalled in the Netherlands. A share of the Dutch fleet can be found in Venlo. Based on an interview with Torsten Merkens, who is a teacher at the Fachhochschule Aachen, there is enough demand for an expansion of the Dutch fleet of vehicles. The Fachhochschule Aachen is a partner of the SHAREURegio in this project (SHAREURegio, n.d.). Torsten could also explain the relatively large differences between the Dutch and the German side of the project. These differences are mostly based on the societal impact of COVID-19 and their additional lockdowns. At the moment of the interview, the German fleet was only available for companies and businesses that had joined the initiative, whilst in the Netherlands the fleet was also made available for individuals. In the interview, it was stated that the German fleet was planned for expansion to the desired amount of 20 vehicles. Only when the desired amount of 20 vehicles is reached on both sides of the border can proper monitoring be started. According to Torsten, no further expansions of the system will take place until exact information is obtained by monitoring.

5.1.5. Overview of all the Mobility Networks

A complete overview of all the mobility networks can be found in a map in Figure 16. This map is created using QGIS. The QGIS map will also be used for further research in this thesis, for instance in the process of deciding the potential hub-locations.

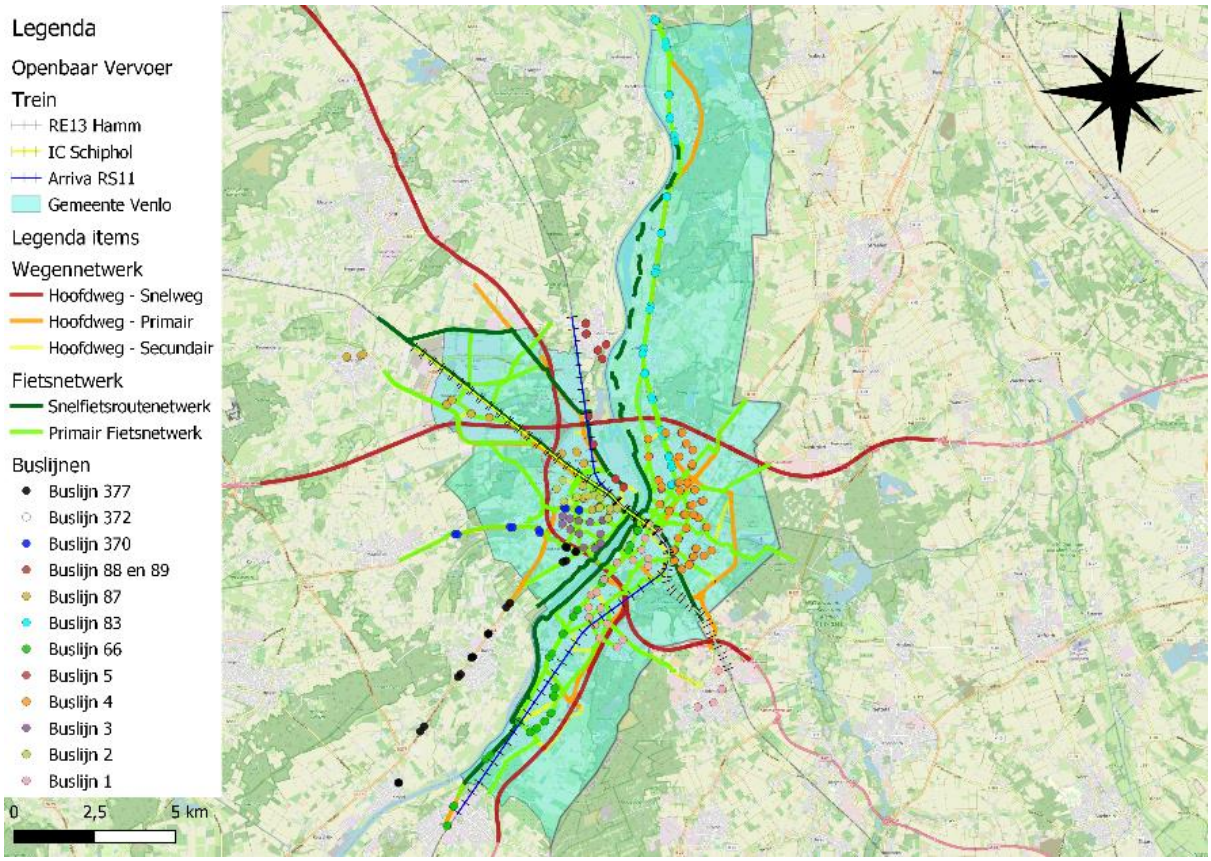

Figure 16: All mobility networks in the municipality of Venlo. Source: author's own

5.2. What are the potential locations and their characteristics for mobility hubs in the municipality of Venlo?

In the process of deciding the potential locations for mobility hubs, there is looked at multiple scale levels in the municipality of Venlo. Close to the city center of Venlo, analyses have been done on a community-scale, which is based on the communities as stated by the CBS. These are the communities in the neighborhoods Venlo-Centrum, Venlo-Zuid, Venlo-Oost-Noord, Blerick-Midden and Blerick-Noord. Outside of these neighborhoods, analyses have been done on the scale of neighborhoods, based on the neighborhoods of the CBS. They are the remaining neighborhoods of Venlo and Blerick, the industrial area Trade-port, and the villages of Tegelen, Steyl, Belfeld, Boekend, Hout-Blerick, Arcen, Lomm and Velden. Based on these analyses, many potential locations for mobility hubs have been chosen. Due to time constraints, there has been chosen to keep the neighborhood hubs out of the equation. They are with some of their functions taken into account by the network hubs. A map of the municipality of Venlo, which contains all the recommended mobility hub locations, can be found in Figure 17.

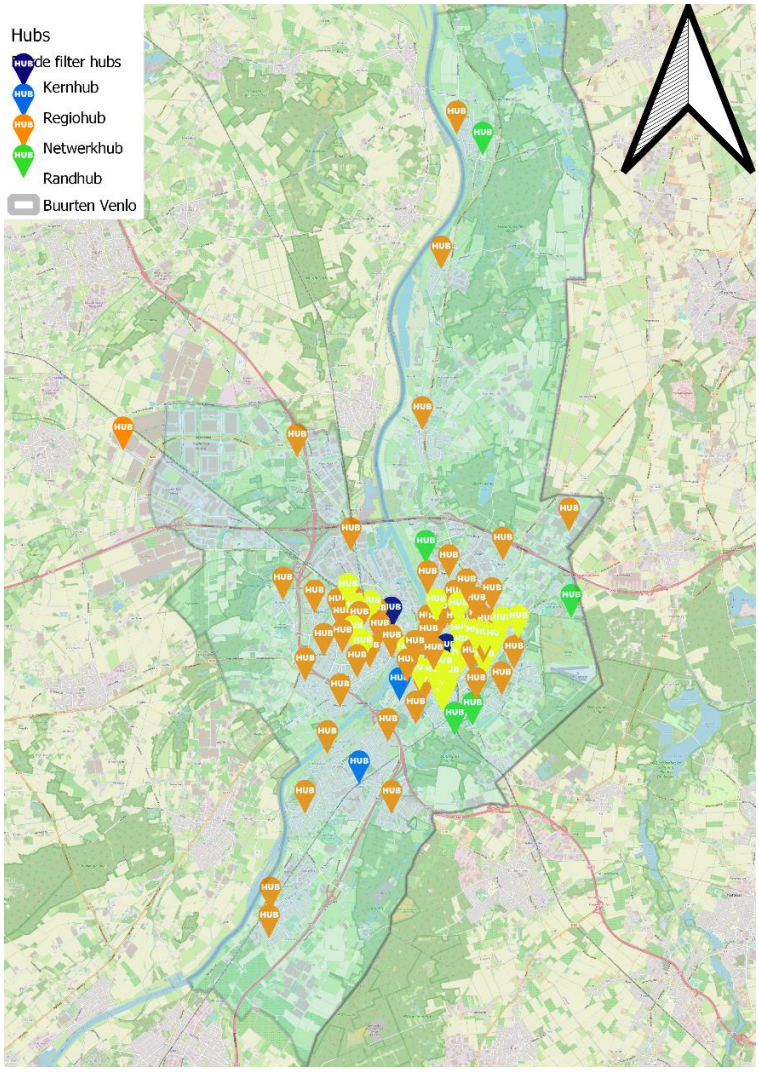

Figure 17: First recommendations for hub locations. Source: author's own

The central hubs can be found at the stations of Venlo and Blerick. Due to the fact that these are the only two locations in the municipality that have public transport going out of the region, they are the only valid options for central hubs. Moreover, an international train departs from the Venlo Station every hour. The Venlo station thereby grants access to all bus lines throughout the municipality, whilst the Blerick station grants access to most bus lines within 300 meters of walking from the station.

There were two potential regional hubs recommended throughout the municipality: the station of Tegelen and the Veilingterrein. Purely looking at the definition of a regional hub, only the station of Tegelen is valid, because of the regional train going to Nijmegen and Roermond. The Veilingterrein is made a regional hub as well, but it is a remarkable situation. This location mostly fits the definition of a P+R hub, but because of the large destinations around it, it is classified as a potential regional hub. Moreover, this large terrain is currently subject for redevelopment, which means that it entails more options for the development of a mobility hub.

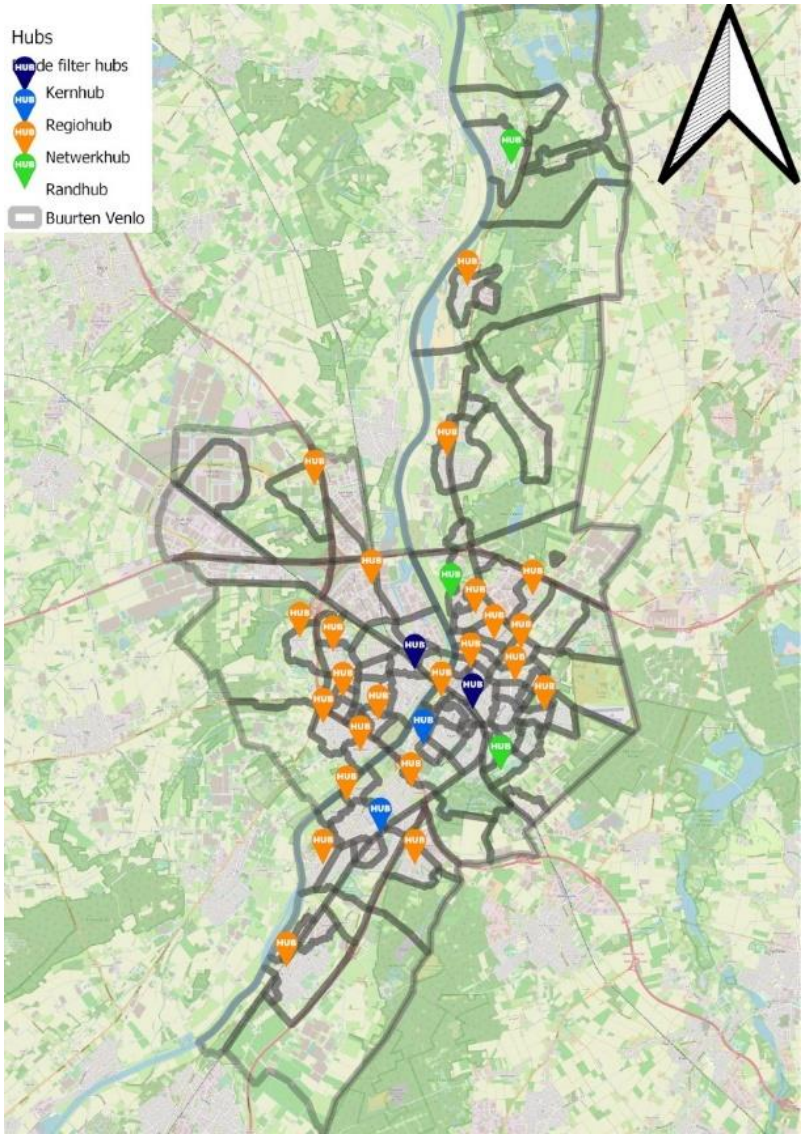

Figure 18: Eventual recommended potential mobility hub locations. Source: author's own

On the field of P+R hubs, there has been made a difference between a tourist function and a pure P+R function. The P+R function is further explored in this research. The idea is the same as the idea of a mobility hub given by Studio Bereikbaar (2020). Their idea is to catch and redirect incoming car traffic early towards their hub, to provide the last-mile with either shared mobility or a shuttle bus (Studio Bereikbaar, 2020). Potential locations for these types of hubs are the parking terrains of the VVV-Venlo stadium, the Canon office campus and the Kasteeltuinen (Castle gardens) in Arcen. The main downside of these locations is that they are all property of external organizations, which means that the municipality should cooperate in order to make use of these locations. P+R hubs with a tourist functions are also a possibility, but that possibility is not further explored in this research.

The last hub type of which there has been looked at potential locations, are the network hubs. Network hubs can serve as point of departure as well as a point of arrival (Van Heugten & Picavet, 2021). Initially, 53 locations for network hubs were given throughout the municipality. However, this amount of locations is way too large for the entire municipality, and has afterwards been reduced to a total of 21 network hubs.

One other method that had been used to reduce the amount of mobility hub locations in the municipality are isochrone analyses. For each mobility hub type, a maximum walking distance had been established, based on Molster (2016). Mobility hubs in overlapping areas were thereby removed to reduce the total amount. The walking distances applied were 1500 meters for central hubs, 1000 meters for regional hubs, and 300 meters for network hubs (Molster, 2016). Because of the standalone function of the P+R hubs, they were not taken into account with the isochrone analysis. The eventual list with recommended mobility hub locations can be found in Table 2.

id	Type Hub	Buurt	Wijk	Stad/Dorp	Toeristisch	Locatie
1	Netwerk	Rosarium	Venlo-Cen.	Venlo	Nee	Nolensplein
2	Kern	Smeliënk.	Blerick-N.	Blerick	Nee	Station Blerick
3	Kern	Hogekamp	Venlo-O-N	Venlo	Nee	Station Venlo
4	Netwerk	Rijnbeek	Venlo-O-N	Venlo	Nee	Rijnbeek
5	Netwerk	Tichelarij	Venlo-O-N	Venlo	Nee	De Tichelarij
6	Netwerk	Stlbrg-N	Venlo-O-N	Venlo	Nee	Nieuw Stalberg
7	Rand	Stlbrg-N.	Venlo-O-N	Venlo	Ja	Groote Heide
8	Regio	Bdrt.Hgrhf	Venlo-Zuid	Venlo	Nee	Veilingterrein
9	Netwerk	Hgrhf-O.	Venlo-Zuid	Venlo	Nee	Nedinscoplein
10	Rand	O&B Molen	Venlo-Zuid	Venlo	Ja	Bovenste Molen
11	Netwerk	Bosserhof	Tgln-Cntrm	Tegelen	Nee	Bosserhof
12	Regio	Tgln-Cntrm	Tgln-Cnrtm	Tegelen	Nee	Station Tegelen
13	Netwerk	Maasveld 2	Tgln-Cntrm	Tegelen	Nee	Maasveld
14	Netwerk	O.d. Heide	Op de Hei	Tegelen	Nee	Op de Heide
15	Netwerk	Klstr-drp	Steyl	Steyl	Nee	Steyl
16	Netwerk	Kern Blfld	Belfeld	Belfeld	Nee	Muldersplein
17	Netwerk	Annak.-O.	Blrck-Zd.	Blerick	Nee	Annakamp
18	Netwerk	Meuleveld	Hout-Blrck	Hout-Blrck	Nee	Meuleveld
19	Netwerk	Kern Ht-Bl	Hout-Blrck	Hout-Blrck	Nee	Hout-Blerick
20	Rand	Vogelbuurt	Venlo-O-Z	Venlo	Nee	Stadion de Koel
21	Netwerk	Craneveld	Venlo-Nrd.	Venlo	Nee	Craneveld
22	Netwerk	't Zand	Venlo-Nrd.	Venlo	Nee	Genooi
23	Rand	Genooy	Venlo-Nrd.	Venlo	Nee	Canon
24	Netwerk	Het Ven	Het Ven	Het Ven	Nee	't Ven
25	Netwerk	Kern Bknd	Boekend	Boekend	Nee	Boekend
26	Netwerk	Vossener-M	Vossener	Blerick	Nee	Vossener
27	Netwerk	Klngrbrg-Z	Klingerbrg	Blerick	Nee	Klingerberg
28	Netwerk	Krn Velden	Velden	Velden	Nee	Velden
29	Netwerk	Kern Lomm	Lomm	Lomm	Nee	Lomm
30	Rand	Kern Arcen	Arcen	Arcen	Nee	Kasteeltuinen
31	Netwerk	Floriade P	Trade-Port	Venlo	Nee	Villa Flora
32	Netwerk	Grt-Boller	Trade-Port	Venlo	Nee	Groot Boller

Table 2: List of potential hub locations. Source: author's own

5.3. What are the characteristics of the target population in the area of potential mobility hub locations?

During the decision-making process for the potential locations of mobility hubs, there is also looked at the characteristics of the concerned neighborhood of community. The characteristics that are looked at are:

- Total population count
- The division of the population by age
- The average income in the neighborhood/community
- The division of population by education level

These characteristics are given for every community in the entire municipality of Venlo. This is opposed to the division in scale that was used for the decision making of the potential hub locations. However, when a certain part of the municipality has been analyzed on the scale of the neighborhoods, these characteristics will also be given in that specific analysis. For the example of Velden, the analysis for the potential hub location has been done on the scale of the neighborhood. But, due to the preparative work that was done for this research, all relevant statistics and characteristics of the communities inside the neighborhood Velden have already been searched and noted down.

For the purpose of comparing, all the statistics for the entire municipality of Venlo have also been looked up. The total population of the municipality is 102.128. The average income of the entire municipality is €24.800,- (AlleCijfers.nl, n.d.). This average income is slightly lower than the average income of the province of Limburg, which is €26.406,- (AlleCijfer.nl, n.d.). The division and total population sorted on income level can be found in Table 3.

Education level	Percentage	Population
Lower educated	34.5%	26.850
Middle educated	41.9%	32.560
Highly educated	23.6%	18.370

Table 3: Education levels for the municipality of Venlo. Source: AlleCijfers.nl (n.d.)

To explain the table there shall be further elaborated on the education levels. Lower educated refers to people that have a certificate on of at most MBO1, practical education, entrance-education, the first three years of HAVO or VWO, or elementary school (AlleCijfers.nl, n.d.). Middle educated people have finished their middle school on HAVO or VWO level, or the career-education on MBO2, MBO3 and MBO4. Highly educated citizens have finished an education on HBO or WO (university) level (AlleCijfers.nl, n.d.).

Knowing some of this information is important in understanding some of the competences of citizens (Shove et al., 2012). They can give a generalized insight in some of the influences on the competences, such as income or education levels. However, because this research has not done surveys or other data collections methods on the citizen level, a real insight in the competences, as well as the meanings, has not been gathered yet.

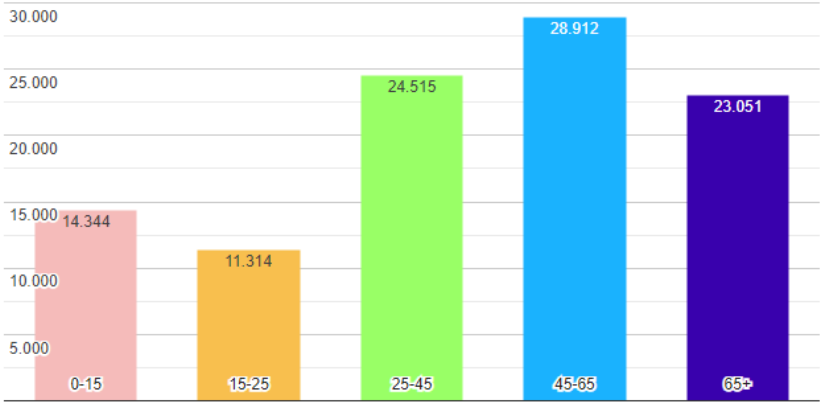

Figure 19: Inhabitants of Venlo divided by age group. Source: AlleCijfers.nl (n.d.)

5.4. Which transport modalities and facilities accommodate the target groups of the potential mobility hub locations?

The subsequent transport modalities and facilities are based on the results from the participatory planning game. One of the foremost important things to mention is that the arrangement of a mobility hub is mostly based on location-specific variables and demand. However, the participatory planning game has given some general guidelines that can be followed when planning a mobility hub. These ideas are further supported by Van Heugten and Picavet (2021) and Studio Bereikbaar (2020). These sources respectively made the mobility hub strategy for the province of Limburg and the strategy for the Brainport area around Eindhoven.

The played participatory planning game has looked at 8 potential locations trough the municipality. These locations were split into four unknown locations, and four known locations. The four known locations were:

1. Station Blerick
2. Veilingterrein
3. Maasveld
4. Muldersplein

The four locations that were kept unknown for the players were:

1. Glazenapplein
2. Nieuw-Stalberg
3. Meuleveld
4. Genooi

However, due to the manner in which the game was played, it was possible for the players to discover the real location in the municipality. This only happened for the location Glazenapplein. After the players discovered this, they were even more convinced that their recommendation for the facilities of the mobility hub was good.

The locations that were kept unknown for the players were played with “characters”. The intention of a “character” was to mimic a specific type of citizen. Every round (playing an unknown location) the “character” would give the demands, ideas and personality that the player should utilize. This method was chosen to see whether differences would come up in the results, when the players were playing as a citizen as opposed to a specialist. The players played the rounds in which the location was known beforehand as themselves, using their own knowledge, insights and ideas.

The main finding from the participatory planning game in the first place is that there is no main route to take for arranging a specific mobility hub. Every hub has a different location, with a different target population and facilities in the area. However, there are some general rules of thumb that came forward from the game, that can be applied in a more broad sense. These rules of thumb are:

The expectation is that mobility hubs will most often be used by younger citizens. These are students, junior employees and middle schoolers to a certain extent. The main reasons that are given for this are that younger generations generally do not own their own car. Furthermore, it is expected that younger generations are more keen to use alternatives to the car, such as shared mobility.

Apart from the age groups of the users, the education levels of the users should also be taken into account. The expectation from the game is that higher educated citizens are more eager to use mobility hubs than other education levels. In this context, higher educated are seen as HBO or university-educated citizens. The reasons given for this are that higher educated are more sensitive for transition, think better about the consequences of their acts and doings, and are less stuck in a structure.

From the surveys, conducted before, during and after the game, can be deducted that younger generations, which are higher educated, are the most likely to make use of a network mobility hubs. In this, it is expected that middle schoolers would most often use the shared bicycle when making use of the mobility hubs. This has mostly to do with them not being in possession of a drivers license of any kind. The expected transport modality for students is not supported by a large portion of the surveys, but at least by a majority of them. It is expected that students would be most likely to make use of shared scooters. For all the working groups, it is expected that the shared car would be the most used modality.

Based on these results, it can be stated that it would be best to take into account the demands of younger generations, which are higher educated. Thereby, it is dependent on the nearby population which transport modalities should be provided. In the case of many students, shared scooters are the recommended transport modality, whilst for older target populations, shared cars are recommended.

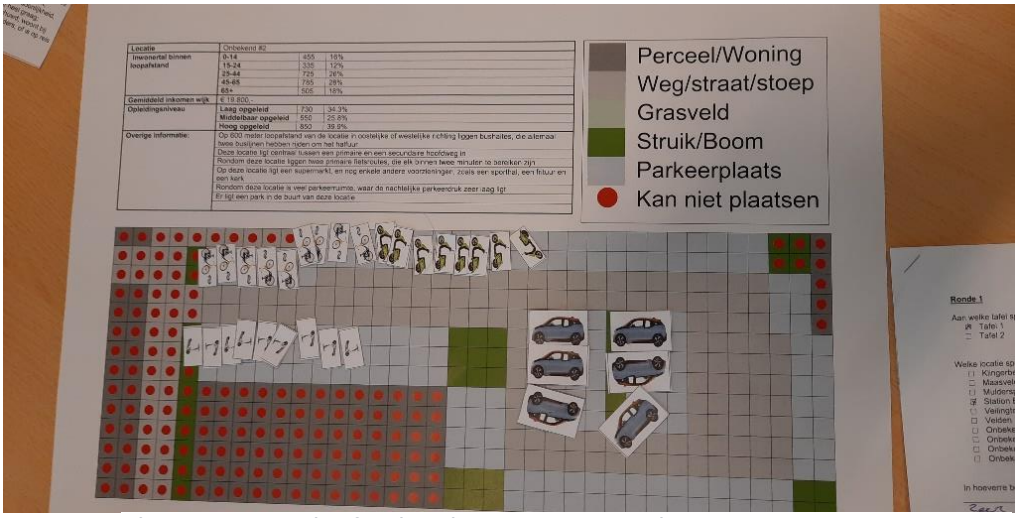

Figure 20: Example of a played game. Source: author's own

Apart from the discussion on the way mobility hubs should be arranged, a discussion also emerged about which strategy to use in doing so. Thereby, the question was whether there should be focused on the demand from the target population in the area, or should there be focused on the ambition form the municipality. By playing into the demand of the target population, and thereby implementing the system gradually, there is a chance of there being too little supply for the demand in the area. This leads to potential losses for the market party which provides the shared vehicles. However, in keeping the supply of shared vehicles in an area little, it becomes harder to monitor the real demand for shared mobility in the area.

The results from some of the played rounds will be further elaborated below. These are the rounds that were played in the own role of the players, meaning that all the locations were known during play. This means that the first four locations that an advise on how to arrange their modalities are the following:

1. Station Blerick
2. Veilingterrein
3. Maasveld
4. Muldersplein

All of the other recommended locations throughout the municipality (see Chapter 5.2) will be arranged using the rules of thumb from above.

The recommended transport modalities for the train station of Blerick are shared cars, scooters and bicycles. These are corresponding to the suggested transport modalities from central hubs as suggested by van Heugten and Picavet (2021). The Blerick station has been chosen as a central hub, due to the currently existing mobility streams in the location including the intercity train to Schiphol. When developing a mobility hub in this location, is remains important to keep in mind that there is enough parking capacity for the current users of the station. The current parking capacity is already put under strain, and a potential mobility hub should not worsen this.

The second location for a mobility hub that was looked at using the game, was the Veilingterrein. The Veilingterrein is a large open space near the southern entrance to the city of Venlo, the hospital, a HBO school and a middle school. For this location, it is important to mention that a development plan for the area has already been made, which makes realizing a mobility hub in the area a challenge. However, there is still looked at the location, because it is an empty space of land open for development, meaning that the players could go for their fullest imagination and ideas. This location was also arranged with all the transport modalities. However, these were more spread out over the terrain. The shared bikes were placed closely to the middle school, as well as all over the terrain to provide an on terrain transport service. Shared cars were placed close to the hospital, due to the working groups there. Shared scooters were placed close to the HBO school.

The third location that was discussed was in the Maasveld, in Tegelen. The suggestion from the second sub-question was to develop a network hub. However, this idea was overruled in the game, in which the players opted to go for more smaller, spread out (neighborhood) hubs. One of the reasons for this decision was that the originally suggested location would be developed at the cost of green. The main statement from all of the players thereby was to never develop a mobility hub at the cost of greenery. Furthermore, because of the stretched nature of the neighborhood, were the spread out hubs suggested. These hubs would be placed at the main roads of the neighborhood, leading to faster departures from the neighborhood. Fitting with this strategy of the main traffic gates to the neighborhood is the transport modality shared cars. Also, shared scooters were suggested.

The last location that was looked at was the Muldersplein in Belfeld. The main finding from this discussion was that the more remote places in the municipality at this point do not favor from the benefits of mobility hubs. Due to the large distances, shared scooters and shared bikes immediately become fruitless. This only leaves the shared cars as a potential transport modality, but due to the remote location, most of the inhabitants of these villages are already owner of their own car. Therefore, the shared car is fruitless too.

These suggestions are developed with the ideas of Shove et al. (2012) kept in mind. The materials can be mapped out almost perfectly, on which the potential locations had been based. Based on the locations and their characteristics, as well as the results of the participatory planning game, these recommendations have been developed.

5.5. To what extent is the development of a mobility hub network obstructed by potential hindrances?

There are some factors and facets that the municipality should be keeping in mind when they plan on developing a network of mobility hubs. By doing so, they enlarge the chances of success of the mobility hub network.

5.5.1 Common problems with mobility hubs

One of the first and foremost important conditions that should be met when developing a network of mobility hubs, is proper flanking policy. When flanking policy is not properly used, mobility hubs will immensely struggle with fulfilling their potential on the area of commuting traffic (Studio Bereikbaar, 2020). One of the parts of flanking policy can be to reduce the accessibility for cars on the most visited locations. This discourages the use of a car towards those destinations, thereby stimulating citizens to take the alternatives that are offered by mobility hubs (Studio Bereikbaar, 2020). Another form of flanking policy is to cooperate with large employers, which could also increase the success chances of mobility hubs. In this cooperation, employers and companies can stimulate their workers to make use of the mobility hub network, as opposed to the employee's own car (Van Heugten & Picavet, 2021). Furthermore, the infrastructural accessibility of the mobility hub should be sufficient as well. There should be decent access to public transport, and good access to either the bicycle or the road network (Studio Bereikbaar, 2020). Alongside these points, it is important that the location of the mobility hub looks inviting, friendly and welcoming. Under this fall ideas like sufficient workspaces, a public park, but also the principle of social security (Studio Bereikbaar, 2020). The last advice that has been given by Studio Bereikbaar (2020) is to ensure that the transport modalities offered by the mobility hub drive frequently, or are sufficiently supplied at the hub location. In line with the good supply of transport modalities lies the idea of reserving your vehicles. Results from a survey conducted by van Heugten and Picavet (2021), it has become clear that the ability to reserve a vehicle is one of the main conditions for citizens to start making use of mobility hubs. This furthermore reduces or removes the fear that citizens arrive at the mobility hub, but that there is no vehicle left for them anymore. This fear can also be reduced by ensuring that the mobility hub is more easily recognized (Van Heugten & Picavet, 2021). One of the solutions for the recognition of mobility hubs can be to implement proper signing, to make use of logos. Another solution might be to make use of Mobility as a Service (MaaS).

5.5.2 Citizen Participation

Citizen participation is another important aspect that should be kept in mind when developing a network of mobility hubs. Upsides and downsides of citizen participation have been discussed in multiple discussions with the same colleague. The main point of these discussions always was to which extent citizens participation was really beneficial for the development of certain policies or projects in the municipality. The colleagues main point was that at some point during the citizen participation process, the citizens will cross over from the common interest towards their own interest (anonymous, may 2022 and June 2022, personal communication). This statement corresponds with the principle of Not In My Back Yard (NIMBY). NIMBY is the idea that citizens are willing to cooperate in certain innovations, projects or policies. However, they are willing to cooperate as long as they themselves do not suffer from the negative externalities (Boyle et al., 2019). During the discussions with the colleague, the main case or example that was discussed was that of greenery in the streets. Citizens want more greenery in the streets. It makes the streets look nicer, and is more environment friendly. Because of this, they go to the governmental institution that can realize the greenery in the streets. The governmental body starts working on a plan, and offers their first idea to the citizens: Half of the parking spaces in the street will be transformed to greenery. At this point, the dilemma for the citizens is between more greenery and less parking

capacity for cars, and vice versa. In the case of NIMBY, citizens still want more greenery. However, at this point, they will start discussing with their respective governmental institution that parking spaces may be turned green. However, when choosing the parking spaces to turn green, the citizens all prompt to turn their neighbors parking space into greenery, and not their own. This means that they still want the greenery in the streets, but they are not willing to make any offers for it themselves. The main point on citizen participation that this paragraph aims to make, is that the division between common interest and personal interest is really small, and is a severe problem to citizen participation.

Citizens participation has another problem: the problem of inclusiveness. While it is not the same, it does have some similarities with transport poverty. The municipality mostly has contact with overarching citizen groups when they make use of citizen participation. These include neighborhood councils, or groups of multiple retail-owners in the city center. (Heutjes, L., van der Beek, J., personal communication, May 2022). Earlier researches have already pointed out that lower educated citizens and younger citizens are the most frequently missing population groups in the citizen participation project (Oude Alink, 2021). However, results from earlier sub-questions have pointed out that younger population groups belong to the most frequent users of mobility hubs. This leads to a skewed citizens participation process. Younger population groups are the most frequent users, but they have more or less the smallest say in the development of mobility hubs. Furthermore, because the citizen participation process is mostly conducted with older target populations, it becomes harder to fully realize a network of mobility hubs. At this point, you aim to create support for an initiative that most of the citizen participation contenders do not (often) make use of. This also holds true for lower educated population groups.

Citizen participation is an important aspect in understanding the competences and meanings of citizens (Shove et al., 2012). By going into dialogue with citizens, their standpoints and ideas are kept into account more. Moreover, their way of thinking becomes more clear, giving a better insight in their meanings (Shove et al., 2012). Citizens are more acquainted with their neighbors, which can give a view of people with disabilities or other restraints. This enforces the understanding of the competences (Shove et al., 2012). The last part, the materials, can be discovered with asking the citizens during the participation process (Shove et al., 2012).

5.5.3 Institutional structure

The corresponding report written for the municipality of Venlo has a place internally in the organization that it falls under. The municipality of Venlo has a institutional structure in multiple layers. The first layer is the Structuurvisie (Structural Vision) Venlo 2040, which was agreed upon by the municipality council in June 2021 (Gemeente Venlo, 2022). Three domains have been formed in line with the Structural Vision. These domains are Fier op Venlo (Proud on Venlo), the Economische Structuurvisie (Economical Structural vision) and the Omgevingsvisie (Environmental vision). These three domains are the second layer of the structural pyramid (Gemeente Venlo, 2022). The third layer of the pyramid consists out of six programs:

1. Gezond en Actief Venlo (Healthy and Active Venlo)
2. Leefbaar Venlo (Livable Venlo)
3. Grenzeloos Venlo (Boundless Venlo)
4. Welvarend Venlo (Prosperous Venlo)
5. Centrumstad Venlo (Central City Venlo)
6. Circulaire en Duurzame Hoofdstad (Circular and Sustainable Capital)

The fourth and final layer of the organizational pyramid are the organizations' products. These are the developments and innovations in the public space. An example of these would be the placement of electric charging poles for cars throughout the municipality. The pyramid of the organizational structure can be found in Figure 21.

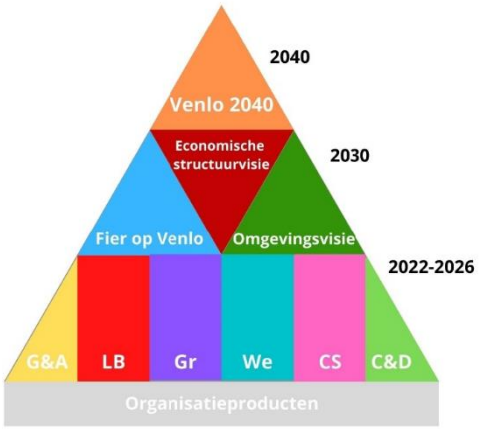

Figure 21: Organizational pyramid for the municipality of Venlo. Source: Gemeente Venlo (2022)

For each of these layers there are set-up documents, that also include the 'rules' and standards for documents of the municipality. All of the written documents have to fulfill these rules and standards, but should also be within the guidelines of the Structural Vision Venlo 2040. To ensure that each policy document complies these rules and standards, a lot of internal communication is required. Hereby, there can be thought of communication with council members, aldermen or project leaders and their teams. Due to this large need for internal communication, the writing process of policy documents is hardened.

5.5.4 Market Parties

At the start of the internship, an idea was planted to conduct a market consultation to discover whether market parties would be willing to step into the project. However, the market consultation was not conducted in the end, due to time restraints. Nonetheless, it remains an important aspect for the eventual success of a network mobility hubs in the municipality, and it is therefore mentioned here. Looking at market parties is important, because the municipality itself does not provide shared vehicles, and is dependent on market parties to do so. However, the problem may arise that market parties are unwilling to step into the project, due to too little profit margins or other reasons.

5.5.5 Mobility poverty

Mobility or transport poverty is a subject, to which a lot of attention can be given. This research uses both mobility poverty and transport poverty interchangeably, but they both refer to the same definition. The concept of mobility poverty can be described as follows: mobility poverty is the extent in which certain individuals have less mobility and accessibility than others, where in some cases the mobility and accessibility is below a socially acceptable level (Martens, 2016). According to van Heugten and Picavet (2021), mobility hubs can have a role in decreasing transport poverty. They mostly refer to people that are less wealthy, or people that are disabled.

Alongside with the discussion about mobility poverty, there is also the discussion about social justice. Social justice is the morally proper distribution of goods and bads among members of society (Martens, 2021). In this definition, the goods and bads are the what question. The members of a society are the question of who. The last question that remains with this definition is the question about what is morally proper (Martens, 2021).
The what question can be answered with accessibility. However, there is no clear manner in which accessibility can be measured (Martens, 2021). The who question can be answered with members of society, alongside the question who do we count in and who do we count out? Moreover, how are members distinguished within a community. For that, there are many dimensions to shape an individuals accessibility: age, gender, income, location of origin, car ownership, disabilities or ethnicity (Martens, 2021). Some of these factors are outside the field of transport planning, such as racism or how women are treated in a society. The last question that remains is the question of what is a morally proper distribution of accessibility amongst members of society. Equality is not the answer to this, as there will always be inequality (Martens, 2021). Other options are to aim for equalization; to reduce the gap between the different groups; or to provide accessibility based on

needs. Therefore, it can be stated that every member of a society should have access to a minimal level of accessibility, but it remains unclear about where the threshold lies for minimum (Martens, 2021). In this, for governmental institution there is a moral obligation to improve accessibility when it is below the threshold. This moral obligation does not exist when the accessibility is above the threshold.

This research has kept mobility poverty mostly in mind when choosing the locations for mobility hubs. For this, the access to public transport for the entire municipality was measured, with an isochrone analysis of 500 meters walking from each bus stop, and a 1000 meters walking from each train station. By doing so, this research has aimed to gain an insight in which locations in the municipality are below the threshold for minimal accessibility, and where the accessibility can be improved.

6. Conclusions

To achieve the research goals, the following research question has been composed: *What are the conditions and characteristics of potential hub locations in order to develop a mobility hub network in the municipality of Venlo?* This research question has been answered on the basis of five sub-questions.

The first sub-question, *what does the current mobility network of the municipality of Venlo entail*, has been answered by looking at the four different modes of transport in the municipality. The first of these is the bicycle network, which looked at the bicycle highways and the main bicycle routes. The second network that was looked at, was the road network. Thereby, there was looked at the highways, main roads and secondary roads. The third network that was looked at, was the public transport network. There was looked at the bus stops, train station and the bus- and train lines. For the last network, there has been looked at the shared mobility options throughout the municipality. At the moment of writing, all shared mobility in the municipality are shared cars and shared scooters. The shared bikes are the OV-fiets, the shared bike provided by the national agency for trains. These bikes can be found at the train stations. The shared cars can be found in the shopping center, or the Nedinscoplein near the municipality's office. The results of this sub-question have all been put in a QGIS-file, and have played a significant supporting role in choosing the potential locations for mobility hubs in the municipality.

The second sub-question, *what are potential locations and their characteristics for mobility hubs in the municipality of Venlo*, and the third sub-question, *what are the characteristics of the target population in the area of potential mobility hub locations*, are both answered using the same methodology. Firstly, there was looked at the characteristics of the population, after which a decision has been made on the potential mobility hub location. These locations are supported by the results of the first sub-question. By using QGIS, analyses have been conducted to discover the places in the municipality with the least access to transport networks.

The fourth sub-question is *which transport modalities and facilities accommodate the target groups of the potential mobility hub locations?* The results of this sub-question were obtained with the use of a participatory planning game. The main finding of the game was that the facilities and modalities are dependent on each subsequent mobility hub, and everything that is specific for this location. However, there are rules of thumb that arose from the results of the game. These rules of thumb are:

- Higher educated are expected to use mobility hubs more often, because they are not stuck in systems, and think better about the consequences of their actions.
- Younger target groups will use mobility hubs more, because they usually do not have their own car, and are more open to different transport options.
- Students are most likely to use shared scooters, whilst all older target groups are expected to make use of shared cars.

The fifth and final sub-question is: *to what extent is the development of a mobility hub network obstructed by potential hindrances?* Thereby, some hindrances have been given and further elaborated upon. The first of these are the common characteristics a mobility hub should have. These include accessibility, social security and availability. Furthermore, exploiting market parties should be kept in mind when developing a network of mobility hubs. Moreover, transport poverty is an important aspect that should be kept in mind, because mobility hubs can play an important role in tackling the problem of transport poverty. This sub-question has also looked at the difficulties that arise with citizen participation. This includes concepts of social exclusion and NIMBY. Lastly, this sub-question has looked at the problems internally to the municipality of Venlo. The main bottleneck in the municipality is the need for extensive internal communication, which is time-consuming.

The main research question of this research is: *What are the conditions and characteristics of potential hub locations in order to develop a mobility hub network in the municipality of Venlo?* To answer this question, it can be said that the conditions are mostly dependent on the inhabitants around the hub location, as well as the hub's users. Young adults and higher educated are more likely to use mobility hubs, which makes them an important condition for the success of a network mobility hubs. The most important characteristics are accessibility, recognition and social security of the hub. Moreover, to answer this research question based on the conceptual model, it can first of all be stated that the materials, meanings and competences are different for every individual. The general rules of thumb for developing a network of mobility hubs can be applied to Practice Theory as well (Shove et al., 2012). The meaning for a mobility hub network is more appeasing for higher educated, as they are not stuck in systems as often as lower educated. For younger population groups, mobility hubs provide a solution, because they generally do not have sufficient material; their own car; to fulfill their daily commutes (Shove et al., 2012). The last rule of thumb, students are more likely to use shared scooters as opposed to cars, has also to do with the competences. Not all students are in possession of a driver's license, but they might have access to a scooter's license (Shove et al., 2012).

6.1 Recommendations to the municipality of Venlo

From the methodology onwards, this research has been focusing on an amount of approximately thirty mobility hubs. However, due to reasons, this amount has been decreased to thirteen mobility hubs. Moreover, these thirteen are not spread out over the entire municipality, but they are contained within Venlo, Blerick and Tegelen. The first reasons for this choice was that thirty mobility hubs still was a too large amount of hubs to realistically realize in the municipality. In due time, this amount can still be reached, but it is way too much for a first recommendation. Thereby, the discussion of ambition or demand arises. Will the hubs be developed based on the demand throughout the municipality, or will they be developed based on the ambition of the municipality. The amount of thirteen is way smaller than the initial amount of thirty, which is done with the idea to strategize based on demand. Furthermore, the amount of mobility hubs is decreased even more based on the expected demand in the municipality. Smaller towns, such as Arcen, Lomm, Belfeld, Boekend, Steyl and Hout-Blerick, have less need for mobility hubs. This is due to the inhabitants of these towns already owning their own cars, and mostly having a higher income. About these towns can be said that the implementation of mobility hubs may reduce the car ownership and usage. However, humans are creatures of habit. Therefore, they are expected to keep using their cars, and not making use of the new mobility hubs. Moreover, there has not been definitive proof that citizens really get rid of their car when shared mobility becomes available. Lastly, the expected users of mobility hubs are students and young adults, who in most cases are in possession of the so-called student travel product, which means that they have free access to public transport as long as they obtain an education diploma within ten years. This discourages them to make us of shared mobility, unless it becomes a part of the student travel product. These are the reasons there is chosen for the eventual amount of thirteen mobility hubs, which can all be found in Blerick, Tegelen and Venlo. Apart from these locations, one hub can be found at the Brightlands Campus in the Tradeport area. A map, which contains all 13 recommended mobility hub locations, can be found in Figure 22.

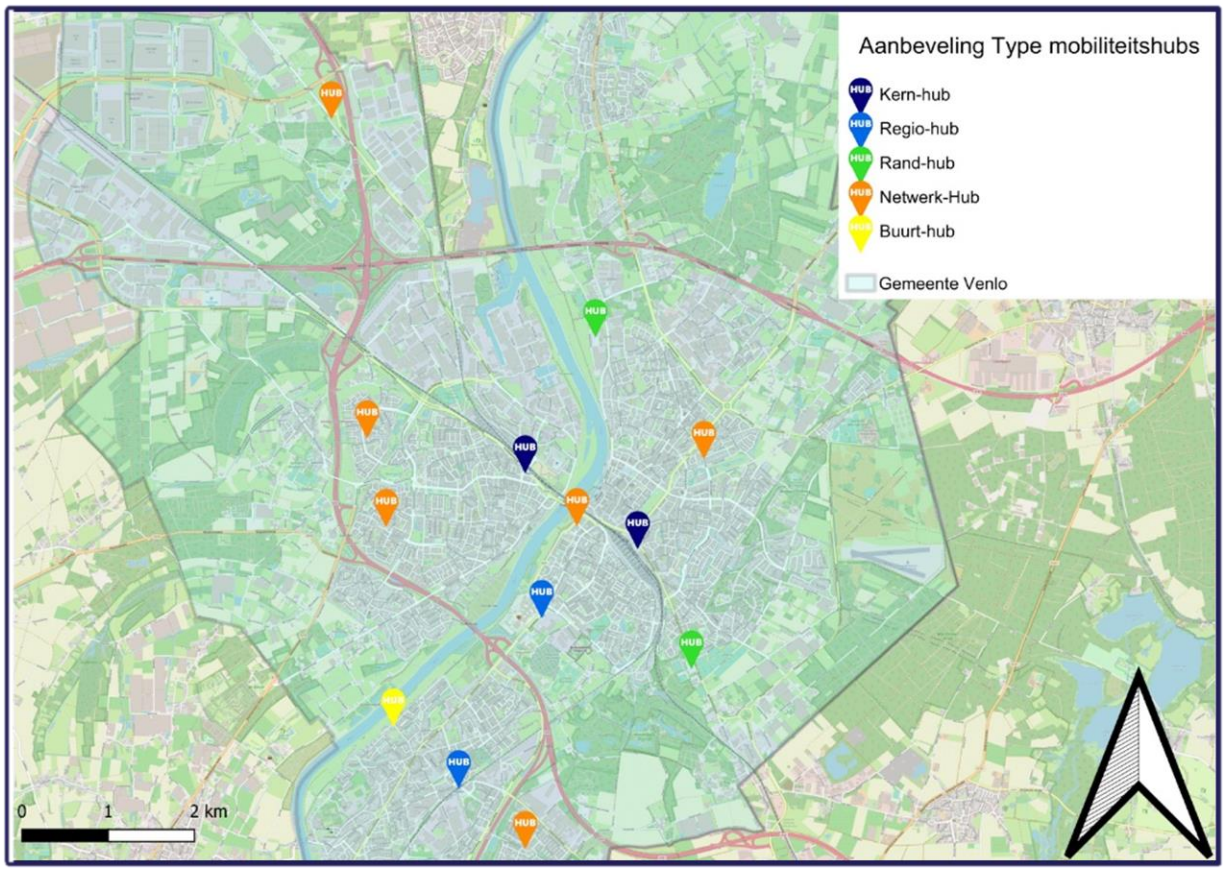

Figure 22: Recommended locations for the development of mobility hubs. Source: author's own

The recommendations hereby is that in the central hubs, there are shared scooters as well as shared bikes. For the central hub of Blerick, shared cars are also recommended. This is not the case for the central hub at station Venlo, due to the lack of public space that is available for parking cars near the station.
The two regional hubs in the municipality both have different characteristics and different functions. However, both regional hubs can be developed with shared scooters, shared cars and shared bikes. This is because both of these hubs have enough public space to them to place all those transport modalities.
The P+R hubs in the municipality have the function to direct incoming car traffic off early. Because of the function of these hubs, it would be an unwise decision to offer shared cars. When this is done, it should be regulated in a way that the cars can only exit the city, and not go further inwards to the center. Shared bikes and shared scooters are suggested for P+R hubs, as an alternative to the car. Another idea would be to implement a shuttle bus from the P+R hub towards the center.
The network hubs differ from each other throughout the municipality, thus they differ in their respective transport modalities. The only recurring trend for all network hubs is that no shared bikes are offered, because the network hubs are placed in locations where shared bikes would not have an added value. Further recommendations for network hubs are largely based on the distance to the city center. Closer to the center tends to have the shared scooter, further away is recommended to have shared cars. Moreover, shared scooters are the ideal modality when talking about students and educational locations. Students are more likely to use shared scooters, due to their driver's license situation.
Based on van Heugten and Picavet (2021) and Studio Bereikbaar (2020), there are other important aspects that should be kept in mind when mobility hubs. One of the main aspects that increase the chances of success for mobility hubs is recognition. This suggestion is not only given in these reports, but is also agreed upon with the mobility hub expert from the province of Limburg. When talking

about recognition, there can be thought of signs on street lanterns, or a recognizable logo on the shared vehicle fleet. Examples of these ideas can be found in Figure 23.

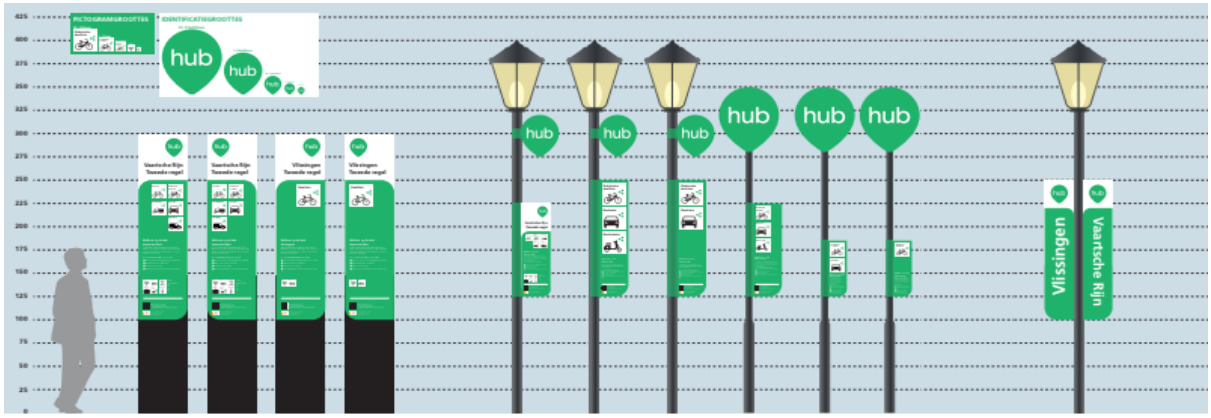

Figure 23: Signage for mobility hubs. Source: Province of Limburg (2022)

Another aspect that should be kept in mind is the social security. Mobility hubs should be safe, which includes proper illumination, or them being placed on locations that are not too remote or abandoned.
Lastly, the problem of behavior still remains significant. The municipality can play a huge role in this when making use of flanking policies. Hereby, there can be thought of cooperating with large companies or employers or neighborhood councils. Other stimuli could also be used, such as extra bonuses when a second car is sold, or a discount on the tariffs of shared transport for specific target groups.

Then, there needs to be talked about strategy. Which strategy is the most effective for implementing a network of mobility hubs. This needs further research, but some of the strategies will be elaborated upon in the following part. The first of these strategies is the consideration of which type of travels the mobility hubs will facilitate in. Is there a focus on the daily commutes of individuals, or will there be a focus on the tourist sector. Because of the larger amount of literature available on the daily commutes, these are looked at. There are a few mentions for the tourist use of a mobility hub, but these options were not further explored. One of the suggestions thereby is to have further research on the function of mobility hubs: tourist use versus daily commutes.

The second strategy is on the area of the implementation of the mobility hub network. Will there be started on the bigger locations, or on the smaller locations. Both locations have their arguments to start with them. Large locations have a lot of daily travelers and commuters, and therefore have more potential users. Smaller locations can play an important role in tackling the problem of transport poverty, but also in decreasing the pressure on the parking capacity. The dilemma of ambition also is important in choosing which location to develop first. The demand at large locations will increase faster than at smaller locations. My own opinion on this is that starting at large locations is more beneficial, because threshold for users is achieved quicker, which also increases the recognition of the system better.

Lastly, this report will suggest the phases in which the mobility hubs can be implemented. Hereby, current developments in the municipality are kept in mind. Currently, shared cars are already available on the Nedinscoplein. When a network of mobility hubs will be implemented officially, this location mostly misses the signing and other recognition. The expected users are employees of the surrounding offices, but there is also a decent amount of housing in the area, of which inhabitants can also use the mobility hub. These are the reasons that there is little need for developing facilities for shared bikes or shared scooters.

Another recent development in the municipality is the implementation of GoSharing scooters. These will be available around the city center, as well as on the Brightlands campus. This makes the Brightlands campus hub also a hub that can be developed quickly. Due to its users and remote location, the Brightlands campus hub is only benefited by shared scooters. Due to GoSharing, these will already be implemented. This also adds to the need to supply students with shared scooters for going towards the campus, thus adding the need for mobility hubs at the stations of Venlo and Blerick. Alongside these four hubs, it is also recommended to start with implementing one smaller hub. For this, there can be thought of locations in Blerick, in the Vossener or the Klingerberg. This hub can be developed in a pilot form, to see whether there is support amongst the citizens. When it has become clear that these hubs are functional and are sufficiently used, the network can be expanded. The recommendation for this is to first implement the other smaller hubs in Venlo and Blerick. These areas are then already acquainted with the concept, which means that this development should be picked up upon fairly quickly. When this proves successful, the network can be expanded towards Tegelen. When this is done, all recommended mobility hubs are developed, except the P+R hubs, which are a special case. Whilst they are mentioned in the network, but they are not necessarily an integral part of it. Due to the significantly different function of the P+R hub as opposed to the other types of hubs, P+R hubs can be implemented independently. However, because the P+R hubs both need cooperation with other, large stakeholders, they can best be developed when the circumstances arise for it. Both of the P+R hubs' function is the same, as well as their recommended shared vehicle fleet. It is completely dependent on the situation which P+R hub would be the best to develop first.
The last mobility hub that is not mentioned, is the Veilingterrein. This is a large hub, because of the many destinations around it. This makes it a regional hub. However, because of the large parking terrain, this location can also fulfill the role of a P+R hub. This hub should be developed with proper cooperation. Development of this hub can be started as soon as the network seems to be successful. This is roughly at the same time as the other hubs in Blerick, Venlo or Tegelen.

7. Discussion

7.1. Reflection

Whilst this research is scientifically based, it is in essence a practical research. This report is based on an initial advice report for the municipality of Venlo, with a recommended strategy for the development of a network mobility hubs throughout the municipality. This means that a lot of the answers and results are based on a more practical standpoint, as opposed to a more scientific standpoint. This problem is dealt with by connecting the practical advices to currently existing literature on the subject. Scientific literature that was supportive for the practical results of this research, include literature about transport poverty, definitions of mobility hubs and different types of mobility.

A lot of literature is available on mobility hubs and their respective networks. However, really successful examples of mobility hub networks are not plentiful, at least in the Netherlands. Some begin to arise, but there are too little to use their policy or development plans as a guideline. Most of the used literature are advisory reports on how a network of mobility hubs should be developed, but do not have concluding proof that their method is best.

This research has also mostly kept to the advisory report of van Heugten and Picavet (2021). Whilst there were other advisory reports, the van Heugten and Picavet (2021) report was written for the province of Limburg. It was therefore used most commonly in this research, to ensure that the results of this research remain externally valid, at least for the province of Limburg.

Moreover, Reckwitz' (2002) and Shove et al.'s (2012) Practice Theory is used to understand the practice of daily commutes, in order to better understand the behavior that comes looking when developing mobility hub networks. Therefore, the practical results are all used to better understand a behavioral pattern that is relevant for mobility hubs and their respective networks. However, because of the given reason of keeping the report internally to the organization, to prevent creating expectations throughout the municipality, this research has not gone in depth. This means that the last bit of understanding the materials is not wholly discovered. This includes smaller facts, like a citizen's amount of cars and bikes. The meanings and competences are just scratched upon, and have given little findings. The main point that this research tries to make is that every mobility hub needs to be developed based on their location. The information of each location is only necessary when an actual start is being made with the development of the mobility hub network. Therefore, some of the results that could further strengthen this research are not obtainable for this case of Venlo, because the implementation of a network mobility hubs is far from being realized.

Also, as stated in the validity and methodology chapter, there are some struggles with the reliability of this research. Once more, this can be explained by the need to keep the research and report internally to the organization. In order to achieve the most reliable findings, surveys have been conducted amongst as many colleagues in the mobility department as possible. More general questions, such as the expected transport modalities for each population group, can be made more reliable when the opportunity arises to go public with the idea and the results.

Apart from these, this research also has a lot of its sub-questions answered based non-scientific sources. This is due to the practical approach of this research. Information about the population or transport networks could easily be accessed through the sources of the municipality. Whenever possible, these findings were supported by scientific literature. Thereby, most research questions contribute to understanding the practice of an individuals' daily travelling, by supplementing to either the meanings, materials or competences.

The only exception to this is the second sub-question, which decided the potential locations for mobility hubs. This sub-question is based on the principle of mobility poverty, which is further elaborated upon in the fifth sub-question. When deciding the potential locations for mobility hubs in the municipality, there is looked at the areas that have the least access to public transport. Also, there has been looked at which areas are furthest away from the major transport networks.

Therefore, whilst this research is mostly practical, its answers are all based in science. This is either on the field of understanding the practice of daily travelling, or on the field of decreasing mobility poverty throughout the municipality.

7.2. Recommendations

Because this research is held back by the inability of implementation at this point, further research should be conducted alongside the implementation of the mobility hub network in the municipality. This would mean that this research should be made public to the inhabitants of the municipality, which would immediately help in understanding the meanings and competences better (Shove et al., 2012). Moreover, that would give the last necessary insights in the materials available to citizens. Thus, when going publicly with this report, and thereby the development of a network of mobility hubs, the research should focus more on individuals. This current research has remained general, and could be strengthened by further research on the opinions, meanings and ideas of individuals.

Also, further research should be done on the tourist function on a mobility hub. Some literature has some ideas for the tourist use of mobility hubs, but the ideas have not been explored thoroughly. This also includes the discussion about which type of tourist hub. Is the hub your point of departure or your point of arrival. Both of these types have their examples in the municipality: departure can be any camping or holiday park, arrival can be at the nature area's at the German border, or near Arcen. Moreover, the idea of a tourism-based mobility hub was discussed with colleagues during the internship. Thereby, most seemed supportive of the idea. Further research on this subject is therefore advised.

More research is also recommended on the field of transport or mobility poverty. This research only scratched the very top of the surface on the subject. Further research could discover a lot of its parts more in-depth. These include researches on which manner each dimension in which inequality can occur: gender, age, income, location of origin, car ownership, disabilities or ethnicity. Each of these dimension could have their own, subsequent research. But on the social justice part, research could also be done on what is morally proper, or what the minimal threshold is for accessibility. As mentioned by Martens (2021), accessibility can not be measured in the same way that the capacity of the sewage or electricity network can be. Additional research on the measurement of accessibility could therefore also be done. Moreover, the philosophical part of morally proper distribution of accessibility could also be further strengthened with more in-depth research.

From the results of the participatory planning game, it became clear that some specialists were of the opinion that some population groups should not be taken into account as much as others when talking about their mobility and accessibility. One of these groups were the kids, which are dependent on their parents or guardians for transport. The other group that was kept in mind less were the elderly, under the argument of "they do not go very far". Further research on this problem is also required, to ensure that transport poverty does not occur due to generalized opinions internal to the governmental institution.

8. References

AlleCijfers.nl, (n.d.). *Informatie gemeente Venlo.* Retrieved from https://allecijfers.nl/gemeente/venlo

Arriva, (2021). *Lijnnetkaarten,* Dienstregeling. Retrieved from https://www.arriva.nl/limburg/reisinformatie/dienstregeling.htm?regioid=153857

Bell, D. (2019). Intermodal mobility hubs and user needs. *Social sciences*, *8*(2), 65.

Boyle, K. J., Boatwright, J., Brahma, S., & Xu, W. (2019). NIMBY, not, in siting community wind farms*. Resource and Energy Economics, 57*, 85-100.

Bras, J., & Bollinger, B. (2018). Improving quality of life through transit hubs. *Delivering city value and prosperity with mobility oriented developments, Report Arcadis*.

Centraal Bureau Statistiek (CBS)., (n.d.). *GIS-datafile municipalities, neighborhoods and communities.*

Den Haag weert nieuwe aanbieders deelscooters vanwege overlast: "Dit gaat zo niet langer". (2022, 2 February). Omroep West. Retrieved on 6 April 2022, from https://www.omroepwest.nl/nieuws/4524336/den-haag-weert-nieuwe-aanbieders-deelscooters-vanwege-overlast-dit-gaat-zo-niet-langer

Finck Michèle, Lamping, M., Moscon, V., & Richter, H. (2020). *Smart urban mobility : law, regulation, and policy* (Ser. Mpi studies on intellectual property and competition law, v. 29). Springer. https://doi-org.ru.idm.oclc.org/10.1007/978-3-662-61920-9

Gemeente Venlo, (2021). *Ambitiedocument Fiets*. Retrieved from https://venlo.bestuurlijkeinformatie.nl/Document/View/c32982e9-6ef6-4da5-8421-22bb9396a591

Gemeente Venlo (2022). BEWUST BETER BELEID: *Handboek voor de beleidsambtenaar van de gemeente Venlo*. [Proces description]

Gemeente Venlo, (n.d.). Samen werken aan het parkeren van morgen, Ambitiedocument Beleidsplan Parkeren.

Geurs, K., Münzel, K., (2022). A multidimensional mobility hub typology and inventory. *SmartHubs Deliverable D 2.1*.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research (pp. 105-117). Thousand Oaks, CA: Sage.

Harbers, A., & Stellen, D. (2016). Smart Transportation, PBL, the Netherlands.

Hensher, D. A., Ho, C. Q. & Reck, D. J. (2021). Mobility as a service and private care use: Evidence from the Sydney MaaS trial. *Transportation Research Part A,* 145, 17-33. https://doi.org/10.1016/j.tra.2020.12.015

Institution for Transportation and Development Policy. (ITDP)., (23 June, 2017). *TOD Standard*. Retrieved from https://www.itdp.org/2017/06/23/tod-standard/

Jacbos, T., Bressers, R., van der Beek, J., Peters, L., (2013). *GVVP – Deelnota Dynamisch Verkeersmanagement.*

Koedood, J. (2020). *Future mobihubs as social connector for the neighbourhood: About positive friction, quantum mechanics and your mother.* TU Delft http://resolver.tudelft.nl/uuid:39e32d21-e63b-444b-8fe7-86f33ee1053e

Koszowski, C., Gerike, R., Hubrich, S., Götschi, T., Pohle, M., & Wittwer, R. (2019). Active mobility: bringing together transport planning, urban planning, and public health. In *Towards User-Centric Transport in Europe* (pp. 149-171). Springer, Cham.

Leiber, T., Stensaker, B. & Harvey, L. C., (2018). Bridging theory and practice of impact evaluation of quality management in higher education institutions: a SWOT analysis. *European Journal of Higher Education,* 8(3), 351-365.

Lenferink, S., G. Arciniegas, A. Samsura, L. Carton (2016) Integrating geodesign and game experiments for negotiating urban development. Research In Urbanism Series, 4(1), chapter 6 in Research in Urbanism Series 4:70-92 S. Nijhuis, S. Zlatanova, E. Dias, F. van der Hoeven & S. van der Spek (eds). DOI: https://doi.org/10.7480/rius.4.844

Martens, K. (2021). People-centered transport planning*. Lecture in course Urban Networks: Mobility and* Accessibility, retrieved from Brightspace.

Martens, K. (2016). *Transport justice: Designing fair transportation systems.* Routledge

Meekes, J., (28 September, 2021). Mobility and Accessibility in Nijmegen*. Lecture in course Urban Networks: Mobility and Accessibility*, retrieved from Brightspace.

Mills, J., Harrison, H., Franklin, R. & Birks, M., (2017). Case study research: Foundations and methodological orientations. In Forum Qualitative Sozialforschung/Forum: Qualitative Social Research (Vol. 18, No. 1, p. 17). DEU (http://www.qualitative-research.net/index.php/fqs/article/view/2655)

Ministerie van Infrastructuur en Waterstaat, (2019). *MaaS-pilots, optimaliseren van het mobiliteitssysteem.*

Mobility Mixx wint aanbesteding Duurzaam Deelvervoer in Noord-Limburg | Mobilitymixx. (n.d.). Mobility Mixx. Retrieved on 21 March 2022 from https://mobilitymixx.com/nl/node/446

Molster, A., (November 2016). *Slimme inzet van voetgangerskennis maakt meer mogelijk.* Molster Stedenbouw. Retrieved from https://www.cvs-congres.nl/e2/site/cvs/custom/site/upload/file/papers_final/2016/cvs16_081.pdf

Oude Alink, V. P. R. (2021). *RESPONS VAN DE INWONER: Een onderzoek naar de inclusiviteit van burgerparticipatie binnen de Regionale Energiestrategie* (Master's thesis).

Over ons – SHAREUregio. (n.d.). SHAREUregio. Retrieved on 21 March 2022 from https://shareuregio.eu/over-ons/

Pearson, M. & Coomber, R., (2010). The challenge of external validity om policy-relevant systematic reviews: a case-study from the field of substance misuse. *Addiction, 105*(1), 136-145. DOI: https://doi.org/10.1111/j.1360-0443.2009.02713.x

Reckwitz, A., (2002). Toward a Theory of Social Practices: A Development in Culturalist Theorizing. *European Journal of Social Theory, 5*(2), 243-263. https://doi.org/10.1177/13684310222225432

Ryghaug, M., & Toftaker, M. (2014). A transformative practice? Meaning, competence, and material aspects of driving electric cars in Norway. *Nature and Culture*, *9*(2), 146-163. https://doi.org/10.3167/nc.2014.090203

Sabbaghi, A. & Vaidyanathan, G., (2004). SWOT analysis and theory of constraint in information technology projects. *Information systems educational journal,* 2(23), 1-19.

Samsura, A., (16 November 2021). Theoretical Perspectives on Game Simulation and Experiment for collaborative action in Spatial Planning Process. *Lecture in the course Urban Future Lab,* Retrieved from Brightspace.

San Diego Forward. (n.d.). *Mobility Hubs.* Retrieved from https://www.sdforward.com/mobility-planning/mobilityhubs

Shove, E., Pantzar, M., & Watson, M. (2012). *The dynamics of social practice: Everyday life and how it changes*. Retrieved from https://uk.sagepub.com/en-gb/eur/the-dynamics-of-social-practice/book235021#description

Studio Bereikbaar, (2020). *Ontwikkelplan Regionale Mobiliteitshubs: Regio Eindhoven*.

Urban Design Studio. (2016). Mobility Hubs: A reader's guide. http://www.urbandesignla.com/resources/docs/MobilityHubsReadersGuide/lo/MobilityHubsReadersGuide.pdf

Van Heugten, J., Picavet, D., (28-9-2021). *Doelgroepen- en drijfverenanalyse deelmobiliteit,* Zuid-Limburg Bereikbaar. Ideate.

Van Thiel, S. (2014). *Research methods in public administration and public management: An introduction*. Routledge.

Venlo in Cijfers, (n.d.). *Venlo in Cijfers*. Retrieved from https://venlo.incijfers.nl/dashboard

Vennix, J. A. M. (2016). *Onderzoeks-en interventiemethodologie*. Pearson.

Witte, J., Alonso-Gonzáles, M., & Rongen, T. (May, 2021). *Verkenning van het concept Mobiliteitshub*. Kennisinstituut voor Mobiliteitsbeleid. Retrieved from https://www.kimnet.nl/binaries/kimnet/documenten/rapporten/2021/05/31/verkenning-van-het-concept-mobiliteitshub/Rapport+Verkenning+Mobiliteitshub_pdfA.pdf

Yin, R.K., (2014). Case Study Research: Design and Methods (5th edn.). Thousand Oaks, CA: SAGE.

Zuid Limburg Bereikbaar, (n.d.). *Mobility as a Service (MaaS) reizigersapp: Glimble by Arriva*. Retrieved from https://www.zuidlimburgbereikbaar.nl/nl/onze-aanpak/werkgeversaanpak/mobility-as-a-service-maas-glimble-by-arriva/