Spatial effects in the ex-ante evaluation of urban underground transportation infrastructure projects

A study of the gap between the perceived spatial effects of Het Souterrain and the spatial effects incorporated in already conducted CBAs

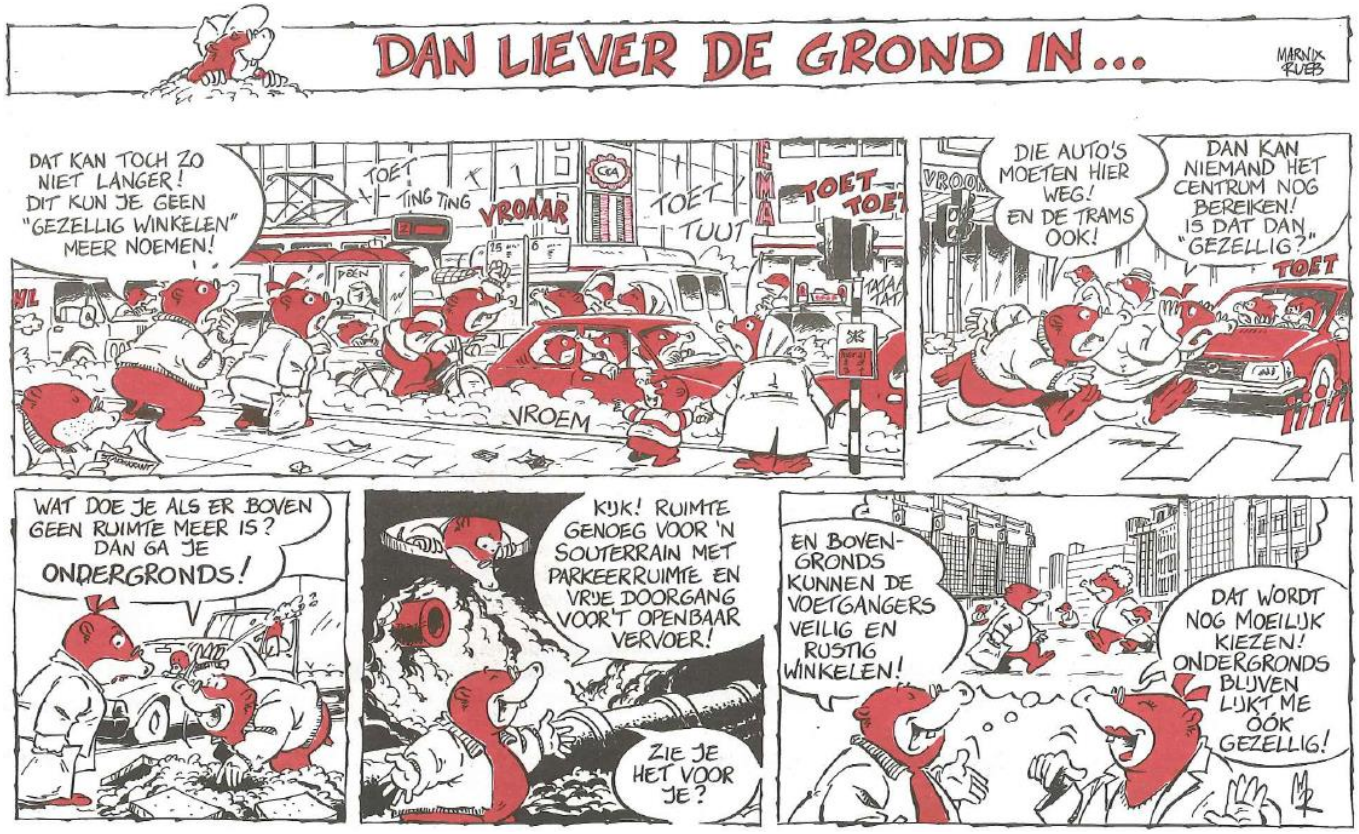

Figure 1: Cartoon by Marnix Rueb (1992)

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Preface

This Master thesis is the final part of the Master Systems Engineering, Policy Analysis and Management at the TU Delft, and therefore the last step in my study career. I have to acknowledge that this Master thesis was the most difficult part of my study, but it also was the most informative part. In my Master thesis I have been able to apply a lot of tools, knowledge and techniques I learned during my study. I am glad that this Master thesis could be linked to an internship with the municipality of The Hague. I learned a lot about working for the municipality and how a large municipality deals with projects. Unfortunately, it was not possible to participate in one of these projects, but I got a reasonably clear picture of how the Department of Traffic of the municipality of The Hague operates due to chats in the flex spaces and the weekly department chats on the Tuesday mornings.

I like to compare my graduation process as a ride in a rollercoaster. If I had to design my graduation process as a rollercoaster in the game RollerCoaster Tycoon, it would be a very long one with many curves and loops. In addition, at the end of the ride the roller coaster cart would move backwards to the starting point. When one starts this ride one is afraid not knowing what to expect, but in the end one is happy to have done it, because one may have overcome a certain fear, got a kick of adrenaline, and will never be the same person as before one got in. I am glad with the results and I hope that my study, besides my graduation, will be of use in the field of decision-making of transportation infrastructure projects in urban areas. This study would not have been completed with success without the support of others.

First of all, I would like to thank my graduation committee for their valuable comments, support and ideas. I especially thank Niek Mouter for his substantive comments, patience, support, enthusiasm and inspiration. I know I have not been the most easy student to coach, but he showed me that if you choose your own path and if you keep believing in yourself you will succeed. I also want to thank the Department of Transport and Logistics of the Faculty of Technology, Policy and Management who allowed me to use its facilities one day a week.

Second, I want to thank the Department of Traffic of the municipality of The Hague for enabling me to link this research with an internship. I especially would like to thank Bart Roels for his patience, support and flexibility.

Third, I thank the persons who agreed to be interviewed in the framework of my thesis. This study would not be there without their detailed information.

Fourth, I like to thank Leni Buisman. Editing the thesis and scientific paper has made the story a lot better and more understandable.

Fifth, I would like to thank my parents, brothers, sister and friends for your love and motivational support during my study and during this Master thesis. You have always believed in me and this gave me the confidence I needed.

Last, I like to thank Lisanne. Without your love and support I couldn’t have finish the thesis.

Summary

Introduction

Underground transportation infrastructure projects are a possible solution to the increasing demand for transportation, limited space and congestion in urban areas. In addition, these kinds of projects are in line with the need for improvement of the quality of the public urban space. Nowadays, when a municipality applies for funding with the national government for the construction of a transportation project a Cost-Benefit analysis (CBA) has to be conducted by an independent party (Ministry of Infrastructure and the Environment, 2012). In the CBA the costs and benefits of the project on the society are balanced and therefore provides the CBA decision-makers with important policy information; whether the benefits outweigh the costs of the project compared to the state of affairs in which no project is build- also called the reference case (van Wee & Rietveld, 2014). The use of the CBA in the decision-making process leads to a better decision-making process (Mouter, Annema, & van Wee, 2013), but it is unclear which exact role a CBA plays in the decision-making process, because politicians also have other reasons than the results of a CBA for reaching a go/no-go decision (Rienstra, 2008; Eijgenraam, Koopmans, Tang, & Verster, 2000; Annema, 2014; Mackie, 2010). A limitation of the CBA is that not all (welfare) effects can be taken (properly) into account in a CBA (Mouter, Annema, & van Wee, 2015). CBAs are often incomplete because project effects are uncertain, unknown or difficult to monetize (Mouter, Annema, & van Wee, 2013). Under these conditions, political decisions based on results of a CBA study are based on incomplete policy information.

Research problem

This research focuses on (intangible) spatial effects of urban underground transportation infrastructure projects. In this thesis spatial effects are defined as *effects on the representation/embodiment/manifestation of the social functions (living, working, recreation and nature) in an urban area (residential areas, working places, areas reserved for leisure) as a result of underground transportation infrastructure.* A potential danger of a CBA for urban transportation infrastructure projects is that spatial effects are not taken into account (properly) and therefore the CBAs are incomplete. Therefore, there is a chance that decisions are taken by decision-makers concerning the construction of such projects on the basis of incomplete policy information.

The goal of this study is to gain insight into the (intangible) spatial effects of urban underground transportation projects and the possible incorporation of these spatial effects in the ex-ante evaluation of those projects. In that case, the policy information during the decision-making process of these projects will become more complete and more informed political decisions can be taken about the construction of urban underground transportation infrastructure projects in the Netherlands.

This research has been conducted on the basis of an in-depth case study: Het Souterrain. Het Souterrain is a tram tunnel located in The Hague under the Grote Marktstraat/Kalvermarkt (on -2), with a length of 1,250 meters, connecting the central railway station of The Hague with Prinsegracht. Above the tram tunnel (on -1) a parking of 500 places has been built. Het Souterrain is chosen as a case study, because it is a prototype urban underground transportation infrastructure project, ensuring an improvement of the public transport system and an improvement of the quality of the public space (Leijten, 2015). A second reason for using Het Souterrain as a case study is that the project ended

several years ago, which increases the feasibility of identifying the spatial effects resulting from this project. The main research question of this thesis is:

What are the perceived spatial effects of Het Souterrain, are these spatial effect incorporated in already conducted CBAs and why can particular spatial effects not (yet properly) be incorporated in CBAs?

In the in-depth case study interviews with experts and a desk research took place to get an answer to the main research question. Perceptions of spatial effects have been assessed with the help of interviews. I chose to study perceptions of spatial effects because I wanted to give a broad exploration of the possible spatial effects of an urban underground transportation infrastructure project. So far as I know not much is known about spatial effects of urban underground transportation infrastructure projects in the Netherlands and therefore not a quantitative research is conducted using surveys, in which an in-depth quantitative research is done into the realized spatial effects. Eighteen people were interviewed by me in the framework of this thesis. The respondents all played a role in the decision-making process of Het Souterrain (the municipality of The Hague, politicians, HTM, Rover, De Kern Gewond, and the Ministry of Transport, Public Works and Water Management[1]) or were Property developers in the private sector. In literature and already conducted CBAs is searched to spatial effects and how these spatial effects are incorporated in already conducted CBAs.

Perceived spatial effects and the role of spatial arguments in the decision-making process of Het Souterrain

The perceived spatial effects of Het Souterrain are:

- A tram-free environment in the Grote Marktstraat has been realized, which is good for cyclists and pedestrians.
- The centre of The Hague has received an impulse and has got new, lively and vibrant.
- An enhanced, more attractive and safer (living) environment have been realized.
- An improved quality of the public space has been realized in the centre of The Hague.
- Private investments have been made possible, improving the adjacent real estate of shops, offices and residential houses.
- Het Souterrain has given an impulse for the chain stores located in the Grote Marktstraat for improvement and (re)development of their real estate.
- The shop and residential climate have got an impulse/An increased attractiveness of housing, offices and cultural facilities has been realized.
- The nightlife of the centre of The Hague has been boosted.
- Many small businesses have moved or have gone bankrupt due to the prolonged construction and poor accessibility.

Spatial arguments were used during the decision-making process of Het Souterrain by the municipality of The Hague to support the go-decision of Het Souterrain. The expected spatial effects, which were used as spatial arguments, had not been calculated via policy analysis tools, but they had a more

[1] The Ministry of Transport, Public Works and Water Management (Ministry of TPW) is in 2010 merged with the Ministry of Housing, Spatial Planning and the Environment, into the Ministry of Infrastructure and the Environment (Ministry of I&E).

qualitative role in the argumentation of the municipality. According to respondent 10 the transportation arguments were not sufficient enough for the go-decision of the project. Spatial arguments were needed to support the realization of Het Souterrain.

Gap between perceived spatial effects of Het Souterrain and already conducted CBAs

Spatial effects in already conducted CBAs are identified on base of eighteen CBAs of underground transportation infrastructure projects, infrastructure projects and urban area development projects. It is hard to see the similarities between the perceived spatial effects of het Souterrain and the spatial effects in already conducted CBAs, for example because different names are used for the same effects. Four spatial effects fall (in full) under a spatial effect incorporated in already conducted CBAs. Many of the perceived spatial effects of Het Souterrain are aggregated effects. These effects may therefore fall (fragmentary) under multiple spatial effects already incorporated in already conducted CBAs. The majority of the perceived spatial effects of Het Souterrain are already incorporated in already conducted CBAs, often under a different name or in (an)other spatial effect(s). Two perceived spatial effects do not quite match with the spatial effects incorporated in already conducted CBAs:

- Private investments were made possible which improved the adjacent real estate of shops, offices and residential houses.
- Het Souterrain has given an impulse for the chain stores located in the Grote Marktstraat for improvement and (re)development of their real estate.

These perceived spatial effects are quite similar to each other, and can therefore be taken together. The (merged) spatial effect is called: *'The spatial development of real estate, resulting from private investments in this real estate'*. This spatial effect isn't (yet properly) incorporated in already conducted CBAs, but according to multiple respondents (3, 4, 5, 6, 7, 8, 11, 12, 14, 15, 16, 17 and 18) this is an important spatial effect of Het Souterrain.

Explanation why particular spatial effects are not (yet properly) incorporated in CBAs

The CBA is a well-known and well-developed policy analysis tool. If spatial effects are not (yet properly) incorporated in already conducted CBAs it is highly likely that this has to be the result of issues that are difficult to overcome by CBA analysts. Two possible explanations, why the spatial effect *'The spatial development of real estate, resulting from private investments in this real estate'* isn't (yet properly) incorporated in CBAs, are:

- The unpredictability of private investments in specific real estate.
- The difficulty of attributing private investments in specific real estate to an individual urban underground transportation infrastructure project.

The unpredictability of private investments in specific real estate

According to multiple respondents (3, 4, 5, 9, 12, 14, 16, 17 and 18) it is difficult to predict in advance with close certainty if and in which extent private investments in real estate will happen as a result of an urban underground transportation infrastructure project. There are multiple unforeseen circumstances (external effects and social developments) that may lead to different outcomes. However, when a few conditions are met by a municipality, the chance is higher according to multiple

Property developers (15, 17, 18) that private investors will invest in high degree in real estate. These conditions are:

- A high quality urban public space should be created, which results in the belief and the securing of trust in a specific location among Property developers.
- There should be a good co-operation relation between the municipality and the Property developers.
- There should be a long-term vision of the municipality which results in a secure investing climate for Property developers.
- The vision of a municipality should be carried out.

The difficulty of attributing private investments in specific real estate to an individual urban underground transportation infrastructure project

According to multiple respondents (9, 12, 16 and 18) it is difficult to attribute private investment in real estate entirely to an individual urban underground transportation infrastructure project. Other projects and spatial interventions may have an influence on the spatial development of an urban area. In addition, also unforeseen circumstances (external effects and social developments) can have an influence on the (spatial) outcome of an urban underground transportation infrastructure project. The (extent of) private investments in adjacent real estate are one of the possible (spatial) outcomes of such projects.

It is difficult to include the spatial effect *'The spatial development of real estate, resulting from private investments in this real estate'* in CBAs, due to the two problems mentioned above.

Generalization to other cases

It is important to know in which extent the results of this research can be generalized to other cases and which lessons can be learned from this study. It is difficult to generalize the spatial effect *'The spatial development of real estate, resulting from private investments in this real estate'* to other urban underground transportation infrastructure projects. Multiple factors influence whether a Property developer will invest in real estate as a result of an urban underground transportation infrastructure project. It can be ruled out that private investments always will occur as a result of urban underground transportation infrastructure projects. It is more plausible to state that chances are greater that private investments will be made in adjacent real estate as the result of an urban underground transportation infrastructure project if certain conditions are met. These conditions are:

- Real estate has to be present in the vicinity of the underground transportation infrastructure project. If real estate is not present in the vicinity of an underground transportation infrastructure project, it will not be possible at all for the Property developers to invest in this real estate.
- The underground transportation infrastructure project is built in a densely built-up area with economic potential. There has to be potential to build real estate in the area. This potential for example increases if an urban area is crowded with shopping public, if it is nice to live in this area, if the business climate is good, and when crime rates are low.
- The economy of a city/country should be healthy. The Property developers must have enough financial potential, making private investments possible from an economic point of view. In addition, Property developers have to make a return on the investments. When the economy is

not thriving, it is more difficult for the Property developers to collect sufficient revenues from the real estate.

- The underground transportation infrastructure project has to lead to a spatial development of the area.
- There should be a good cooperative relation between the Property developers and the municipality.
- The municipality should have a clear persistent long-term vision/ambition based on the consistency of policies. The vision of the municipality should have a connection with the vision of the Property developers. It is important that this vision will be carried out by the municipality and the does not stay a plan. This leads to a secure environment to invest for Property developers.

Implications for CBAs

In the discussion of this thesis it is recommended for a particular urban underground transportation infrastructure project to conduct an ex-ante evaluation of the spatial effect *'The spatial development of real estate, resulting from private investments in this real estate'* on basis of a scenario analysis. The scenario analysis takes into account the unpredictability of private investments in specific real estate and the difficulty of attributing private investments to an individual urban underground transportation infrastructure project. At least two scenarios should be made: a best-case scenario and a worst-case scenario. In the best-case scenario the spatial effect is maximally included and in the worst-case scenario the spatial effect is not included at all. For each scenario a separate CBA should be made. The spatial effect could be incorporated qualitatively in the CBA; in the best-case scenario the effect should get a ++ or a + and in the worst-case scenario the effect should get a 0. The worst-case scenario does not need to be monetized because the effect is 0 (euro). So, the best-case scenario better should be monetized. My preferred method, to get an indication of the economic value of (potential) private investments in real estate, would be to interview existing and potential Property developers. During the interview the following question should be asked: How will the real estate develop when particular spatial developments are done by the municipality and what would be the increase of value of the real estate? When it is difficult to monetize this spatial effect, this effect should be incorporated qualitatively in the scenario analysis and in the CBA.

Decision-makers are enabled to make a more informed political decision concerning an urban underground transportation infrastructure project when analysts provide them with the two kinds of scenarios and CBAs.

Recommendations for further research

The first recommendation for further research is to study (qualitatively) multiple underground transportation projects in urban areas, to find the perceived spatial effects and their role in the decision-making process of the projects and to establish the conditions under which the spatial effects were realized. My second recommendation for further research is to study the perceived spatial effects of the multiple cases (of the first recommendation) with one or multiple quantitative method(s) to determine to what extent the perceived spatial effects have been realized. The third recommendation for further research I wish to make is to monetize the spatial effects of urban underground transportation infrastructure projects on basis of the valuation methods mentioned in this thesis. The fourth recommendation for further research is to test my preferred method, treated in the discussion

of this thesis. This method is about the incorporation of the spatial effect *'The spatial development of real estate, resulting from private investments in this real estate'* in a CBA.

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1. Introduction

This chapter gives an introduction to the research addressed within this Master's thesis project. First, the context of the research is explained, which leads to the research problem, the research objective and the research questions. In the research problem a knowledge gap and a problem statement is identified. Then, the previous research of the research problem will be discussed. Thereafter, the scientific relevance and the social relevance of the research are explained. Then, the role of CBAs and the categorization of benefits will be treated in greater detail. Finally, an outline of the report will be given.

1.1 Context research

Transportation infrastructure projects are critical to our society, because we depend heavily on the services that these infrastructures provide. Due to transport infrastructure people are able to move between locations and to perform activities at different locations whilst freight is able to be transported from location A to location B (van Nes, 2002). Passenger transport and freight transport have grown enormously the past 30 years in the Netherlands[2] (Bogaerts, et al., 2004), which have led to congestion in urban areas[3] (TomTom, 2014). Urban areas become denser, which results in less available space for transport infrastructure (COB, 2016). A possible solution to high traffic intensities and limited space in urban areas is the construction of urban underground transportation infrastructure[4]. These kinds of projects might lead to improvements of the public transportation system and might lead to an improvement of the quality of the public space in urban areas. The decision-making process of such projects are complex due to the political environment, different disciplines involved, dynamics, uncertainties, large expenses, technical innovative construction methods, implementation times and number of (different) actors involved (de Bruijn, ten Heuvelhof, & in 't Veld, 2010; Priemus & van Wee, 2014).

During the decision-making process of transportation infrastructure projects the costs and benefits need to be balanced (Özdemiroglu & Pearce, 2002). A Cost Benefit Analyses (CBA) is a tool that provides insight into the distribution of costs and benefits to the relevant actors, as a result of the project (Eijgenraam, Koopmans, Tang, & Verster, 2000). This is the most important role of a CBA. A CBA therefore gives important policy information to the decision-makers of transportation infrastructure projects (Mouter, Annema, & van Wee, 2013). The CBA makes it clear whether the benefits outweigh the costs of the project compared to the state of affairs in which no project is build, also called the reference case (van Wee & Rietveld, 2014). CBAs are usually carried out by independent experts (CBA analysts). Since 2000, the use of this method is mandatory in the Netherlands, during the decision-making process of large infrastructure public projects (Annema, Koopmans, & van Wee, 2007). A CBA has to be conducted, when a municipality applies for funding with the national government (above a financial threshold[5]) for a transportation infrastructure project. A limitation of

[2] Growth passenger transport ± 30% and growth freight transport 70%-90%.

[3] In 2013, The Hague: travel times are on average + 22% (in comparison with the predicted travel times) due to congestion.

[4] With urban underground transportation infrastructure literally is meant in this research, transport infrastructure that is located in urban areas under the ground, thus not transportation infrastructure on the surface level. Note that underground transport modes, such as the metro of Paris and London, also are located on the surface level. Transportation infrastructure on the surface level falls outside the scope of this study.

[5] A CBA is mandatory in the decision-making process of projects in the Netherlands when the funding by the Dutch government is above 225 million euro (for projects in The Hague, Amsterdam and Rotterdam), and is above

CBAs is that not all the (welfare) effects can be taken (properly) into account in a CBA (Mouter, Annema, & van Wee, 2015). CBAs are often incomplete because project effects are uncertain, unknown or difficult to monetize (Mouter, Annema, & van Wee, 2013). For more information about the role of CBAs see paragraph 1.8.

Political decisions are taken by decision-makers based on incomplete policy information[6], if benefits which are not known by the decision-makers and the CBA analysts are not presented to the decision-makers via other studies and if project effects are not monetized or operationalized in other indicators via other studies. It is possible that due to this incomplete policy information, transportation infrastructure projects are implemented which are economic less efficient than alternative transportation infrastructure projects, which are not implemented. This might result in cost overruns and disappointing achievements (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Priemus, 2010). For more information about benefits of transportation infrastructure projects see paragraph 1.9.

An assumption of the COB (Centrum Ondergronds Bouwen)[7] is that the value of building underground is not fully covered in decision-making processes of construction projects in the Netherlands[8] (COB, 2017). Building underground is relatively expensive, but it leads to many spatial effects. Underground options are often not or late included in decision-making processes. The value of an underground project lies mainly in the additional value above the ground. In the decision-making process of construction projects a good trade-off must be made between on the one hand costs and risks of underground constructions and on the other hand the additional value of the underground (van Eekelen, et al., 2013). The CBA might be a limited tool when evaluating urban underground transportation infrastructure projects during the decision-making process if benefits aren't included (properly) in the CBA.

To acquire more knowledge about (intangible) benefits of urban underground transportation infrastructure projects, their role in the decision-making process of these projects and relation with a CBA of such projects this research concentrates on the decision-making process of urban underground transportation infrastructure projects in the Netherlands. The problem owners of the research are the

112,5 million euro (for projects in the rest of the Netherlands) (Ministry of Infrastructure and the Environment, 2012).

[6] What must be emphasized is that the relationship that is presented here is a possibility and therefore not a certainty. An assumption that is made for this relationship to hold is that decision-makers are rational and that they therefore make the 'best' decisions on base of the available information. In practice however, decision-makers make decisions which are technical irrational and thus not only based on the available information (Ariely, 2012)[6]. Note that from a political perspective a technical irrational decision can be a political rational decision. A political decision is often a decision made between different parties. The decision should make a win-win situation for all the different players. Unfortunately, it is possible that complete information can lead into win-lose situations. Often a decision is a compromise between different parties. It is also possible that a player loses on one subject but wins at another subject. So, rationality is a complex concept, which can be interpreted differently from other perspectives. One needs to be thoughtful when using this concept.

[7] The COB is a network organization focused on collecting, developing and capturing knowledge of underground construction and underground space use (COB, 2017).

[8] The COB recently started a project called *'De waarde van ondergronds bouwen'* to get more insight into the additional value of the use of the underground in the development of an area in terms of the costs, benefits and arguments to give the use of underground space a stronger position in decision-making processes of construction projects.

different decision-makers: the Ministry of Infrastructure and the Environment (Ministry of I&E) and the local governments (municipalities). The aim of the research is to contribute to the enhancement of the decision-making process of urban underground transportation infrastructure projects in the Netherlands.

1.1 Research problem

The focus of the research is on making the policy information for decision-makers more complete so that more informed political decisions can be made on the construction of an urban underground transportation infrastructure project in the Netherlands. Spatial effects of these projects are the subject under study. The assumption made is that when we have more knowledge about these spatial effects the policy information for the decision-making of urban underground transportation infrastructure projects is more complete. A geographical boundary is taken into account, because in different countries different legislation, decision-making processes and politics apply. Because a case study has been chosen in the Netherlands, this research focuses on urban areas in the Netherlands. In this paragraph as a start the research problem will be further explored. Then, the knowledge gap will be defined, resulting in a problem statement and a research objective. Next, the planned research product will be presented. Finally, the scientific relevance and social relevance of the proposed research are explained.

1.1.1 Incompleteness of CBAs due to the absence/not proper inclusion of spatial effects

The extent to which the effects of a project can be predicted and determined is critical for carrying out an accurate CBA (Romijn & Renes, 2013). As already mentioned, CBAs are often incomplete due to intangible benefits. Due to intangible benefits, decision-makers are unaware of all the project effects of urban underground transportation infrastructure projects. In the situation where not all the project effects are known and thus not included in the CBA, it is possible that a wrong tradeoff is made by the decision-makers, and when project effects aren't monetized or operationalized in other indicators it is difficult to make a tradeoff between all the project effects, because in this situation the project effects aren't comparable. Moreover, uncertain Cost-benefit ratios are probably the result when not all the project effects are taken (properly) into account in a CBA. A wrong tradeoff and an uncertain Cost-benefit ratio will result in a political decision that is taken on base of incomplete policy information. This political decision, based on incomplete policy information, may lead to cost overruns and disappointing achievements (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Priemus, 2010). Previous research about the inclusion of intangible benefits in the decision-making process of transportation infrastructure projects and previous research concerning finding a solution for non-monetized benefits can be found in paragraph 1.4.

Building underground leads to many spatial effects, but we don't know exactly which spatial effects (are important during the decision-making process) and if these spatial effects are already incorporated in already conducted CBAs.

1.1.2 Knowledge gap

Based on the problem definition and the analysis of previous research, the following knowledge gap is identified: there are benefits of urban underground transportation infrastructure projects which are known, certain, can be monetized and have a clear relationship with a particular project (also known as the tangible benefits), but there are also benefits of urban underground transportation infrastructure projects which are unknown, and/or uncertain, and/or cannot be monetized, and/or do

not have a clear relationship with the project (also known as the intangible benefits). An assumption made in this thesis is that spatial effects are intangible benefits and are therefore frequently not included (properly) in CBAs of urban underground transportation infrastructure projects. For the decision-makers to make more informed political decisions concerning urban underground transportation infrastructure projects, more knowledge about these intangible spatial effects is needed.

1.1.3 Problem statement

Concluding, the problem statement is: a potential danger of a CBA for urban transportation infrastructure projects is that spatial effects are not taken into account (properly) and therefore the CBAs are incomplete. That may lead to decisions being made by decision-makers concerning the construction of such projects based on incomplete policy information.

1.2 Research objective

Based on the problem statement the following research objective has been formulated: to gain insight into the (intangible) spatial effects of urban underground transportation projects and the possible incorporation of these spatial effects in the ex-ante evaluation of these projects, so that the policy information during the decision-making process of these projects will become more complete and that therefore more informed political decisions can be made about the construction of urban underground transportation infrastructure projects in the Netherlands. This research objective leads to the research questions, formulated in the next paragraph.

1.3 Research questions

To determine the spatial effects of urban underground transportation infrastructure projects a case study of Het Souterrain will be undertaken. Het Souterrain is a tram tunnel located in The Hague under the Grote Marktstraat/Kalvermarkt (on -2), with a length of 1,250 meters, which connects the central station of The Hague with Prinsegracht. Above the tram tunnel (on -1) lays a parking of 500 places. Het Souterrain is chosen as a case study because it is a case that has both improved the public transportation and the quality of the public space (Leijten, 2015). A second reason for choosing Het Souterrain as a case study is that the project ended years ago, which increases the feasibility of identifying the spatial effects which resulted from this project. Perceptions of the spatial effects are researched with the help of interviews. Chosen is to study perceptions of spatial effects because I want to give a broad exploration of the possible spatial effects of an urban underground transportation infrastructure project. So far as know by me not much is known about spatial effects of urban underground transportation infrastructure project in the Netherlands and therefore not a quantitative research is conducted using surveys, in which an in-depth quantitative research is done into the realized spatial effects. For example, a hedonic price analysis could be carried out in which the realized effects could be measured, but the goal is to get a broad exploration of the possible spatial effects instead of an in-depth analysis of one of the realized effects. Hence, the main research question follows from the research problem and the research objective and is stated as follows:

What are the perceived spatial effects of Het Souterrain, are these spatial effect incorporated in already conducted CBAs and why can particular spatial effects not (yet properly) be incorporated in CBAs?

In order to get an answer to my main research question seven sub-questions have been formulated. To determine the possible spatial effects of urban underground transportation infrastructure projects

I carried out an in-depth case study of Het Souterrain. The first sub-question is drafted to get a broad introduction of this case. It is important to get information about the actors, their power, interests and the dependencies between the actors for two reasons:

- To get a complete picture of (the decision-making process of) Het Souterrain.
- This research is mainly based on the perceptions of these actors. In order to get a representative selection of respondents to interview in this research it is needed to know who the actors were.

1. What are the key features, who are the actors and what is the history of Het Souterrain?

This research ultimately aims to improve decision-making processes of urban underground transportation infrastructure projects by making the CBA of these projects more complete. The CBA might be made more complete by providing information about spatial effects of these projects. As has been told before this is done based on the case Het Souterrain. In order to improve decision-making processes by getting more knowledge about spatial effects and the possible incorporating of these spatial effects in CBAs, it is crucial to get a picture of the decision-making processes of an urban underground transportation project. A CBA is a policy analysis tool and therefore it is important to know what the role of knowledge and policy analysis tools in the decision-making process of Het Souterrain was. Sub-question 2 therefore focusses on the (role of policy analysis tools in the) decision-making process of Het Souterrain.

2. How did the decision-making process of Het Souterrain take place and which role played knowledge and policy analysis tools in the decision-making process of Het Souterrain?

The focus of this research is on the spatial effects of urban underground transportation infrastructure projects. This is done on base of a case study of Het Souterrain. In sub-question 3 therefore the subject of study is to get insight about the perceived spatial effects of Het Souterrain. Besides more knowledge about these perceived spatial effects, this thesis gives more information about the possible incorporation of these spatial effects in CBAs. Therefore, it is also important to know what the role of spatial arguments was in the decision-making process of Het Souterrain.

3. What are the perceived spatial effects of Het Souterrain and what was the role of the spatial arguments in the decision-making process of Het Souterrain?

Since most existing studies do not explicitly investigate which spatial effects are taken into account in CBAs and how these spatial effects are incorporated in the CBAs sub-question 4 is drafted. In this question the subject of study is to get insight about spatial effects in already conducted CBAs.

4. What spatial effects can be derived in already conducted CBAs and which of these spatial effects are monetized and what are their valuation method(s)?

Sub-question 3 mainly focuses on the perceived spatial effects of Het Souterrain to establish the possible spatial effects of urban underground transportation infrastructure projects and sub-question 4 focusses on the incorporation of spatial effects in already conducted CBAs. In the next sub-question the perceived spatial effects of Het Souterrain have to be compared with the spatial effects in already conducted CBAs to determine whether there is a gap. Resulting in sub-question 5:

5. Is there a gap between the perceived spatial effects of Het Souterrain and the spatial effects in existing literature and CBAs?

It is necessary to find an explanation why certain perceived spatial effects are not (yet properly) incorporated in already conducted CBAs. The CBA is a well-known and well-developed policy analysis tool in the Netherlands. If certain spatial effects are not (yet properly) incorporated in already conducted CBAs there should be legitimate reasons. Sub-question 6 therefore focusses on these reasons.

6. Why can particular spatial effects not (yet properly) be incorporated in CBAs?

Finally, it is important to know whether the results of this study can be generalized to other (future) cases. To investigate this, research question 7 has been drawn up.

7. Can the results of this study be generalized to other (future) cases?

1.4 Previous research

Previous research has tried to find a solution for the inclusion of intangible benefits in the decision-making process of transportation infrastructure projects. Mouter, Annema, & van Wee (2015) mentions to organize 'Effect survey meetings' (Effect Arenas) to solve the problem of hidden welfare effects of transportation infrastructure projects. As already mentioned, an assumption made in this thesis is that spatial effects are intangible effects. Niek Mouter (2015) mentioned that key actors in the Dutch CBA practice perceive that spatial effects are frequently not included in CBAs of transport projects, particularly not in urban underground transportation infrastructure projects. Romijn and Renes (2013) developed two different analytical methods (Plan-objectification and Agglomeration-operation), which should increase the knowledge and the view on the (spatial) effects of a project on the (functioning of a) city. The study by Romijn and Renes focuses on urbanization projects. They take a big scope: all kinds of projects belong to urbanization projects and therefore, further research about spatial effects is needed specifically for urban transportation infrastructure projects. This could lead to better policy information of an urban transportation infrastructure project.

Some project effects are difficult to monetize, because the methodology is not (yet properly) well developed (Hanemaayer, de Gucht, Gerritsen, & Doets, 2010; Planbureau voor de Leefomgeving, Centraal Planbureau, 2010). An incomplete CBA makes it impossible for the decision-makers to compare all project effects with each other, because not all the project effects have been translated into the same metric. The easiest way to compare project effects is if they are all monetized in the same unit. Monetized project effects thus get more attention in a CBA than non-monetized project effects. An incomplete CBA will probably result in an uncertain Cost-benefit ratio, which could lead to a decision made on the basis of poor policy information. Previous research has tried to find a solution to non-monetized benefits. Mouter, Annema, & van Wee (2015) investigate how to manage project effects that are difficult to monetize in a CBA study. Sijtsma, Heide, & Hinsberg (2011) discuss the nature value indicator, an indicator to measure project effects on biodiversity. Sijtsma, et al. (2012) discusses the Hotspot index, an indicator to measure landscape effects. Barfod, Salling, & Leleur (2011) discuss COSIMA, a method to evaluate and appraise transport projects using a combination of the CBA and the Multi Criteria Analysis (MCA). Both non-monetized project effects and monetized project effects are incorporated in this method. A total rate of return is calculated by translating the results of the MCA into the same language as the CBA results. So, literature is present that tries to find a solution

for non-monetized benefits, but in so far as known by me no literature is present which tries to find a solution for the non-monetized spatial effects of urban underground transportation infrastructure projects[9]. Further research into the monetization or operationalization into other indicators of spatial effects will probably lead into more complete CBA, which might lead into a better informed decision-making process.

1.5 Internships associated with thesis

This research is combined with an internship at the municipality of The Hague, at the Department of Urban Development, Sub department: Traffic. Het Souterrain is the case under investigation in this Master thesis. The research is connected with this internship, because the municipality of The Hague was the problem owner of this case. I did an additional internship at the COB. During this internship I worked for the project *'De waarde van ondergronds bouwen'*. The goal of this project is to support the design process and the decision-making process of projects in which underground options are possible, by acquiring/assembling information about the value of the underground. I took part in the developing of the *'Format Besluitvorming van ondergrondse projecten (spoor A)'*. This format helps to clarify the decision-making process and the arguments of underground projects. Besides that, the format has been worked out by me for the project Het Souterrain. In the next paragraph the scientific relevance and the social relevance of this research is treated.

1.6 Scientific relevance and social relevance

The scientific relevance of this thesis is that more knowledge will be made available about the possible spatial effects and the possible incorporation of these spatial effects of urban underground transportation infrastructure projects. CBAs of these projects might therefore become more complete. The social relevance of the research is related to the scientific relevance. When we know more about spatial effects of urban underground transportation infrastructure projects, decision-makers will be able to make a political decision whether to construct an urban underground transportation infrastructure project in the Netherlands based on more complete policy information. Furthermore, better tradeoffs can be made by the decision-makers because the awareness of the project effects increase. This could result in the implementation of more economic efficient urban underground transportation infrastructure projects, which is in the interest of Dutch society. In the next paragraph the role of CBAs in decision-making processes will be explained.

1.7 Role of CBAs

In this paragraph the role of CBAs in the decision-making process of transportation infrastructure projects is further explained. Key-actors in the Dutch CBA practice mentioned that a CBA must be given a role in the appraisal of spatial-infrastructure projects and that the CBA ought to be used to support a go/no-go decision in the ex-ante evaluation of spatial-infrastructure projects (Mouter, Annema, & van Wee, 2013). According to the key-actors the use of the CBA in the decision-making process leads to a better decision-making process and in better decisions. It is unlikely that there will be consensus among economists and spatial planners about the value of the CBA in the decision-making process of a project (Mouter, Annema, & van Wee, 2013). It is unclear what exactly the role of a CBA is in the decision-making process because politicians seldom seem to use CBAs outcomes as an important source to support their go/no-go decision for a certain project and politicians also use other reasons

[9] It should be noted here that it might be possible that spatial effects currently are being considered in other effects in the CBA.

besides the results of a CBA in this decision (Rienstra, 2008; Eijgenraam, Koopmans, Tang, & Verster, 2000; Annema, 2014; Mackie, 2010). So, the role of a CBA in the decision-making process is positive but not dominant. It seems that CBAs in the decision-making process adds value, but its role varies in time and place and the weight that is given to a CBA in the decision-making process is dependent on the governmental culture (International Transport Forum, 2011). According to Mouter et al. (2012) a CBA should be used in a virtuous way- a CBA should be used while knowing the advantages and limitations of the CBA. The most important role and advantage of a CBA is that it provides important policy information concerning the benefits and costs and the distribution of these project effects to the relevant actors. The decision-makers can use this information when making trade-offs for a go/no-go decision. For more information about CBAs and the role of CBAs in the decision-making process of transportation infrastructure projects see Appendix A. In the next paragraph the concept of intangible benefits is explained.

1.8 The categorization of benefits

In this paragraph the categorization of benefits in tangible benefits and intangible benefits will be explained. Benefits of transportation infrastructure projects can be separated in two groups: tangible benefits and intangible benefits (see Figure 2). Tangible benefits are known by CBA analysts and decision-makers, and tangible benefits can be monetized. Moreover tangible benefits are certain and have a clear relationship with a project. Examples of tangible benefits are: travel time savings, traffic safety, air quality and noise nuisance. A benefit is an intangible benefit[10] when it has minimal one of the following conditions:

- Intangible benefits are benefits which could be unknown (and thus hard to predict) by CBA analysts and the decision-makers.
- Intangible benefits are benefits which could be uncertain.
- Intangible benefits are benefits which couldn't be monetized or operationalized in other indicators.
- Intangible benefits are benefits for which it could be difficult to determine the relationship between a project and the benefit.

Due to the unpredictability and uncertainty of intangible benefits, decision-makers are unaware of all the benefits and due to non-monetized benefits, not all the benefits can be compared with each other. It is hard to fully attribute an intangible benefit to a project due to the possible unclear relationship between the benefit and a project. Therefore, intangible benefits may lead into uncertain Cost-benefit ratios and incomplete informed political decisions.

[10] The definition of an intangible benefit is based on the definition Niek Mouter gives in his doctoral thesis (Mouter, 2014).

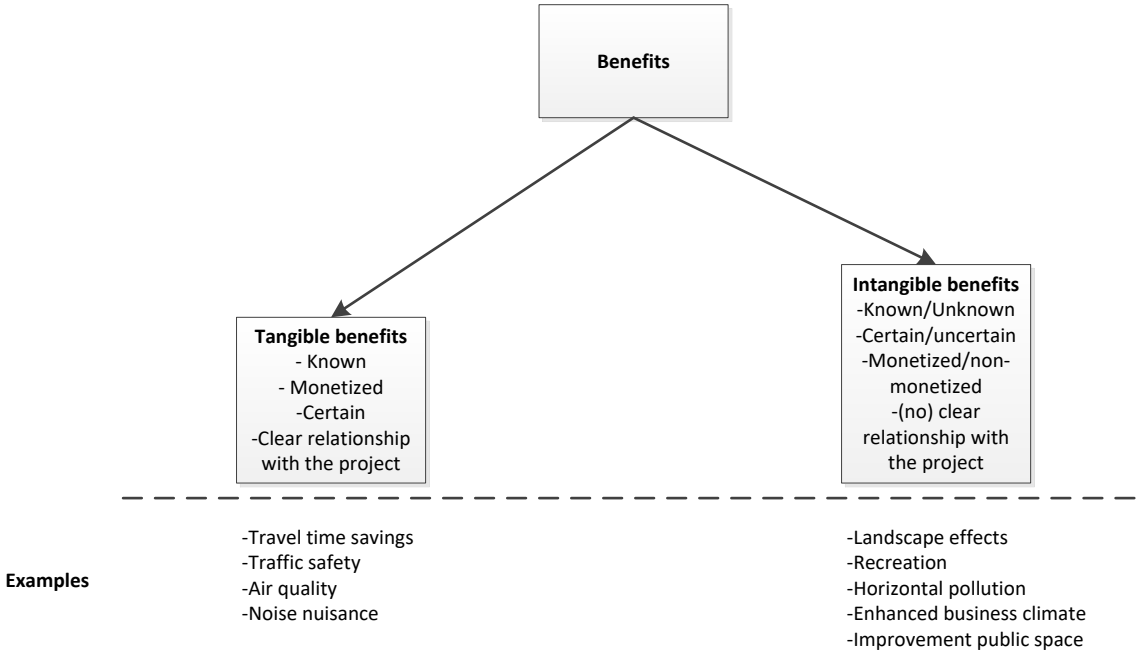


Figure 2: Categorization of benefits

Particularly underground projects have intangible benefits. Besides the direct effects like the transport of trams or parking cars, underground projects have other effects which express themselves in their environment (at ground level). An example of these (spatial) effects is; an improvement of the public space. These effects can be intangible. Intangible benefits are especially interesting for these kinds of projects, because the construction of underground projects is often expensive (van Eekelen, et al., 2013). When we have more knowledge about these intangible benefits, underground projects come faster on the political agenda and/or underground projects gets faster a go-decision. Urban areas often have limited financial resources for the construction of such projects and frequently need to apply for funding at the national government (Mouter, Annema, & van Wee, 2013). Therefore, for such projects more co-decision-making takes place nowadays by the national government [11] and the local governments[12] (Rijksoverheid, 2014). The CBA might be a too limited tool when evaluating urban underground transportation infrastructure projects during the decision-making process if the intangible benefits are not included (properly) in the CBA. In the next paragraph follows the research outline.

1.9 Research outline

The research outline builds upon the research questions described in paragraph 1.3. Figure 3 presents the research outline, in which is shown what is treated per chapter and which sub-questions are answered in each chapter.

[11] In the Netherlands: Ministry of Infrastructure and the Environment.
[12] In the Netherlands: Provincial states & municipalities.

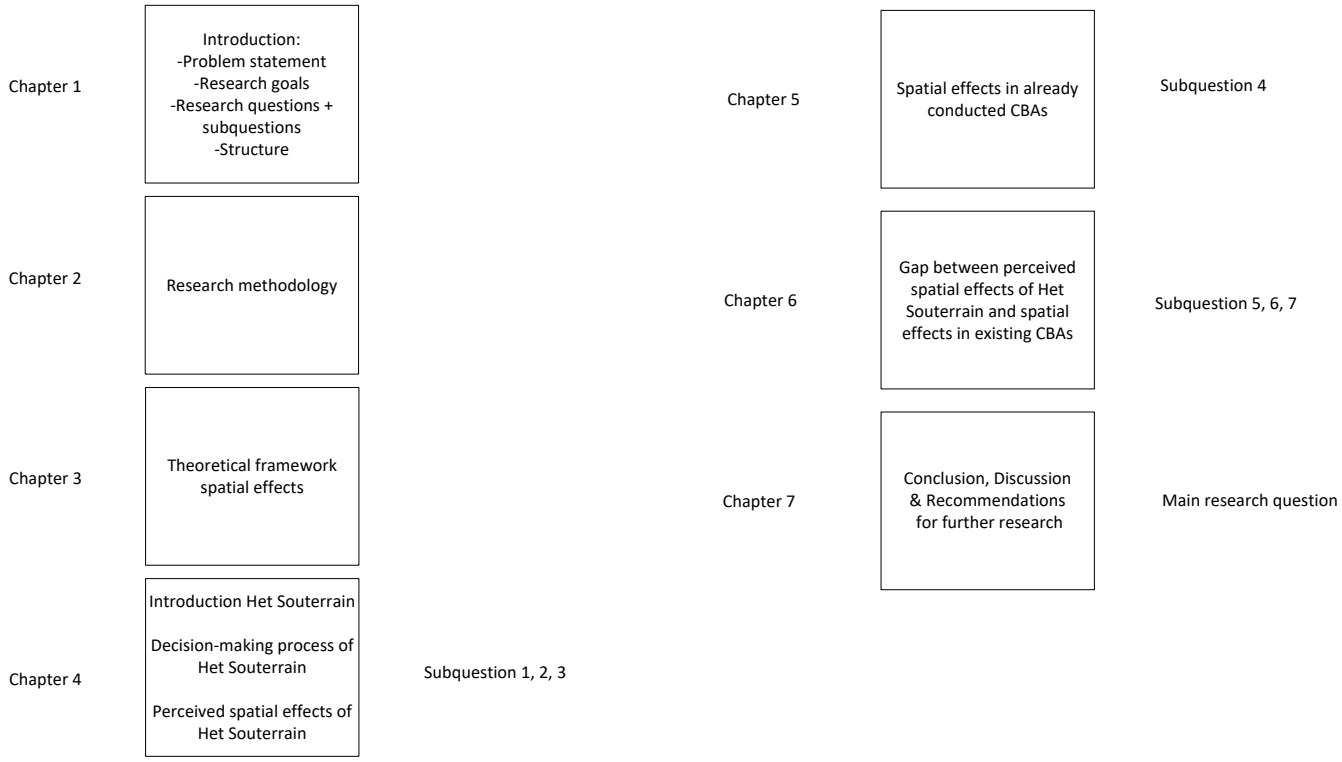


Figure 3: Research outline

2. Research methodology

In this chapter the research methods and data collection tools are presented and explained, which are used to answer the research questions.

2.1 Research methods & data collection tools

In order to answer the research questions stated in the previous chapter two research methods have been used: an in-depth single case study and a desk research. The in-depth single case study was conducted using also desk research, expert interviews and an actor analysis. In an in-depth single case study one studies a phenomenon/case in depth by using several data sources, like available documents, interviews and observations (Swanborn, 2010). In a desk research one gathers data by searching through material produced by others (Verschuren & Doordewaard, 2010). In an interview one collects data by asking people involved in a certain process or experts in a certain field open-ended or closed questions (Hammer & Wildavsky, 1989). In an actor analysis one defines the key actors in the field, who can influence certain means, who are influenced by a certain mean, what the interdependencies between the actors are, what the powers, interests, goals and dedications of the actors are (Bryson, 2004). The research approach is presented in Figure 4.

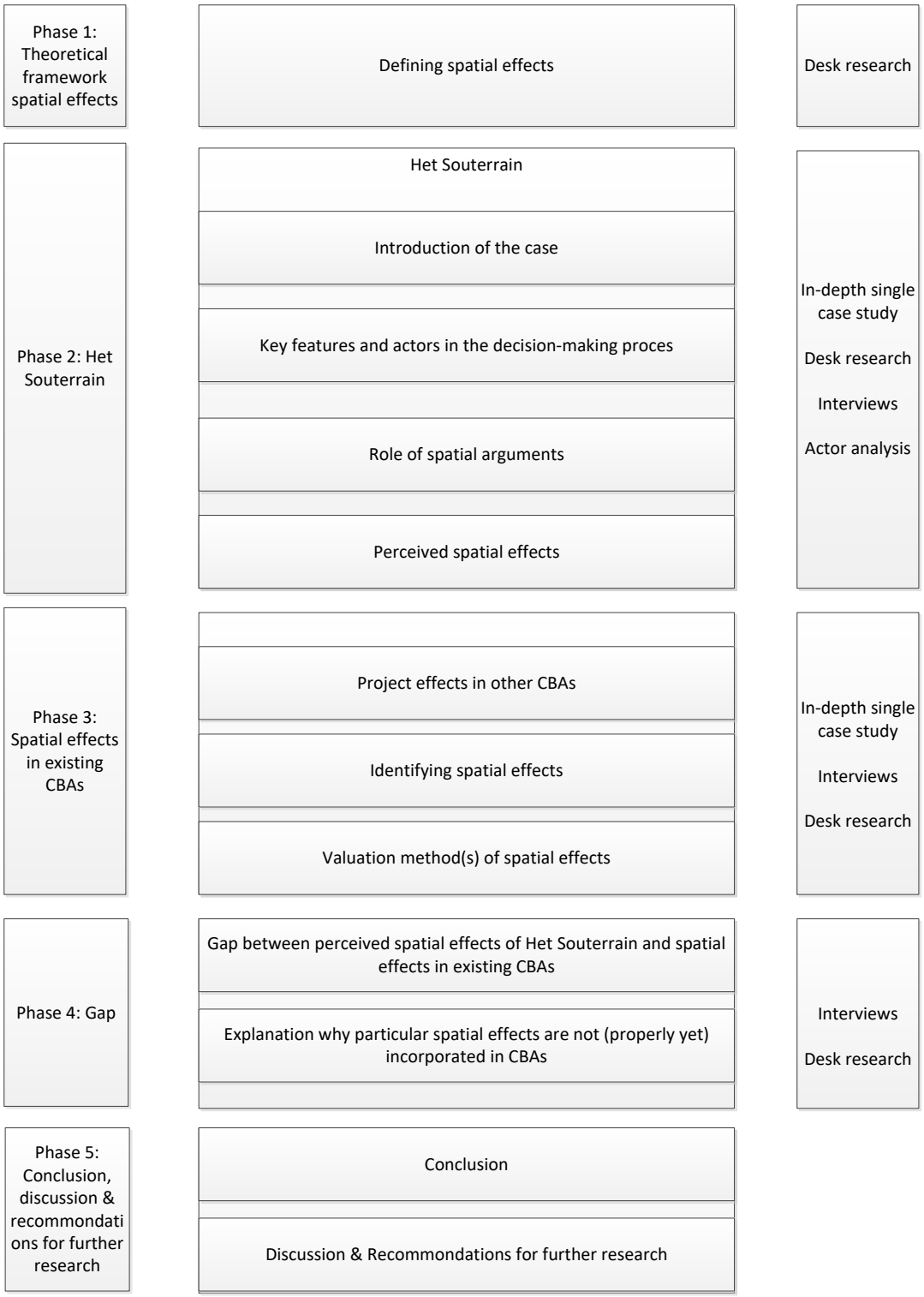


Figure 4: Research approach

In chapter 3 a theoretical framework about spatial effects will be described . In this chapter literature has been reviewed about spatial effects on the basis of desk research. The following keywords were used to discover reports, articles and minutes of meetings: spatial effects, spatial economic effects, transport.

The main subject of research in the sub-questions is the case study: Het Souterrain. An actor analysis has been conducted to answer part of sub-question 1. In this analysis has been explored who the

important actors for the municipality of The Hague were, and what their resources, interdependencies, interests, goals, power and were. To get an answer to the sub-questions data has been collected by searching in scientific literature, records of council meetings, brochures, newspapers, and reports.

Another source of data collection existed of interviewing people closely involved in the decision-making process of Het Souterrain. I interviewed 18 people in total. I selected them from relevant groups, parties and organizations. My internship at the department of Traffic at the municipality of The Hague, proved to be useful in that respect, because people at this department provided me with names and contact details of the relevant persons to interview. Furthermore, respondents also gave me other names. See Table 1 of an (anonymous) list of respondents. Note that in the description is shown where the respondent is employed. It is possible that a particular respondent is not working anymore at this organization. In order to guard the anonymity of the respondents, the description does not indicate whether someone is currently employed or was employed at this organization.

Table 1: (anonymous) List of respondents

Respondents	Description
Respondent 1	Department Traffic at the municipality of The Hague
Respondent 2	Department Traffic at the municipality of The Hague
Respondent 3	Department urban management at the municipality of The Hague
Respondent 4	Department Traffic at the municipality of The Hague
Respondent 5	Department Traffic at the municipality of The Hague
Respondent 6	Department Traffic at the municipality of The Hague
Respondent 7	Council member of the municipality of The Hague
Respondent 8	High-rank position within the municipality of The Hague
Respondent 9	De Kern Gewond
Respondent 10	Ministry of Transport, Public Works and Water Management
Respondent 11	HTM
Respondent 12	Department of Urban Development at the municipality The Hague
Respondent 13	Rover
Respondent 14	Department of Urban Development at the municipality The Hague
Respondent 15	Property developer
Respondent 16	Property developer
Respondent 17	Property developer
Respondent 18	Property developer

Much information needed for the research had not been documented or had been destroyed, because it was an old case. This information is only known by the people who were closely involved with the case during the decision-making process. Questions in the interviews were about perceptions, trade-offs, interests and opinions of the people involved.

The interviews were conducted anonymously, so that all information from them could be used in this report. All the respondents gave me permission for that. There is always a chance that a respondent does not want to be quoted if anonymity has not been assured. I wanted to avoid this and therefore the interviews are done anonymously. Moreover, people are more inclined to withhold information when interviews are not conducted anonymously. Anonymity invites to tell the real story. Some quotes or information provided are put in the report with name. In those cases I got written permission. All interviews were recorded on tape to ensure that no information would go lost. A disadvantage of recording interviews is that a respondent might be cautious in telling everything he or she knows.

Guarantee of anonymity helps to build trust. Open questions, so that respondents can give information and opinions in their own words helps too. Sometimes though, I asked whether respondents agreed to certain assessments of another respondent or found in documents. In order to verify the validity of assessments.

As has been written in the previous chapter this thesis aims to improve the decision-making processes of urban underground transportation infrastructure projects by making the CBA of these projects more complete. The CBA is made more complete by including information about spatial effects of these projects. I used the case Het Souterrain to do that. In order to improve decision-making processes by acquiring more knowledge about spatial effects and the possible incorporating of these spatial effects in CBAs, it is important to get a picture of the decision-making processes of an urban underground transportation project. So, I made an analysis of the decision-making process of Het Souterrain. The stream model of Kingdom and the rounds model of Teisman were used by me as a tool for mapping the decision-making process of Het Souterrain. An analysis of the decision-making process of Het Souterrain was especially helpful to establish the role of knowledge and policy analysis tools in the decision-making. In particular the role of spatial effects and spatial arguments in the decision-making process of Het Souterrain were important for my thesis.

In the stream model of Kingdom (Enserink, et al., 2010) three streams are distinguished: the problem stream, the policy stream and the political stream. The problem stream defines that a particular condition has to be a problem, the policy stream defines that there have to be alternatives for implementation and the political stream defines political events. In addition, participants (Policy entrepreneurs) are required who push their perceptions when the time is ripe. The streams have to be aligned for a matter to be dealt with in the political agenda. When the three streams come together, a window of opportunity (policy window) is open: there is a known problem, a workable solution, and the time is ripe. Policy entrepreneurs are important because they recognise the policy windows and ensure that a project or situation come on the political agenda.

According to the rounds model of Teisman (Enserink, et al., 2010) decision-making takes place in different rounds and arenas. In each round the activities may differ; for example: exploring a problem, designing a solution, choosing a solution. Moreover, each round may have different actors with different powers, resources and interests. In round A, actor A may have a particular interest, with a specific goal and power position, while in round B, actor A may have a different interest with another goal and a different power position. The focus of the rounds model is on the interactions between the different actors (Teisman, 2000). Each round ends with a crucial decision (or with crucial decisions) in which a decision or outcome is taken for granted and functions as a point of departure for new rounds of negotiations and influences the behaviours of the actors and thus influences the rest of the decision-making process. The different activities within the decision-making process may take place at the same time, in different arenas, or they interchange in different rounds. The decision-making process in the rounds is characterized by a capricious process with ups and downs, iterations and a zigzag course.

In already conducted (existing) CBAs is searched to spatial effects and the way in which these spatial effects are incorporated. A selection of 18 projects is analyzed. A selection of different kinds of projects is made to get the validity of the results of this analysis as high as possible. CBAs are analyzed of underground transportation projects (tunnels), infrastructural projects and urban area development projects. It is analyzed what the role of the spatial effects are in the already conducted CBAs. It is

possible that the spatial effects have a qualitative role, but it is also possible that the spatial effects are monetized in the already conducted CBAs. If the spatial effects are monetized we need to know what the valuation methods are of these spatial effects. Table 2 shows the list of CBAs analyzed. In the first column the full names of the projects are mentioned, in the second column the abbreviated names of the projects are displayed, and in the third column the reference to the CBAs are shown.

Table 2: Full names of the projects

Full names of the projects	**Abbreviated names of the projects**	**Reference to the CBAs**
Boulevard Scheveningen	Boul. s	(de Nooij, Hof, & Poort, 2007)
Dublin port tunnel	Du. po. t.	(Rattigan)
Tunnel under the N65 at Helvoirt	Tunnel n.	(The Committee N65 Ondergronds bij Helvoirt)
Bolu Mountain tunnel	Bolu	(Kocabaş & Kopurlu, 2010)
New West River crossing	New w.	(Ecorys, 2012)
Tunnel investment and tolling alternatives in Antwerp	Antwerp	(Proost, Van der Loo, de Palma, & Lindsey, 2005)
Road network in the region Arnhem-Nijmegen	Ro. Ar-N.	(DHV, 2011)
Western access of Amersfoort	Wes. Am.	(Wageningen UR; MUConsult;, 2012)
Urbanization variants and public transport projects in Almere	Urb. Alm.	(Zwaneveld, Romijn, Renes, & Geurs, 2009)
Zuidas in Amsterdam	Zuid. Am.	(Eijgenraam, Ossokina, Blokdijk, & Groot, 2006)
Option for Schiphol and the region	Opt. Sch.	(Decisio; bureau Louter; SEO/AAE;, 2008)
Sportcampus in Rotterdam	Spo. Rot.	(Decisio, 2013)
Provincial arrangements within urban development in the province Utrecht	Pro. Utr.	(Rosenberg, Buys, Buitendijk, & Wever, 2012)
Inner urban or outside?	In. ur. ou.	(Lubbe, de Boer, Marlet, Koopmans, & Willebrands, 2011)
Urban renovation	Urb. ren.	(den Breejen, et al., 2006)
Building successfully in the city	Bui. city.	(van Hoek, Koning, & Mulder, 2011)
Area development Atalanta	Are. At.	(Briene, Hamdi, & Verheijen, 2011)
Benefits of rerouting railways to tunnels in urban areas: a case study of the Yongsan line in Seoul[13]	Ben. Yon.	(Chang, Han, Jung, & Kim, 2014)

[13] This paper isn't a conducted CBA, but it is an analysis of the benefits of the case the Yongsan line in Seoul.

3. Theoretical framework spatial effects

The focus of this Master thesis is on spatial effects of urban underground transportation infrastructure projects. Before starting the actual research it was important to elaborate on the definition of spatial effects adopted in this study. In this chapter a theoretical framework about spatial effects is created. This chapter is based on scientific literature. It starts with the definition of a spatial effect. Several examples are described of spatial effects to further clarify the definition. Furthermore, in literature has been searched for types of spatial effects to categorize possible spatial effects of urban underground transportation infrastructure projects. Later, in chapter 4 the perceived spatial effect of Het Souterrain and in chapter 5 the spatial effects in CBAs will be classified in these categories. This will provide a good picture of the (possible) spatial effects of urban underground transportation infrastructure projects and the types of spatial effects.

3.1 Definition spatial effects

Before finding literature about spatial effects and giving a definition of spatial effects it is important to know what is meant with space and what is meant with effect. Van Dale (2017) defines space as *'a particular place which is bounded'*. Space is thus a geographical concept in this definition. Niekerk (2000) defines an effect as *'A change of state with respect to an existing situation, as a result of the execution or omission of a particular action'*. A combination of these two definitions leads to the definition of a spatial effect; a change of state of a particular place.

Oude Ophuis et al. (1999) made a guidance to monetize spatial effects in urban areas. They define spatial effects as *'Effects on the spatial component of social functions as a result of the construction, presence and use of line infrastructure'.* Five social functions are distinguished: living, working, recreation, agriculture and nature. Moreover, it is stated that traffic and transport (mobility) can be named as derivative of the five social functions. Because the guidance is about urban areas, the agriculture and nature function is disregarded by Oude Ophuis et al. The spatial component is defined as *'The representation/embodiment/manifestation of the various functions in an urban area'*. Specifically, it concerns residential areas, working places, areas reserved for leisure and infrastructural works. To further clarify this definition a figure is made by Oude Ophuis et al. (see Figure 5). The figure shows the relationship between (underground) infrastructure and its surface (aboveground) area. The spatial effects include this relationship.

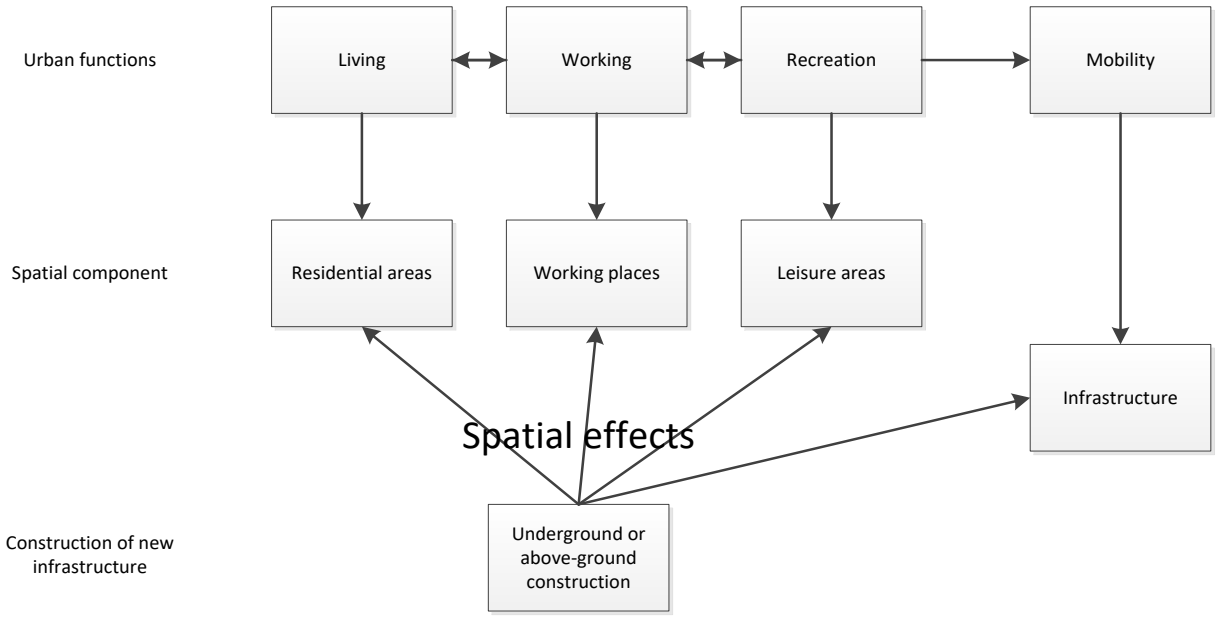


Figure 5: Clarification of definition of spatial effects

The nature function is included in the definition of a spatial effect in this Master thesis, in contrast to the definition of a spatial effect given by Oude Ophuis et al., because in urban areas also nature is present mainly due to landscaped greenery and water (Reumer, 2000). Also like the definition of Oude Ophuis et al; in this thesis the agriculture function is irrelevant because agriculture is not really present in urban areas in the Netherlands. Nowadays agriculture in urban areas becomes more popular, but only on a very small scale and often at the edge of a city (Wageningen University & Research, 2017). The focus in this thesis is on transportation infrastructure and, in particular, underground transportation infrastructure in urban areas. So, in this thesis spatial effects are defined as:

Effects on the representation/embodiment/manifestation of the social functions (living, working, recreation and nature) in an urban area (residential areas, working places, areas reserved for leisure) as a result of underground transportation infrastructure.

Van Maarseveen & Romijn (2015), Rietveld (1994), and Oosterhaven & Knaap (2002) have conducted research on spatial economic effects of transport infrastructure. According to their reports an improvement of transport infrastructure positively influences the relative attractiveness of a specific area for businesses and the public/ people in general. These scientists conclude that the increase of attractiveness of an area possibly affects location choices of businesses and people. The change in attractiveness of a working place possibly results in changes of productivity, employment, number of offices and commercial value of offices. The change of attractiveness of an area reserved for leisure possibly results in more people who recreate in this area. The change of attractiveness of a residential area may lead to an increase of the number of residents and an increase of land values and housing prices. Spatial economic effects are economic impacts in an area due to its increased attractiveness. The studies of Van Maarseveen & Romijn (2015), Rietveld (1994), and Oosterhaven & Knaap (2002) define the attractiveness of an area as: a more improved accessible area due to the transport infrastructure which results in more proximity of transport infrastructure in the area, time saving and saving of travel expenses. This kind of attractiveness of an area is a transportation effect and not a spatial effect. The spatial economic effects resulting from this kind of attractiveness of an urban area are not spatial effects as meant in this Master thesis. Examples of these kinds of spatial economic

effects are; more productivity, employment, increase of housing prices. Spatial economic effects which are the result of a more attractive area due to a changing layout of the space are spatial effects as meant in this Master thesis. Note that, looking back at the definition I chose of a spatial effect, a spatial economic effect still should ensure a spatial change in an area. For example, an increase of the number of shopping public in a city due to a more attractive shopping area is a spatial economic effect. It is a spatial economic effect, but it is not a spatial effect, because the effect doesn't ensure a spatial change in the area. It is more an economic effect. A private investment in real estate due to a more attractive public area is a spatial economic effect. It is also a spatial effect, because the effect ensures a spatial improvement of the area: adjacent real estate is (re)developed. In Figure 6 is explained which spatial economic effects are also spatial effects.

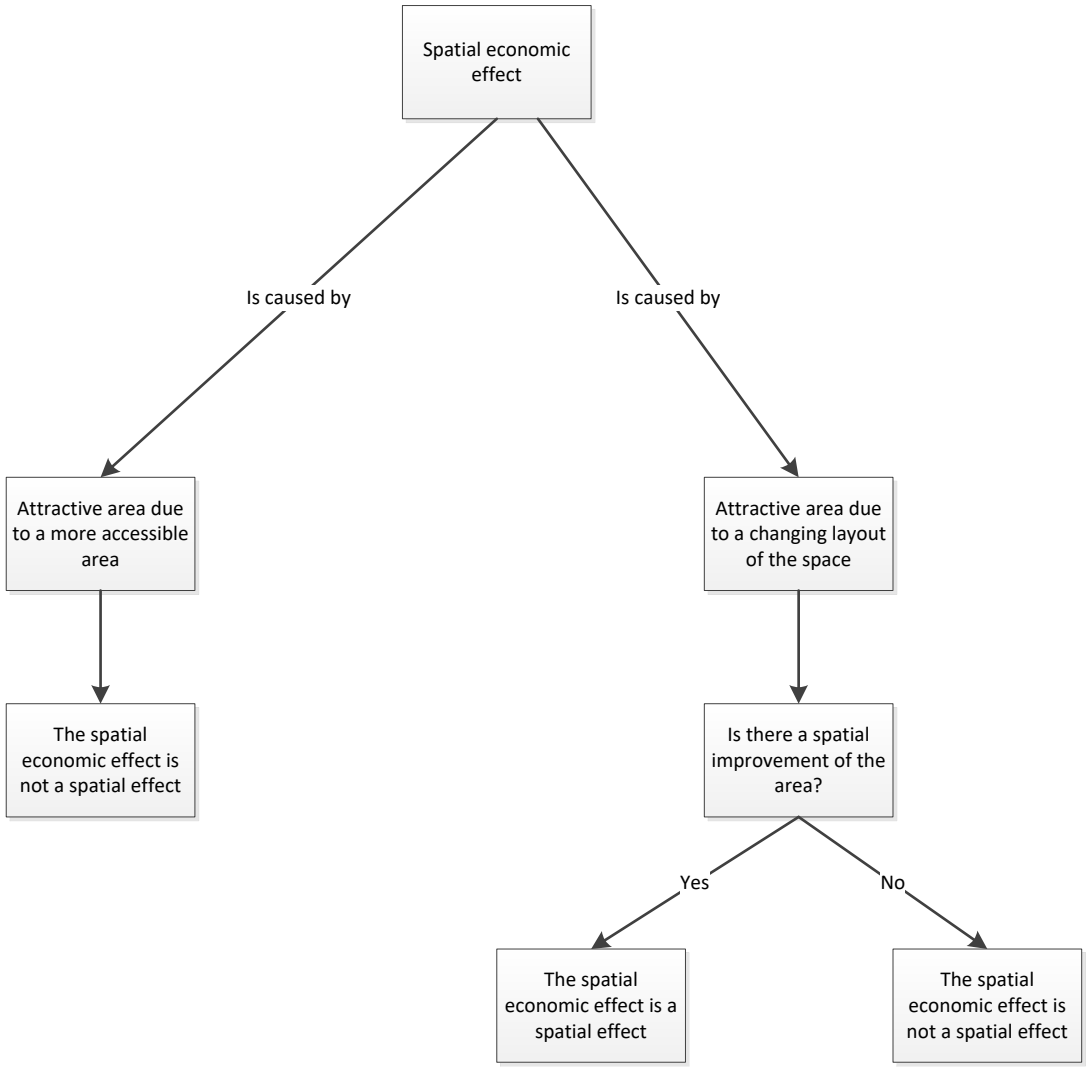


Figure 6: Which spatial economic effects are also spatial effects?

To further clarify the definition of a spatial effect some examples will be given of spatial effects. Figure 7 gives a few examples of (positive) effects of urban underground transportation infrastructure projects. The red ovals are examples of spatial effects. In the figure also the relation is shown, described by van Nes (2002) in the Layer model, between the economic activities (performed by persons and goods at different locations), transport services that are needed to transport the persons and goods between the different locations, and the traffic services which provide the possibilities for

a particular transportation mean to make a trip. This relation is included in the picture to show why traffic services are needed.

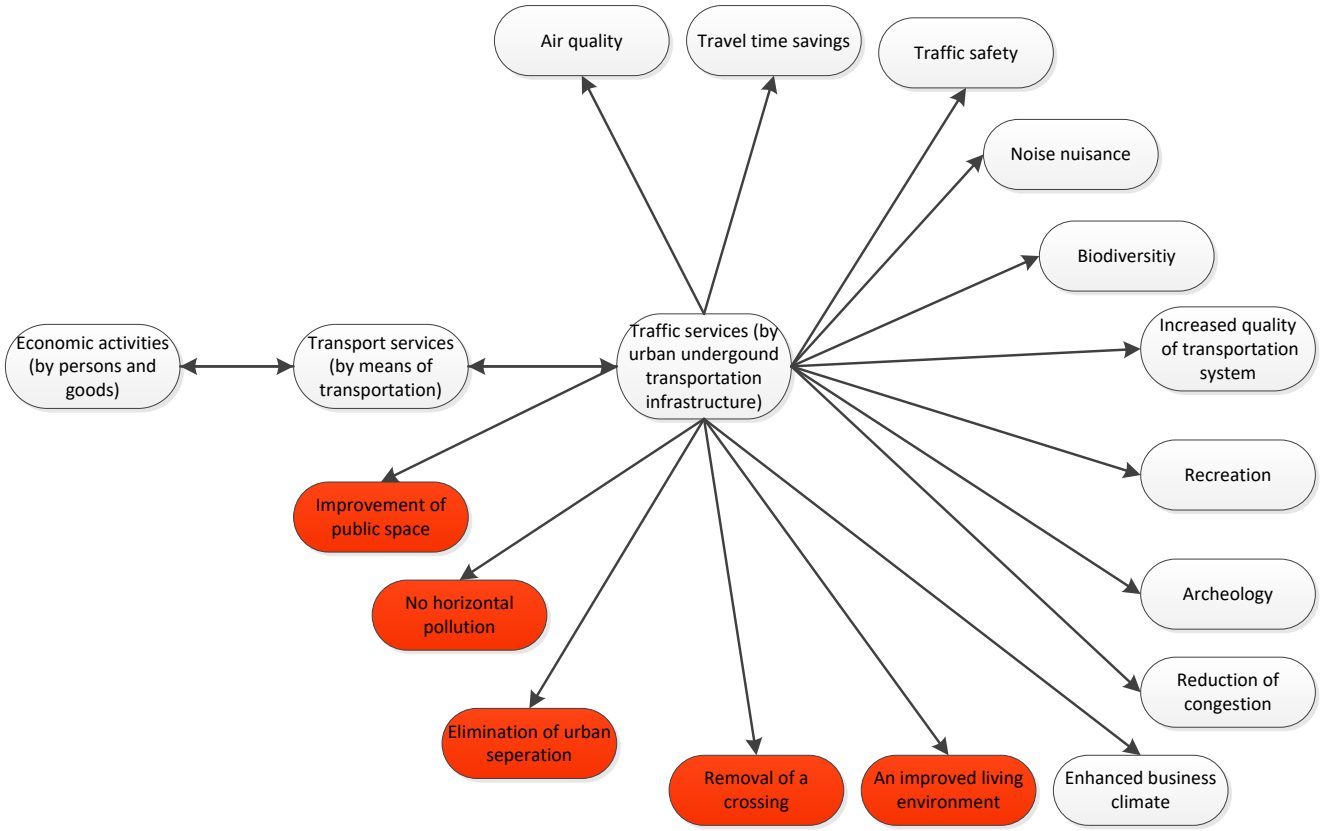


Figure 7: Spatial effects (red ovals)

3.2 Types spatial effects

Oude Ophuis et al. (1999) distinguish five categories of spatial effects as a result of the construction, presence and use of infrastructure:

- Use of space: Use of space has influence on above ground functions. Infrastructure on the ground uses much space. Underground infrastructure makes less use of space. When the wall-roof method is used as construction method (as was the case with Het Souterrain) the space on the ground is temporarily (at the start) used. When a drilled underground construction method is used, as in the case of the North-South line no space on the ground will be used.
- Construction nuisance: In the area where infrastructure is constructed negative external effects will occur, such as noise and vibrations, visual pollution, degradation of amenities and barrier effects. These nuisance aspects will influence negatively the functionality of the space.
- (Re)development of area: In the phase when infrastructure is realized and in use, the space that will be available after the construction of the infrastructure can be (re)designed and (re)developed. This will be determined by two factors: the construction method and the typology of the urban area. The construction method determines the physical opportunities for the (re)development of an area. For above ground infrastructure the construction activities take up approximately 20% of the total area required during the construction phase. This 20% can be (re)developed. After the construction of the underground infrastructure by means of the wall-roof method the total space

above ground can be (re)developed. When the underground infrastructure is constructed by means of the drilling method[14] the space above ground already can be (re)developed during the construction time. The typology of the urban area provides information about the potential of the urban area.

- Nuisance by the use of infrastructure: The nuisance by the use of infrastructure is the nuisance as a result of the presence and use of the infrastructure (visual and noise pollution). This applies mainly to infrastructure above ground. It has a negative effect on the quality of the area and the values of the area.
- Intersections: Intersections are created because above ground infrastructure traverse existing traffic and transport in urban areas. Intersections lead to detours, more travel time and fragmentation of the urban structure. This category does not apply to underground infrastructure.

These categories are developed for infrastructure on the ground and for infrastructure underground. This thesis only focuses on underground transportation infrastructure and therefore I made a slight modification to the types of spatial effects mentioned above:

- Use of space (during construction)[15]: Underground transportation infrastructure projects can be constructed by the wall-roof method and can be constructed by the drilling method. With the wall-roof method the use of space during construction is only temporally at the start of the construction. With this method first the walls are built and later the roof is built on the walls. After this has been done the ground will be restored and the construction on the ground starts. Space still will be used on the ground (during the construction), but only at the beginning and the end of the tunnel and possible intermediate stations. With the drilling method the total construction is underground. Space still will be used on the ground (during the construction) at the beginning and the end of the tunnel and possible intermediate stations.
- Construction nuisance: In the area where infrastructure is constructed negative external effects will occur, like noise and vibrations, visual pollution, degradation of amenities and barrier effects. These nuisance aspects will deteriorate the functionality of the space. When underground transportation infrastructure is constructed by the wall-roof method, construction nuisance will occur at the beginning of the construction. When the roof has been placed on the walls the construction on the ground is ready. This ensures that the construction nuisance disappears.
- (Re)development of area: In the phase when the infrastructure is in use, the space that will be available after the construction of the infrastructure can be (re)designed and (re)developed. The (re)development of an area will be determined by two factors: the construction method and the typology of the urban area. When underground transportation infrastructure is constructed by the wall-roof method the total space above ground can be (re)developed after the roof is placed. When underground transportation infrastructure is constructed by the drilling method no construction takes place on the ground and therefore during the total

[14] During and after the construction of underground infrastructure via the drilling method the above ground area is unchanged. The total construction is underground and therefore no building site is needed at ground level with this construction method.

[15] Note that space on the ground will be used for underground projects at the beginning and the end of the tunnel and possible intermediate stations.

construction time the space on the ground can be (re)developed. The typology of the urban area provides information about the potential of the urban area.

- Elimination of nuisance by the use of infrastructure: When above ground infrastructure is brought underground (like Het Souterrain), the nuisance as a result of the presence and use of the infrastructure (visual and noise pollution) are eliminated. The quality of the area will be improved and the value of the area will be increased.
- Removal of intersections: When above ground infrastructure is brought underground (like Het Souterrain), intersections on the ground disappear. The quality of the area will be improved and the value of the area will be increased.

4. Key features, history, decision-making process and perceived spatial effects of Het Souterrain

This Master thesis is, as mentioned before, based on a single in-depth case study of Het Souterrain. In this chapter the case and its decision-making process will be discussed and the perceived spatial effects of the case will be analyzed. Sub-questions 1, 2 and 3 are answered in this chapter. In the first paragraph the key features of Het Souterrain are described and the actors who had some sort of role or who are influenced by the project are introduced. In the second paragraph the history of Het Souterrain will be described. In the third paragraph the decision-making process of Het Souterrain is described using the stream model of Kingdom and the rounds model of Teisman. This results in a nice picture of the decision-making processes of an urban underground transportation project. The paragraph also describes the role of knowledge and policy analysis tools in the decision-making process of Het Souterrain. In the fourth paragraph the role of spatial arguments in the decision-making process of Het Souterrain is described. In paragraph 5 the perceived spatial effects of Het Souterrain are analyzed. This chapter ends with some conclusions.

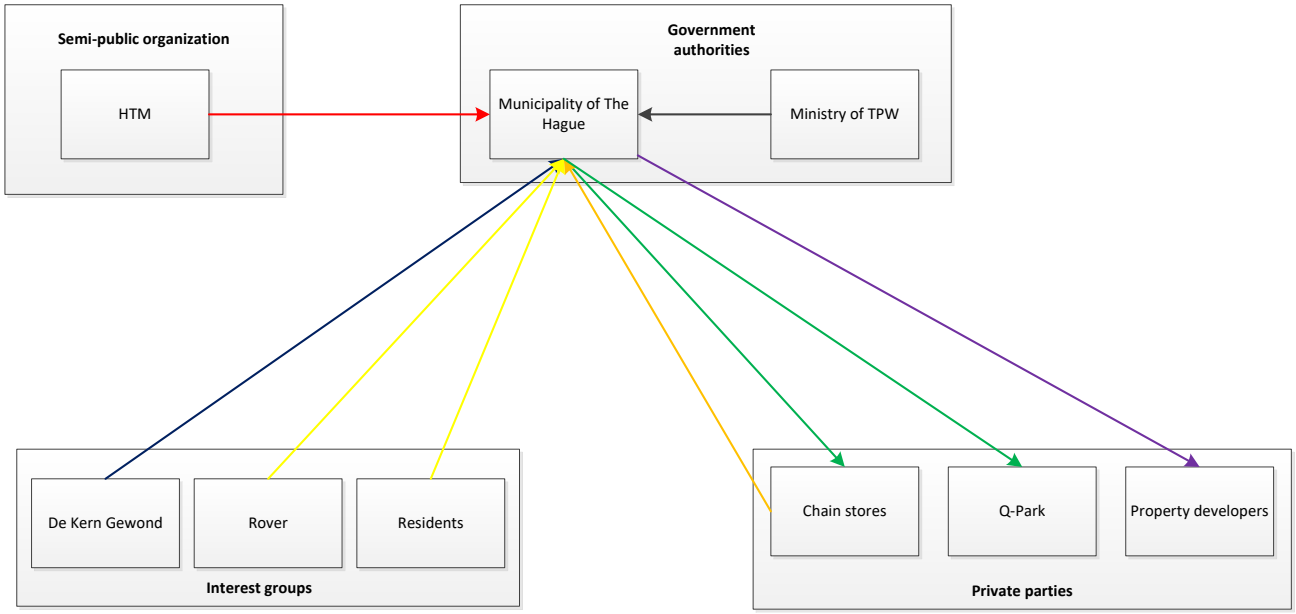
4.1 Key features and actors

Het Souterrain is a tram tunnel and a parking garage located in The Hague under the Grote Marktstraat/Kalvermarkt. The tram tunnel has a length of 1,250 meters and is situated on -2 (relative to the ground) , connecting the central railway station of The Hague with Prinsegracht. Above the tram tunnel a parking garage (-1 relative to the ground) of 500 places has been built (City Council The Hague, 1993). The tunnel contains two underground tram stations: Spui and Grote Markt. Line 2, 3 and 6 of The Hague tramlines make use of the tram tunnel since the opening of Het Souterrain and line 3 and 4 of RandstadRail make use of the tram tunnel since 2007. RandstadRail is a light rail connecting The Hague, Zoetermeer and Rotterdam. It is operational since 2006. The owner of the tram tunnel, the municipality of The Hague[16], is responsible for the daily management of the installations of the tunnel. HTM takes care of the daily management of the installation of the tram tunnel on behalf of this department. The owner of the parking garage, Q-Park, is responsible for and takes care of the daily management of the installations of the parking garage. Het Souterrain is designed by architect Rem Koolhaas. Het Souterrain has been built by using the wall-roof method. With this method first the walls were built and later the roof was placed on the walls. When this was ready the street above the tunnel could be restored and the construction on the ground took place. This construction method had been chosen to diminish nuisance, due to the fact that the major part of the construction was underground. Due to a leak during the construction of the tunnel, the costs rose from € 139 million (estimated construction costs) to € 234 million (real construction costs). Completion was delayed for over four years (total construction period was 8 years).

In Appendix A a detailed actor analysis can be found about the actors who played a role during the decision-making process of Het Souterrain and the actors who have been influenced by the realisation of Het Souterrain. The actors who were involved in the decision-making process of Het Souterrain are: the municipality of The Hague, the Ministry of Transport, Public Works and Water Management (Ministry of TPW), De Kern Gewond, HTM, Rover, residents and chain stores. Property developers and Q-Park have been influenced by the realisation of Het Souterrain. It is important to know who these actors were and which interests they had and which power they exercised to get an adequate picture

[16] Department of Water and Constructions of service City Management

of the case. Moreover, it is important to get more insight about the actors, because this Master thesis is based on the perceptions of these actors. Knowledge about the actors was necessary to make an adequate selection of respondents. Figure 8 pictures the formal chart of the actors in this case. At the bottom of this figure a legend is displayed. From the formal relations between the actors one can determine the interrelations and dependencies between the actors and the powers of the actors.



Legend

Blue arrow: Lobby power and providing advice that is based on professional analysis
Red arrow: Strong advisors and intitiating plans in the Municipal council
Yellow arrow: Lobby power
Orange arrow:Threat power
Green arrow: Decentral rules and regulation
Purple arrow: Decentral rules, regulation and creating the conditions (nice public space + good infrastructure) for the real estate developers to invest
Black arrow: National rules, regulation and giving subsidy

Figure 8: Formal chart

The key features of the actors can be found in table 3. More explanation about the actors has been given in the text.

Table 3: Key features actors

Actors	Important resources	Critical actor	Supporters/Opponents	Interests
Municipality of The Hague	Big	Yes	Supporter	High
Ministry of TPW	Big	Yes	Supporter	High
HTM	Big	Yes	Supporter	High
De Kern Gewond	Limited	No	Opponent	High

Rover	Limited	No	Opponent	High
Residents	Limited	No	Supporters and opponents	High
Chain stores	Big	Yes	Supporter	High
Property developers	Big	Yes	Supporter	High
Q-Park	Limited	No	Supporter	Low

The municipality of The Hague is the principal and owner of Het Souterrain. The municipality had the overall responsibility during the construction of the project. The municipality had some financial resources, however limited, for the construction of the project. The power of the municipality was big. The municipality had multiple interests in favour of Het Souterrain. The (main) interest of the municipality of The Hague was a faster flow of trams in the centre of The Hague and to get a solution for the traffic congestion on the crossing Spui/Grote Marktstraat. Another interest of the municipality was a solution for the car parking in the centre of The Hague. A third interest of the municipality was an improvement of the public space in the centre of The Hague.

The Ministry of TPW had a system responsibility for the public transport network in the Netherlands. The Ministry of TPW ensured that public transport travellers can travel faster, more comfortable and affordable in the Netherlands with the possibility to travel with multiple modalities. The travellers ought to have the possibility to travel with multiple transport modalities and therefore the different transport modalities ought to be properly interconnected. The Ministry of TPW had the financial resources for the construction of infrastructure projects. The Ministry of TPW provided a lot of funds to the municipality of The Hague for the construction of Het Souterrain. These funds were important for the continuation of the project, so the power of the Ministry was big. The granting of the funding suggests that the Ministry finally had a positive interest for the project.

HTM is a carrier of passengers with trams, buses and RandstadRail in the region Haaglanden (HTM, 2015). At that time (90s) the power of HTM was great, because HTM was part of the municipality. HTM presented plans in the Municipal council, so they had some decisional power. Moreover, HTM exercised lobby power and advised the municipality, based on professional analysis of HTM experts. HTM thus had formal decisional power and knowledge power. The advice was seriously taken into account by the Municipal council and was used as ammunition for the arguments of the municipality. HTM had a positive interest, because due to the tram tunnel travel times could be reduced and the expected growth of the number of passengers could be promoted due to the tram tunnel.

De Kern Gewond was an action group which was against Het Souterrain. De Kern Gewond represented the interests of small and medium sized businesses. Due to the construction nuisance, which was accompanied by temporary bad accessibility many of the companies left or got bankrupt (Wijsmuller, 2004). From respondent 9 follows that this action group consisted of business owners, Joris Wijsmuller[17], and Karel van Rijckenvorsel[18]. The power of De Kern Gewond was limited. They had

[17] Joris Wijsmuller was an activist of the association 'De Blauwe aanslag' (De Blauwe aanslag was a squatters building on the Buitenom 212-216 along the Singelgracht).
[18]Karel van Rijckenvorsel was chairmen of the foundation Levi Lassen and founder of the Markthof.

lobby power and they provided the municipality with advice based on professional analysis conducted by professor Schiebroek and professor Witsen. De Kern Gewond did not possess any decisional power. From respondent 9 follow that the municipality of The Hague mainly informed De Kern Gewond about decisions already made. The advice that was given to the municipality wasn't taken into account properly.

Rover represents the interests of the public transport passengers in the Netherlands. Rover is committed to the interests of all passengers in buses, trains, trams, metros and other public transport. This organization aims to improve public transportation in the broadest sense (Rover, 2015). The power of Rover was limited. They had lobby power and did not possess any formal decisional power. The municipality of The Hague mainly informed Rover about decisions that already were made. Rover was not in favour of the project, because according to Rover the tram also could easily ride on the ground. Rover had multiple arguments against Het Souterrain.

Residents have suffered from the construction of Het Souterrain. This was to a limited extent because the wall-roof method as construction method was used. The major part of the construction was carried out underground, which did not lead to much nuisance. The power of the residents was limited. They had lobby power and did not have any formal decisional power, only indirect through political parties represented in the council. The municipality of The Hague mainly informed the residents of decisions already made.

Since several decades a few chain stores are located at the Grote Markstraat in The Hague; C&A, V&D and the Bijenkorf. These chain stores are instrumental for the economy and the number of visitors of The Hague. The chain stores had some power during the decision-making process of Het Souterrain. The chain stores threatened to move to other cities if no adjacent parking garage would be built. Multiple respondents (2, 5, 6, 8, 9, 11 and 13) mentioned that the parking garage (as part of Het Souterrain) was a deal with the chain stores. A parking garage was built for the chain stores to keep them satisfied for the disturbances during the construction of Het Souterrain. Due to the parking garage the chain stores where in favour of Het Souterrain.

Property developers have invested, according to multiple respondents (14, 15, 16, 17 and 18), in real estate located in the Grote Marktstraat due to the improvement of the public space in the centre of The Hague. Several (re)developments have taken place since the realization of Het Souterrain. Examples are; the redevelopment of the Amadeus project, the Passage, the Marquis and the Sijthofcity complex. During the construction of Het Souterrain Property developers were against the project, because the construction nuisance resulted in fewer visitors, shopping public and a decline of the value of real estate. Multiple Property developers (15, 16, 17, 18) mentioned during the interviews that after the completion of Het Souterrain the Property developers were content with the realisation of Het Souterrain, because the project led to an improvement of the accessibility and public space of the centre of The Hague, which led to an increase of the value of the real estate.

The owner of the parking garage ,Q-Park, takes care of the daily management of the installations of the parking garage. Q-park is a private company. Q-Park did not play a role in the decision-making process of Het Souterrain. Q-park wants as much as possible use of the parking garage, which leads to as much as possible revenue. They thus had a positive interest with the project.

4.2 History

In Figure 9 a timeline is presented of the history of Het Souterrain. The timeline is further elaborated in this paragraph.

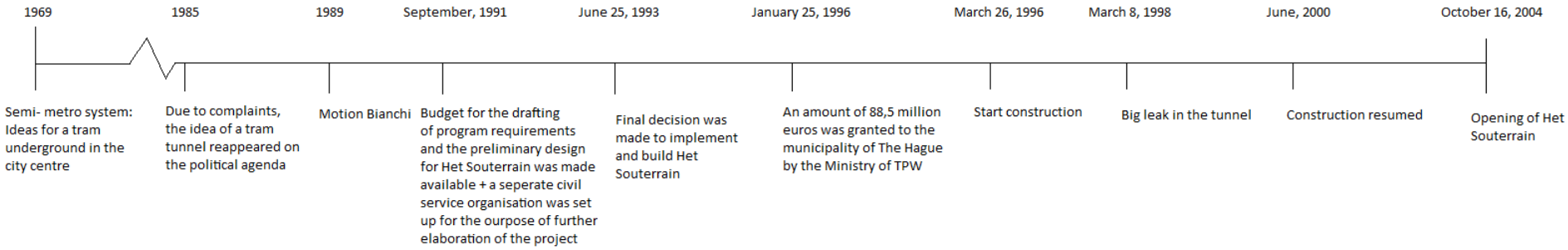


Figure 9: Timeline Het Souterrain

The first ideas of a tram tunnel in the centre of The Hague date back to 1969. In the 'Nota Openbaar Vervoer' from 1969 the municipal council decided to implement a Semi-metro system in The Hague (Bruin & Bosboom, 1969). This is a public transportation system in which the tracks in sections were separated from the roads, but where crossings on the ground could be present. In the Nota was state that tunnels, viaducts and free tracks should be built for city rail traffic. The aim of this system was to ensure faster and better public transportation connections between the suburbs and the centre of The Hague. The Semi-metro system was a HTM idea. The idea to put the trams underground in the centre of The Hague was part of the Semi-metro system plan. The tram tunnel plan was put on hold because the municipality of The Hague didn't want to build big projects in the 80s (municipality of The Hague, 2004).

Investors, entrepreneurs and business owners complained in the mid-80s that the centre of The Hague was not accessible. Due to these complaints the ideas of a tram tunnel in the centre of The Hague reappeared on the political agenda of the municipality of The Hague in the mid-80s (municipality of The Hague, 2004).

Wil Bianchi, a City councilor, proposed in 1989 a motion at the Municipal council, the Motion Bianchi. Wil Bianchi mentioned during an interview with me that the motion had been proposed in the discussion of the Nota 'De Kern Gezond', to investigate the possibility of a tram tunnel under the Grote Marktstraat. Thee Grote Marktstraat dealt with a lot of traffic; Busses, trams, cars, cyclists and pedestrians. The Grote Marktstraat was a shopping area (the largest one in the centre of The Hague) and a road with ongoing traffic. This caused a lot of traffic delays, chaotic situations for the shopping public and numerous accidents. According to Wil Bianchi traffic had to move faster and more efficiently in the centre of The Hague. The Nota 'De Kern Gezond' (municipality of The Hague, 1989) existed of a zoning plan and aimed at an improvement of the public space and the urban situation in The Hague, leading to a new and lively heart in the middle of The Hague centre; a better living climate in the centre; a greener environment in the centre; a more accessible centre with public transport, so that the shops and companies would become more accessible; and a quality improvement of the public transportation in the centre of The Hague. Moreover, in the Nota it was stated that the Grote Marktstraat and the crossing Grote Marktstraat/Spui should become car free.

The Municipal council of The Hague decided in September 1991 to allocate budget for the drafting of the program requirements and the preliminary design of the tram tunnel under the Grote Marktstraat, an underground parking garage under that street and an underground expedition street (to stock the chain stores underground) under the Voldersgracht. Furthermore, a separate civil service organization was set up for the project (municipality of The Hague, 1991). Respondent 4 and 5 mentioned that the Projectgroep Binnenstad further elaborated the idea of the project, did research on the feasibility of the project, created support for the project, and searched for budget for the project.

On June 25, 1993 a final decision was made by the Municipal council to implement and build Het Souterrain. Approval was given to realise the tram tunnel and the underground parking garage (municipality of The Hague, 1993). The expedition street, was not included, because (as respondent 8 mentioned) the chain stores did not want to co-invest in the expedition street. Het Souterrain was the only part of the RandstadRail plan (at that time) that was implemented, because there was too little budget for the total implementation of RandstadRail. RandstadRail was temporally put on hold[19].

On January 25, 1996 Minister Jorritsma of the Ministry of TPW allocated a grant of 88,5 million euros[20] to the municipality of The Hague for the construction of Het Souterrain (Haagsche Courant, 1996). March 26, 1996 started the construction of Het Souterrain (de Haagse Tram Vrienden, n.d.). On March 8, 1998 a big leak in the tunnel emerged , causing water and sand to flow into the tunnel. The tunnel was put completely under water to prevent that more sand would flow into the tunnel and to prevent damage to adjacent buildings (Cobouw, 2010). In June 2000 the construction of Het Souterrain was resumed. The tunnel has been finished under increased pressure (COB, 2016). On October 16, 2004

[19] Stated in a newspaper of that time: 'Den Haag graaft zich een tunnel'
[20] 195 million gulden

Het Souterrain was officially opened by Minister Peijs of the Ministry of TPW, and former Mayor of The Hague Wim Deetman (RVS NON FERRO, n.d.).

4.3 Decision-making process

In this paragraph the decision-making process of Het Souterrain is described to illustrate how the decision-making process of an underground transportation infrastructure project may proceed. At the end of this paragraph it is described how policy information is determined and used in the decision-making process of Het Souterrain.

4.3.1 Two types of decision-making processes

Two (extreme) types of decision-making processes have been identified in literature (Bekkers, 2007): the rational decision-making type and the political decision-making type. The decision-making process in practice is often a mix of these two extremes; it has characteristics of the rational decision-making type and it has characteristics of the political decision-making type. The rational decision-making type is characterised by a number of successive phases:

- Phase 1: Orientation
- Phase 2: Discussion
- Phase 3: Decision-making
- Phase 4: Implementation

In the orientation phase the problem is defined, the goals are determined and the planning of the decision-making process is drafted. In the discussion phase data are collected, alternatives are identified and alternatives are evaluated by choice models based on objectives set in the orientation phase. In the decision-making phase the best alternative is chosen. In the implementation phase this alternative is implemented and the alternative is re-evaluated after completion. The rational decision-making type looks at policy from an uni-central perspective, i.e. policy is determined by a central organisation and this organisation possesses tools and techniques to transfer this policy to other organizations.

The political decision-making type is not characterised by a number of successive phases. The political decision-making type can be explained on the basis of the stream model of Kingdom and the rounds model of Teisman. The political decision-making process views policy from a multi-actor perspective and thus from a poly-central perspective.

4.3.2 Decision-making process of Het Souterrain

To be as complete as possible the decision-making process of Het Souterrain was analysed based on the stream model of Kingdom and on the rounds model of Teisman. Firstly, the decision-making process of Het Souterrain is analysed on basis of the stream model and secondly, the decision-making process is analysed on basis of the rounds model. The second part of this paragraph describes the role of knowledge and professional analysis in the decision-making process of Het Souterrain.

4.3.2.1 The stream model of Kingdom

As mentioned in the previous paragraph, Het Souterrain was put on the political agenda of the municipality of The Hague by the Motion Bianchi, meant to investigate the possibility of a tram tunnel under the Grote Marktstraat. This street experienced the problem of a lot of traffic (busses, trams,

cars, cyclists and pedestrians) which caused a lot of traffic delays and accidents. This is the problem stream.

Wil Bianchi mentioned during an interview with me that a few other cities were visited by people from the municipality of The Hague in order to see how these cities handled this kind of problem. City trips were made for example to Karlsruhe and Frankfurt. In these two cities a few traffic flows were noted that were handled on ground, but also traffic flows were noted that were handled underground. After these city trips, within the municipality of The Hague the idea of a tram tunnel was revived. This is the policy stream.

There are four political events (political events stream) which strengthened the arrival of Het Souterrain:

- The Motion Bianchi had been filed during the discussion on the Nota 'De Kern Gezond'. This Nota aimed at an improvement of the public space in the centre of The Hague, a more accessible centre by public transport and to make the Grote Marktstraat car-free.
- Respondent 2 and 4 stated that the Ministry of Housing, Spatial Planning and the Environment was developing key projects based on the fourth Nota Spatial Planning. These key projects were meant to strengthen the big cities of the Netherlands. The Hague is a big city of the Netherlands, reason to search in the beginning of the 90s whether it could get national funding.
- Respondent 14 mentioned that Het Souterrain was a political compromise. The VVD agreed to the construction of the City Hall, if the PVDA agreed to the construction of the tram tunnel.
- According to multiple respondents (2, 6, 8, 11, 12, 13 and 14) the parking garage was a deal with the chain stores. The chain stores threatened to move to other cities, if no parking garage would be built. So the parking garage was built to keep the chain stores happy during the (disturbances by the) construction of Het Souterrain.

A window of opportunity had risen because the three streams came together. There was a problem in the centre of The Hague (problem stream), underground projects were popular in other cities (policy stream) and four political events strengthen the arrival of Het Souterrain (political events stream).

4.3.2.2 The rounds model of Teisman

The decision-making process of Het Souterrain cannot be characterized as a rational decision-making processes with one phase ending with the emergence of a new phase. The decision-making process of Het Souterrain can better be characterized as a political decision-making process with rounds in which different activities took place and in which different actors were involved then as a rational decision-making process. The decision-making process of Het Souterrain can be described by nine rounds. I have chosen to make the rounds as small as possible to give an as clear and comprehensive as possible analysis, resulting in many rounds. It might be that different rounds actually belong together. Each round will be described separately.

Round A

This round took place around 1969. The Municipal council of The Hague decided to realize the Semi-metro system (see previous paragraph) in The Hague. The critical decision of this round is that the tram tunnel plan was put on hold, because the municipally of The Hague did not wish to start large projects in the city.

Round B

The ideas of a tram tunnel in the centre of The Hague re-emerged on the political agenda of the municipality of The Hague in the mid-80s, because investors, entrepreneurs and business owners complained that the centre of The Hague was not accessible enough. These kinds of complaints resulted in the Nota 'Hart voor Den Haag' (1988). The goal of the Nota was to better develop the city, and particularly the centre of The Hague. It was followed by the Nota 'De Kern Gewond'. This was a redevelopment plan to improve the public space of the centre of The Hague. Wil Bianchi proposed during deliberations on the Nota 'De Kern Gezond' in 1989 a motion in the Municipal council to investigate the possibility of a tram tunnel under the Grote Marktstraat. The critical decision of this round is that within the municipally there already was broad agreement on the tram to go underground in the centre.

Round C

Based on the Motion Bianchi the municipality of The Hague and HTM did some work to assess possibilities of a tram tunnel in the centre of The Hague. The Motion Bianchi was proposed in the discussions on the Nota 'De Kern Gezond'. This Nota aimed at an improvement of the public space and the urban situation of The Hague. A lot of time was put in the preparation of the council meeting concerning the tram tunnel. The Municipal council of the The Hague decided in September 1991 (the critical decision of this round) to allocate budget for the drafting of the program requirements and the preliminary design of the tram tunnel under the Grote Marktstraat, an underground parking garage under the Grote Markstraat and an underground expedition street under the Voldersgrach. Moreover, a separate civil service organization was set up for the project (municipality of The Hague, 1991). According to respondent 4 and 5 Projectgroep Binnenstad elaborated the project further, did research on the feasibility of the project, created support for the project and searched for budget for the project.

Round D

in the period 1990-1993 a lot of negotiations have taken place between chain stores and the municipality of The Hague. The chain stores were not very happy about the expected nuisance of the construction of the tram tunnel and threatened to move to other cities, if no adjacent parking garage was built. Multiple respondents (2, 6, 8, 11, 12, 13 and 14) mentioned that the parking garage (as part of Het Souterrain) was the result of a deal with the chain stores. This deal was the critical decision of this round. Negotiations also have taken place between the municipality and the chain stores about the underground expedition street. The chain stores did not wish to co-invest in the expedition street. Therefore this expedition street has not been realized.

Round E

This round is about the first ideas of RandstadRail. It took place from late 80s to early 90s. The idea of a tram tunnel in the centre of The Hague also had a play in the RandstadRail plan. According to respondent 12 the RandstadRail plan was put on hold by the Ministry of TPW, because there was not enough budget. This is the critical decision of this round. The RandstadRail plan was revived again when the tram tunnel flooded. The Ministry proved to allocate more funds to Het Souterrain, with the RandstadRail plan.

Round F

This round took place in the beginning of the 90s. The Ministry of Housing developed key projects based on the 4th Nota 'Ruimtelijke Ordening'. The Ministry of TPW was the most important financier of the key projects. The aim was to strengthen large cities in the Netherlands through key projects. Het Souterrain became a key project (this is the crucial decision of this round) and therefore the municipality of The Hague could get on in an easier way then usually.

Round G

On June 25, 1993 a final decision was made by the Municipal council to implement and build Het Souterrain. This is the crucial decision of this round. Approval was given for the realisation of the tram tunnel and the underground parking garage (municipality of The Hague, 1993). The expedition street to stock the chain stores underground, did not proceed, because the chain stores did not wish to invest anymore in the expedition street. The decision was the result of preparative work from the Projectgroep Binnenstad.

Round H

In this round negotiations between the municipality of The Hague and the Ministry of TPW took place and professions analyses were carried out (see more about the professional analysis in the next paragraph). On January 25, 1996 Minister Jorritsma of the Ministry of TPW made a grant of 88,5 million euro available (this is the critical decision of this round). The funds were granted based on the public transportation argument. The ministry gave on basis of the 'Wet en Besluit personenvervoer' the funding to the municipality of The Hague (municipality of The Hague, 1993). The grant by the Ministry of TPW was the crucial decision of this round.

Respondent 10 mentioned that within the Ministry pros and cons were discussed regarding the project. The respondent mentioned that in the studies of the municipality of The Hague and HTM to gross assumptions were made. These studies concluded that the tram tunnel was needed to settle the problem of tram traffic. But according to the Ministry also in the situation without the project the traffic could be settled.

Round I

The municipality of The Hague had to talk with actors with less power and who had a smaller role during the decision-making process of Het Souterrain to maintain support for the project. These parties thus were not really involved in the decision-making process, but had to be informed about the state of affairs during the decision-making process. Rover, De Kern Gewond and the residents are examples of this type of actors. Respondent 8, 9 and 13 mentioned that there has been too little consultation and information evenings. Instead of consulting, most time was put at explaining plans to these parties, when the support seemed to diminish. A crucial decision was not made in this round.

4.3.2.3 The role of knowledge and professional analysis

Respondent 10 mentioned that an ex-ante quick scan CBA was made of Het Souterrain. For this quick scan CBA, costs and benefits were entered in a software programme[21]. Spatial effects were not incorporated in this CBA. It turned out that the outcome of this CBA was positive, i.e. the total benefits were larger than the total costs. It is questionable whether the data entered in the CBA were correct.

[21] Unfortunately, the quick scan CBA isn't available anymore.

Respondent 14 mentioned for example that the costs were deliberately aimed to low, because otherwise the project would not have been proceeded.

HTM conducted a study to the expected settlement of the trams at the Grote Marktstraat should the tram not go underground. This study showed that 72 minutes were needed in an hour to settle all the trams at the Grote Marktstraat. Multiple respondents (2, 9, 10 and 13) mentioned that the result of this study was used by the municipality as ammunition for the support of the tram tunnel. There was impression management by the municipality of The Hague to convince everyone of the need to bring the tram underground.

Professor Witsen was hired by De Kern Gewond to examine the traffic needs of the tram tunnel (Wijsmuller, 2004). Professor Witsen substantiated that the traffic need was absent and that bringing the tram underground was not a necessity. Subsequently an audit has been executed by the Adviesdienst voor Verkeer & Vervoer[22] as a reaction to the research of HTM (Wijsmuller, 2004). Respondent 9 mentioned that from the audit followed that the method used by HTM was unknown and that crucial parts of the capacity calculation were incorrect. The recommendation of the audit was that it was desirable to do further research on alternatives, basically at ground level in the Grote Marktstraat or directly around the Grote Marktstraat. Moreover, De Kern Gewond hired professor Schiebroek to research the construction risks (Wijsmuller, 2004). Professor Schiebroek warned for the risky construction method in combination with the treacherous dune sand. The study by professor Witsen and the audit by Adviesdienst voor Verkeer & Vervoer were ignored and the construction risks of professor Schiebroek were downplayed (Wijsmuller, 2004).

According to respondent 9 the municipality of The Hague asked Witteveen & Bos in response to the audit of the Adviesdienst voor Verkeer & Vervoer to do further research. Witteveen & Bos tried to refute the conclusions of the audit with incorrect calculations. The audit commission Adviesdienst voor Verkeer & Vervoer did not get the chance to form an opinion about the results of the research of Witteveen & Bos, because on January 25, 1996 Minister Jorritsma of the Ministry of TPW allocated a grant of 88,5 million euro for the project. The funding was motivated by the public transportation argument. The ministry gave on basis of the 'Wet en Besluit personenvervoer' funding to the municipality of The Hague (municipality of The Hague, 1993).

Respondent 10 mentioned that within the Ministry pros and cons existed regarding the project. The respondent stated that in the studies of the municipality of The Hague and HTM to gross assumptions were made. These studies concluded due to the gross assumptions that Het Souterrain was needed to settle the tram traffic. But according to the respondent also in the situation without the project the traffic could be settled.

The conclusion can be drawn that the role of knowledge and professional analysis in the decision-making process of Het Souterrain was that information in favour of the tram tunnel was used as ammunition by the municipality of The Hague for the support of the tram tunnel and information that was not in favour of the tram tunnel was ignored by the municipality of The Hague. Knowledge thus was not used fully independently. Now that we know how the decision-making process of Het

[22] This organization was part of the Ministry of TPW.

Souterrain proceeded, we can determine what the role of spatial arguments were in the decision-making process of Het Souterrain in the next paragraph.

4.4 The role of spatial arguments in the decision-making process

As mentioned before Het Souterrain returned on the political agenda of the municipality of The Hague, because of a motion filed by Wil Bianchi in the Municipal council of The Hague. The Motion Bianchi was proposed in the discussions on the Nota 'De Kern Gezond'. The Nota 'De Kern Gezond' (municipality of The Hague, 1989) was a zoning plan and had as goal the improvement of the public space and the urban situation of The Hague. Het Souterrain thus returned on the political agenda, because of the wish to improve the quality of the public space in the centre of The Hague. One of the main reasons of Het Souterrain was thus a spatial reason. The reasoning was that the Grote Markstraat and the area around it (centre of The Hague) should be (re)developed and Het Souterrain was an important link in this plan. Multiple respondents (2, 3, 4, 5, 6, 8, 11 and 12) mentioned that the Grote Markstraat was a through traffic road and insufficient space was available for the large shopping street. The Grote Marktstraat should get a boost and should become a strong (international) shopping area again. The expectation was that The Hague would become a strong (shopping) city partly, because of the realisation of Het Souterrain. Also, the Grote Marktstraat should become a nice residential area and business area. The new layout of the central area should lead to spatial developments.

Respondent 8 mentioned that one reason for implementing Het Souterrain and an important expected spatial effect of Het Souterrain was that the chain stores located in the Grote Marktstraat would get an innovative improvement [23] (redevelopment of the chain stores) by building an underground expedition street and underground parking garage.

According to respondent 2 a number of parking places on the ground would disappear. This would be good for the limited space in the centre of The Hague. According to respondent 2 and 13 not all parking places are disappeared. For example the parking garage behind Bezemplein is still open, but it was agreed to close this parking garage.

The underground parking garage had a spatial value: it was a solution for the parking problem in the centre of The Hague, but the most important value of the parking garage was that it was a part of a political process during the decision-making process of Het Souterrain. As mentioned before in the previous paragraph, the parking garage was the outcome of a deal with the chain stores: to keep the chain stores satisfied for the disturbances during the construction of Het Souterrain.

According to multiple respondents (3, 4, 12 and 14) there were only minor expectations during the decision-making process of Het Souterrain that after the completion of Het Souterrain a push would come from private investors who would invest in offices and shops. It was more about expectations and hopes, that when the centre of The Hague would be redeveloped, private investors got some incentives to invest in real estate. The municipality should create the (spatial) conditions on which the private parties could react. Het Souterrain has played a role in the development plan of the centre of The Hague and thus has played a role for many (private) developments. For more information about the relation between private investments in real estate and Het Souterrain see chapter 6.2. According to respondent 14 and Property developers interviewed for my research private investors have responded positively to this spatial development. So, public developments and private developments

[23] For example: the chain stores would be connected with Het Souterrain, and the Passage would be enlarged

were linked to each other. Respondent 14 mentioned that during the decision-making process of Het Souterrain no scenario was made on the meaning of the tunnel for private investments in real estate. The respondent states*: 'The question remains whether anyone would have believed such a scenario in the 90s and thus whether such a scenario is relevant. The politicians namely wanted to make a decision on base of hard numbers. Because of the uncertainty of this effect no calculations were made. It seems now that approximately 300 million euro is invested by private organizations.'*

The construction nuisances which have led to the disappearance[24] of many small companies are a negative spatial effect of Het Souterrain. During the decision-making process of Het Souterrain this has had too insufficient attention. According to respondent 9 typical businesses (including old special shops) of The Hague have disappeared and chain stores have grown in The Hague.

Respondent 10 mentioned that transportation effects have been calculated well during the decision-making process of Het Souterrain. According to respondent 5 one thought it difficult to include the spatial effects in the decision-making process, because they are situational and time-dependent, thus making them very uncertain. Therefore spatial effects have not been calculated. So, spatial arguments played a qualitative role in the decision-making process of Het Souterrain. Respondent 10 mentioned that if transportation arguments are not sufficient enough for the go-decision of a project, other arguments have to be looked at. This was the case for Het Souterrain and therefore also spatial planning arguments became important. So, spatial considerations were included in the decision-making process of Het Souterrain. As mentioned before these spatial considerations have not been included in an official policy analysis tool like a CBA.

A respondent who had a high-ranking position within the municipality of The Hague (respondent 8) mentioned that in projects like het Souterrain courage and vision are needed from the politicians, because a lot of the (spatial) effects are long-term effects, while in politics often the short-term is more important than the long-term. He stated and I cite: *'Some things can't be measured and for these issues political choices should be made on base of a vision and courage.'*

According to respondent 8 urban spatial arguments were used during the decision-making process of Het Souterrain in order to make the tram tunnel longer with an extra tram station. It was no option (seen from an urban design perspective) for the municipality of The Hague to only go underground at the crossing Grote Marktstraat/Spui, because then you would go above the ground in the middle of the Grote Marktstraat. When the tram would go above the ground in the middle of the Grote Marktstraat the same problems would arise as in the old situation.

According to respondent 7 and 8 spatial arguments were especially important in the beginning of the decision-making process to get Het Souterrain on the political agenda of the municipality of The Hague. According to respondent 8 and 10 later in the decision-making process transportation arguments became more important. This was because obtaining the funds from the Ministry of TPW was mainly based on transportation arguments supported with calculations. Though, spatial arguments have played some role in the obtainment of the funding and according to respondent 10 without these spatial arguments the funds would not have been allocated. But, according to multiple respondents

[24] Forty five companies submitted a claim for compensation for loss to the municipality of The Hague. From a letter of Joris Wijsmuller in 2004 follows that six of them are moved, 22 have stopped and three have gone bankrupt (Wijsmuller, 2004).

(2, 8, 10 and 13) the main argument was a transportation argument: the traffic problem on the crossing Grote Marktstraat/Spui should be solved and there should be a faster flow of trams in the centre of The Hague.

We now have a good picture of Het Souterrain, the decision-making process of the case and the role of spatial arguments in the decision-making process of Het Souterrain. In the next paragraph the perceived spatial effects of Het Souterrain will be analyzed.

4.5 Perceived spatial effects of Het Souterrain

In this section the (possible) effects specifically for urban underground transportation infrastructure projects are identified. This is done with the use of the case Het Souterrain. In policy documents and newspapers was searched for (predicted and perceived) effects of Het Souterrain and interviews were held to identify the (predicted and perceived) effects of Het Souterrain[25]. Next, it is described whether these effects are or can be monetized and which effects are perceived spatial effects.

In chapter 1 a definition has been given of spatial effects. Spatial effects are *effects on the representation/embodiment/manifestation of the social functions (living, working, recreation and nature) in an urban area (residential areas, working places, areas reserved for leisure) as a result of underground transportation infrastructure.* In the next table one can see the effects of Het Souterrain. The effects are perceived effects and/or predicted effects. Note that a predicted effect also can be a perceived effect and that an effect which is predicted might not be perceived. It is indicated which kinds of sources mentioned the effects. The second column indicates whether an effect is positive or negative and the third column indicates whether a project effect is a spatial effect. With a X is meant that the perceived effect is mentioned in one or more policy documents, newspapers or interviews. With colours is shown which effects belong together. Based on this table roughly two kinds of project effects can be identified for Het Souterrain: transportation effects (yellow) and spatial effects (red). Also some other effects can be identified: economic effects (orange), safety effects (purple), effects on other policy of the municipality (blue), environmental effects (green) and other effects (white).

Table 4: Effects of Het Souterrain

Effects of Het Souterrain	**Is the effect positive or negative?**	**Is the effect a spatial effect?**	**Are the effects mentioned in one or more of the policy documents[26]?**	**Are the effects mentioned in one or more of the newspapers[27]?**	**Are the effects mentioned in one or more of the interviews?**
The traffic problem on the crossing Grote Marktstraat/Spui has been solved.	Positive	No	X	X	X

[25] Note that the policy documents and newspapers are about expected effects.

[26] 'Openbaar vervoertunnel en Souterrain onder de Grote Marktstraat/Kalvermarkt' written by the municipality of The Hague (1993); 'Randstadrail: Een openbaar Vervoertunnel onder de Grote Marktstraat' written by the municipality of The Hague (1991); 'Vaststelling bestemmingsplan De Kern Gezond' written by the municipality of The Hague (1989)

[27] 'Grote Marktstraat weer gezellige winkelstraat', 'Den Haag gaat met Souterrain ondergronds in de Grote Marktstraat', 'Van verkeersriool naar klinkende namen', 'Den Haag Nieuw Centrum. Souterrain Grote Marktstraat-Kalvermarkt', 'Die tunnel wordt voor ons echt de nekslag'

The expected increase of public transport travellers has been handled.	Positive	No	X		
A decrease of delays has been realized.	Positive	No	X		X
An improved accessibility has been realized.	Positive	No	X		X
A faster flow of public transport (tram) travellers has been realized.	Positive	No	X	X	X
An increase of quality of the public transportation system has been realized.	Positive	No	X	X	X
The traffic has been moved to the Amsterdamse Veerkade.	Negative	No			X
For travellers, it has been taken longer to get to the tram stations due to the stairs.	Negative	No			X
The transport capacity problem in the Grote Marktstraat has been solved.	Positive	No	X		X
A tram-free environment in the Grote Marktstraat has been realized, which is good for cyclists and pedestrians.	Positive	Yes	X	X	X
The centre of The Hague has received an impulse and has got new, lively and vibrant.	Positive	Yes		X	X
An enhanced, more attractive and safer (living) environment have been realized.	Positive	Yes	X	X	X
An improved quality of the public space has been realized in the centre of The Hague.	Positive	Yes	X		X
Private investments have been made possible, improving the adjacent real estate of shops, offices and residential houses.	Positive	Yes	X	X	X
Het Souterrain has given an impulse for the chain stores located in the Grote Marktstraat for improvement and (re)development of their real estate.	Positive	Yes	X		X
The shop and residential climate have got an impulse/An increased attractiveness of housing, offices and cultural facilities has been realized.	Positive	Yes	X	X	X
The nightlife of the centre of The Hague has been boosted.	Positive	Yes			X
Many small businesses have moved or have gone bankrupt due to the prolonged construction and poor accessibility.	Negative	Yes		X	X

An improved (traffic) safety has been realized.	Positive	No	X		X
An improved business climate and more employment (economy) have been realized.	Positive	No	X	X	X
An increase of the number of visitors/shopping public has been realized.	Positive	No		X	X
The first step was made for RandstadRail	Positive	No	X	X	X
Het Souterrain has led to the fact that public transportation in The Hague has been made more competitive with cars.	Positive	No	X		
The car accessibility has been increased because the parking facilities were increased. Parking in the centre of The Hague has thus been made more attractive.	Positive	No	X	X	X
Profiling of the city has improved, i.e. that the city dares to undertake large projects.	Positive	No			X
The centre of The Hague has become more green/A better environment has been realized[28].	Positive	No	X		X
Het Souterrain is an iconic project which has given a proud feeling to the residents of The Hague.	Positive	No			X

All spatial effects which were expected by the municipality are also perceived by the respondents of this research. As far as known by me[29], one spatial effect is not included in the policy documents or newspapers: 'The nightlife of the centre of The Hague has been boosted'. I assume that this spatial effect was not included in policy documents or newspapers, because was is not an important effect and/or because it was not expected. All spatial effects mentioned in Table 4 are perceived spatial effects of Het Souterrain. The spatial effects have not been monetized during the decision-making process of Het Souterrain. As has been described in the previous paragraph, the spatial effects had a qualitative role in the decision-making process of Het Souterrain.

The spatial effects can be classified in the categories of spatial effects of chapter 3. The perceived spatial effect 'Many small businesses have moved or have gone bankrupt due to the prolonged construction and poor accessibility' belong to the category 'Construction nuisance'. The perceived spatial effect 'A tram-free environment in the Grote Marktstraat has been realized, which is good for cyclists and pedestrians.' belong to the category 'Elimination of nuisance by the use of infrastructure. The other perceived spatial effects belong to the category '(Re)development of area'. The perceived spatial effects 'An enhanced, more attractive and safer living environment have been realized' and 'An

[28] Less noise pollution and lower emissions

[29] It is possible due to the age of the case that particular policy documents or newspapers no longer exist.

improved quality of the public space has been realized in the centre of The Hague' could also belong to the category 'Removal of intersections'.

4.6 Conclusions

The decision-making process of Het Souterrain should be described as different rounds in which different actors were involved with different interests and power(s) and in which crucial decisions were taken. It was not a rational decision-making process in which one phase ends with a new phase.

The role of knowledge and professional analysis in the decision-making process of Het Souterrain was that information that was in favour of the tram tunnel has been used as ammunition by the municipality of The Hague for the support of the tram tunnel and information that was not in favour of the tram tunnel has been ignored by the municipality of The Hague. Knowledge thus was not used fully independently. A quick scan CBA was made of Het Souterrain and in this CBA the spatial effects were not incorporated. Spatial arguments played a qualitative role in the decision-making process of Het Souterrain. Spatial arguments were especially important in the beginning of the decision-making process to get Het Souterrain on the political agenda of the municipality of The Hague. Later in the process they became almost absent, because transportation arguments became more important for obtaining the funding of the Ministry of TPW.

Multiple spatial arguments were used qualitatively by the municipality of The Hague for the go-decision of Het Souterrain. According to respondent 10 the transportation arguments were not sufficient enough for the go-decision of the project. Spatial arguments were needed to get Het Souterrain realized. But it should be noted that the transportation arguments were the main arguments and the spatial arguments were the additional arguments.

Nearly all perceived spatial effects were used as spatial argument during the decision-making process of Het Souterrain. There were expectations that private investments would be possible which could improve the adjacent real estate of shops, offices and residential houses. According to multiple respondents (3, 4, 12 and 14) this was not a very certain effect, mainly because during the decision-making process of Het Souterrain the economy was not very thriving. The most popular category of spatial effects among the perceived spatial effects of Het Souterrain is: '(Re)development of area'.

In the next chapter spatial effects in already conducted CBAs will be analyzed to subsequently compare the perceived spatial effects of Het Souterrain with the spatial effects in already conducted CBAs.

5. Spatial effects in already conducted CBAs

The spatial effects of urban underground transportation infrastructure projects are the object of investigation in this Master thesis. It is clear what the definition of a spatial effect is, what the potential spatial effects of an urban underground transportation infrastructure project are and how spatial arguments played a role in the decision-making process of an urban underground transportation infrastructure project (Het Souterrain). This chapter identifies which spatial effects are incorporated in already conducted (existing) CBAs of underground transportation projects (tunnels), infrastructural projects and urban area development projects. In addition, I will explore how these spatial effects have been incorporated in those CBAs; whether these spatial effects are monetized or only described qualitatively. It is mentioned by me what the valuation method(s) of a spatial effect are if a spatial effect is monetized in the already conducted CBAs. At the end of this chapter the similarities are depicted between the perceived spatial effects of Het Souterrain and the spatial effects in already conducted CBAs. The chapter ends with some conclusions. This chapter provides an answer to sub-question 4.

5.1 Benefits of transport infrastructure projects and area development projects

In this paragraph a literature study is conducted on the basis of 18 CBAs. I made a selection of different kinds of projects to get the validity of the results of this analysis as high as possible. CBAs are analyzed of underground transportation projects (tunnels), infrastructural projects and urban area development projects. In the first part of this section it is identified what all the effects are, and whether these effects are monetized. In the second part of this section it is analysed which of these effects are spatial effects. Already conducted CBAs are analysed to gain more knowledge about potential (spatial) effects of (urban underground) transportation infrastructure projects. In addition, already conducted CBAs are analysed to investigate whether potential spatial effects of urban underground transportation infrastructure projects have been incorporated in already conducted CBAs. If spatial effects are included in already conducted CBAs, it is interesting to see whether these spatial effects have been monetized and how or if these spatial effects are only described qualitatively.

One can find in Table 5 the effects that are identified in already conducted CBAs. With a X is meant that the effect is monetized in the CBA and with a 0 is meant that the effect is not monetized in the CBA. With colours is shown which effects belong together. The names of the projects are abbreviated in the table. In Table 2 of chapter 2 the abbreviated names of the projects are already shown. The second column indicates whether an effect is positive or negative.

We can conclude from Table 5 that there are many and different kinds of project effects observed in the studied CBAs. This is in line with my expectations, because quite a lot of projects were analyzed (18) and different kinds of projects were analyzed. With colours is shown which effects belong together. All sorts of project effects are identified: transportation effects (yellow), safety effects (purple), environmental effects (green), spatial effects (red), economic effects (orange) and other effects (white).

Table 5: Project effects in already conducted CBAs

Project effects in already conducted CBAs	Is the effect positive or negative?	Boul. s	Du. po. t.	Tunnel n.	Bolu	New w.	Antwerp	Ro. Ar-N.	Wes. Am.	Urb. Alm.	Zuid. Am.	Opt. Sch.	Spo. Rot.	Pro. Utr.	In. ur. ou.	Urb. ren.	Bui. city.	Are. At.	Ben. Yon.	#
An increase in value of houses/An increase of quality of houses	Positive	X								X				X	X	X	X			6
An increase in value of offices/An increase of quality of offices	Positive									X							X			2
An increase of amenity value and recreational value	Positive	X	0							X			X	X		X	X	X		8
Effects for the flora and fauna	Positive	0																		1
Value of lost view	Negative	0																	X	2
An increase of spatial/urban quality-An increased attractiveness of the centre	Positive					0					X		X	0				X	X	6
An improvement of the open (green) public space	Positive												X	X		X	X			4
Nuisances during construction	Negative							0									X			2
Land revenues	Positive									X	X			X				X		4
Real estate revenues/Positive real estate market effects	Positive									X		0								2
Allocation of land for	Positive												X							1

different functions																			
Positive living ability effects	Positive												X	X	X		X	X	5
Real estate revenues/Positive real estate market effects	Positive								X		0	X							3
Regional economic developments	Positive					X		0	0										3
Positive labour market effects	Positive										X				X		X		3
An improved business climate for (international) organisations	Positive	0							0			0				X				4
An improved quality of existing public transport	Positive													X						1
Positive traffic effects	Positive	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	16
An improved accessibility	Positive																X			1
A decrease of congestion and an increase of travel reliability	Positive					X	X							X			0			4
An increase of robustness/ reliability of the network	Positive					0		X	X	X										4
Savings of costs of traffic	Positive		X		X	X		X	X	X										6
(Traffic/social) safety benefits	Positive	0	X	X	X	X	X	X	0					0		X		X		11
Environmental effects	Positive		0	X		X	X	X	0	X /0	X	X		X		X	0	X	X	14

(emissions, noise, nature, landscape and recreation, social aspects and agriculture)																				
Loss of archaeological values	Negative	0				0														2
Agglomeration effects	Positive										X				X					2

Most of the project effects are positive. The majority of the effects are monetized in at least one of the CBAs. Only the following project effects are not monetized in any CBA: 'Effects for the flora and fauna', 'Loss of archaeological values' and 'Value of lost view'. The seven most frequently mentioned project effects are: 'Positive traffic effects' (16), 'Environmental effects (emissions, noise, nature, landscape and recreation, social aspects and agriculture)' (14), '(Traffic/social) safety benefits' (11), 'Savings of costs of traffic' (6), 'An increase of spatial/urban quality-An increased attractiveness of the centre of The Hague' (6), 'An increase in value of houses/An increase of quality of houses' (6) and 'An increase of amenity value and recreational value' (6).

5.2 Spatial effects in already conducted CBAs

In chapter 3 a definition of spatial effects has been formulated. Spatial effects are *effects on the representation/embodiment/manifestation of the social functions (living, working, recreation and nature) in an urban area (residential areas, working places, areas reserved for leisure) as a result of underground transportation infrastructure.* Positive spatial effects should increase the future value and market value of an area. I hope in the most ideal situation, as mentioned already in chapter 1, to monetize all the possible spatial effects of urban underground transportation infrastructure projects in a CBA. Therefore we try to capture this (future) market value in Euros. One can find in the first column of Table 6 the spatial effects that are identified in already conducted CBAs. In the second column of the table it is mentioned whether a spatial effect is monetized in at least one of the CBAs. If a spatial effect is monetized the valuation method(s) are mentioned in the third column. In the last column the references of the CBAs belonging to the valuation method(s) are mentioned.

Table 6: (non) Monetized spatial effects

Spatial effects in already conducted CBAs	Monetized effect?	Valuation method(s) if monetized	References
An increase in value of houses/An increase of quality of houses	Yes	• The increase of houses is determined by radiation effects. In one case, when the house was between 0-100 metre of the project the increase of the value would be 5% and when the house was between 100-200 metre the increase of the value would be 2,5%. In another case the increase	• (de Nooij, Hof, & Poort, 2007; Zwaneveld, Romijn, Renes, & Geurs, 2009; Rosenberg, Buys, Buitendijk, & Wever, 2012)

		of the value was between 2-10% and the size of the radiation effect was between 150-500 metre. • The value of houses is determined by the national model house value. • The value of houses is determined by the land revenues of houses (residual land value calculation).	• (Lubbe, de Boer, Marlet, Koopmans, & Willebrands, 2011) • (van Hoek, Koning, & Mulder, 2011)
An increase in value of offices/An increase of quality of offices	Yes	• The value of real estate (offices) is dependent on environmental characteristics. These envionmental characteristics are dependent on the distance to the offices. According to the report there are different methods to calculate the quality of the environment: interviews with experts, contingent valuation method, travel costs method and the hedonic price analysis. In the report is described for each environmental characteristic what the effect is on the average rents. • The value of offices is determind by the land revenues of offices (residual land value calculation).	• (Weterings, Dammers, Breedijk, Boschman, & Wijngaarden, 2009)[30] • (van Hoek, Koning, & Mulder, 2011)
An increase of amenity value and recreational value	Yes	• Based on the expenditures of the visitors. • Reflected in the housing prices. • Willingness to pay. • A higher appreciation of a recreation visit (so-called experience benefits). In the Netherlands based on travel costs studies a key number 1 euro per visit is used. • Travel costs method. • Land revenues of facilities (residual land value calculation).	• (Briene, Hamdi, & Verheijen, 2011) • (den Breejen, et al., 2006) • (Zwaneveld, Romijn, Renes, & Geurs, 2009; Decisio, 2013) • (Rosenberg, Buys, Buitendijk, & Wever, 2012) • (den Breejen, et al., 2006) • (van Hoek, Koning, & Mulder, 2011)
Effects for the flora and fauna	No		
Value of lost view	Yes	• The aesthetic satisfaction that people have with the natural and man-made features of their environment can be calculated by landscape costs (these are the urban visual intrusions due to infrastructure on the ground). This value is estimate based on the anthropocentric method in the form of a benefit transfer.	• (Chang, Han, Jung, & Kim, 2014)

[30] This reference is not a CBA

An increase of spatial/urban quality—An increased attractiveness of the centre	Yes	• The effect of an investment in the living environment are for new houses, commercial real estate and offices discounted in ground- and real estate prices. • An improvement of the spatial quality can contribute to the value of real estate, which is an expression of the value that residents give to the spatial quality boost. • A radiation effect can be expressed in the housing prices or rent of houses. • An increase of the attractiveness of a centre can lead to an increase of the expenditure of visitors. • The elimination of crossing can be calculated based on the annual operating costs and the annual accident costs. • Urban separation can be calculated with the excess travel time for pedestrians.	• (Eijgenraam, Ossokina, Blokdijk, & Groot, 2006) • (Decisio, 2013) • (Eijgenraam, Ossokina, Blokdijk, & Groot, 2006) • (Briene, Hamdi, & Verheijen, 2011) • (Chang, Han, Jung, & Kim, 2014) • (Chang, Han, Jung, & Kim, 2014)
An improvement of the open (green) public space	Yes	• Reflected in the housing prices. • Costs of construction and maintenance. • Valuation of the housing consumer. • The quality of the public space is expressed in the real estate price.	• (Rosenberg, Buys, Buitendijk, & Wever, 2012; den Breejen, et al., 2006) • (den Breejen, et al., 2006) • (van Hoek, Koning, & Mulder, 2011) • (Decisio, 2013)
Nuisances during construction	Yes	• Compensation for losses.	• (van Hoek, Koning, & Mulder, 2011)
Land revenues	Yes	• Ground exploitation. • Residual land value.	• (Zwaneveld, Romijn, Renes, & Geurs, 2009; Rosenberg, Buys, Buitendijk, & Wever, 2012) • (Eijgenraam, Ossokina, Blokdijk, & Groot, 2006; Briene, Hamdi, & Verheijen, 2011)
Real estate revenues/Positive real estate market effects	Yes	• Residual land revenues.	• (Zwaneveld, Romijn, Renes, & Geurs, 2009)
Allocation of land for different functions	Yes	• Ground exploitation balance.	• (Decisio, 2013)
Positive living ability effects	Yes	• Decrease of (im)material damage costs. • Travel costs method. • Judgement of people. • 'Leefbaarometer' (a model that calculates the living ability on basis of fifty objective measurable indicators).	• (den Breejen, et al., 2006) • (den Breejen, et al., 2006) • (Rosenberg, Buys, Buitendijk, & Wever, 2012) • (Rosenberg, Buys, Buitendijk, & Wever, 2012)

		• Reflected in the value of real estate (due to decline of social housing, new buildings and the disappearance of unattractive places). • Living ability indicators. • Reflected in annoyance costs. • Reflected in health costs.	• (Rosenberg, Buys, Buitendijk, & Wever, 2012; Lubbe, de Boer, Marlet, Koopmans, & Willebrands, 2011; den Breejen, et al., 2006; Briene, Hamdi, & Verheijen, 2011) • (den Breejen, et al., 2006) • (Chang, Han, Jung, & Kim, 2014) • (Chang, Han, Jung, & Kim, 2014)

It is important to note that the majority of the effects mentioned in the previous table, also could be the result (indirectly) of an improved accessibility. In this case, the effects are not spatial effects. 'An increase in value of houses', 'An increase of value in offices', and 'Real estate revenues/Positive real estate market effects' could also be influenced by transportation effects. These kinds of effects are therefore transportation effects.

It is possible to classify the spatial effects to the categories of spatial effects of chapter 3, if we disconnect the spatial effects of the projects and we come to see them as spatial effects caused by underground projects. Almost all the spatial effects could be classified as an 'Elimination of nuisance by the use of infrastructure', 'Removal of intersections' and as '(Re)development area'. The exception is that the spatial effect 'Value of lost view' should be categorized as 'Use of space'.

There is overlap between the spatial effects of Table 5. 'An increase in value of houses' and 'An increase in value of offices' belong together. 'Real estate revenues/Positive real estate market effects' are the same as 'An increase in value of houses' and 'An increase in value of offices'. Moreover, a better spatial quality has influence on the living ability of an area. Living ability therefore falls within spatial quality.

Many of the spatial effects in Table 5 are monetized as an increase of the price of adjacent houses, offices, shops and other real estate. The increase of the real estate price depends on the distance between the project and the real estate object. Closer real estate objects get a higher increase of the price than more distant real estate objects (the radiation effect). A valuation method that also uses increases of real estate (houses) is the hedonic price analysis[31]. Other valuation methods which could be used to determine the value of the effects are: willingness to pay, expenditures of visitors, experience benefits, contingent valuation method, travel costs method, landscape costs, recess of costs in other policy of spatial planning, annual operating costs, annual accident costs, excess travel time, costs of construction and maintenance, annoyance costs, health costs, compensation for losses and the leefbaarometer. These valuation methods are mainly based on the appreciation/valuation/expenditure of people and the fluctuation of certain costs.

An important condition when monetizing an effect is that double counting should be avoided. With double counting is meant that the effects may not be counted more than once in the CBA. If for example a certain spatial effect is already reflected in the housing price than this effect should not be calculated anymore via for example the willingness to pay method. To prevent double counting the project effects should be categorized in three categories: direct effects, indirect effects and external effects. Direct effects are effects that have an influence on the market in which a certain project engages, indirect effects are effects that have an influence on other markets than where a certain

[31] Hedonic price analysis is used to monetize ecosystems/environmental services on base of housing prices that reflect the value of local environmental attributes (King & Mazotta, 2017).

project engages and external effects are effects that are unintentional and cause damage for third parties (Eijgenraam, Koopmans, Tang, & Verster, 2000). Certain indirect effects are already included in the direct effect. These indirect effects shouldn't be included in a CBA to prevent double counting (Faber & Mulders, 2012).

In the next paragraph is researched which of the perceived spatial effects of Het Souterrain are incorporated in already conducted CBAs. Similarities are depicted between the perceived spatial effects of Table 2 of chapter 4.5 and the spatial effects in already conducted CBAs of Table 5 of chapter 5.2.

5.3 Perceived spatial effects of Het Souterrain incorporated in already conducted CBAs

In Table 7 the similarities are depicted between the perceived spatial effects of Het Souterrain and the spatial effects in already conducted CBAs. The second column shows which of the perceived spatial effects directly could be translated to a spatial effect incorporated in already conducted CBAs. The third column shows the possible spatial effects incorporated in already conducted CBAs under which the perceived spatial effect may fall.

Table 7: Similarities between the perceived spatial effects of Het Souterrain and the spatial effects in already conducted CBAs

Perceived spatial effects	Fall under the spatial effect incorporated in already conducted CBAs	May fall under the spatial effects incorporated in already conducted CBAs
A tram-free environment in the Grote Marktstraat has been realized, which is good for cyclists and pedestrians.		• An increase of spatial/urban quality- An increased attractiveness of the centre • An improvement of the open (green) public space • Positive living ability effects
The centre of The Hague has received an impulse and got new, lively and vibrant.		• An increase of amenity value and recreational value • An increase of spatial/urban quality-An increased attractiveness of the centre • An improvement of the open (green) public space • Allocation of land for different functions • Positive living ability effects
An enhanced, more attractive and safer (living) environment have been realized.	• Positive living ability effects	• An increase in value of houses/An increase of quality of houses • An increase of spatial/urban quality- An increased attractiveness of the centre • An improvement of the open (green) public space • Land revenues • Real estate revenues/Positive real estate market effects

An improved quality of the public space has been realized in the centre of The Hague.	• An increase of spatial/urban quality- An increased attractiveness of the centre	• An increase in value of houses/An increase of quality of houses • An increase in value of offices/An increase of quality of offices • An increase of amenity value and recreational value • An improvement of the open (green) public space • Land revenues • Real estate revenues/Positive real estate market effects • Allocation of land for different functions • Positive living ability effects
The shop and residential climate have got an impulse/An increased attractiveness of housing, offices and cultural facilities has been realized		• An increase in value of houses/An increase of quality of houses • An increase in value of offices/An increase of quality of offices • An increase of amenity value and recreational value • An increase of spatial/urban quality-An increased attractiveness of the centre • An improvement of the open (green) public space • Land revenues • Real estate revenues/Positive real estate market effects • Allocation of land for different functions • Positive living ability effects
The nightlife of the centre of The Hague has been boosted.	• An increase of amenity value and recreational value	
Many small businesses have moved or have gone bankrupt due to the prolonged construction and poor accessibility.	• Nuisances during construction	

The specific perceived spatial effects of Het Souterrain are hard to unravel in a CBA. Four spatial effects fall (in full) under a spatial effect incorporated in already conducted CBAs (see the second column of the previous table). Many perceived spatial effects of Het Souterrain are aggregated ones. These effects may therefore fall (fragmentary) under multiple spatial effects incorporated in already conducted CBAs (see the third column of the previous table). When a CBA is made for a specific urban underground transportation infrastructure project there are several options when naming the spatial effect for each of the aggregated spatial effects. For each aggregated spatial effect one should distribute/place the spatial effect in the right type spatial effect. The correct type of spatial effect is the one that can be monetized as accurately as possible. Double counting should be avoided. To prevent double counting the project effects can be categorized in three categories: direct effects, indirect effects and external effects. Some indirect effects are already included in the direct effect.

These indirect effects should not be included in a CBA to prevent double counting (Faber & Mulders, 2012). In addition, different indirect spatial effects can measure the same. For example, the indirect effect 'Real estate revenues/Positive real estate market effects' measures the same as the indirect effects 'An increase in value of houses' and 'An increase in value of offices'.

Let us take for example the perceived spatial effect 'An improved quality of the public space has been realized in the centre of The Hague' to show how this effect could be incorporated in a CBA. The direct spatial effect (incorporated in already conducted CBAs) of this perceived spatial effect is: 'An increase of spatial/urban quality-An increased attractiveness of the centre of The Hague'. Due to the increase of spatial/urban quality, the value of houses and offices could increase, the amenity value and recreational value could be increased too. The increase of spatial/urban quality can lead to land revenues, real estate revenues/positive real estate market effects and allocation of land for different functions. The increase of the spatial/urban quality can also indicate an improvement of the open (green) public space or positive living ability effects. For this perceived spatial effect multiple indirect/flywheel effects exist. Because for this perceived spatial effect a direct spatial effect already exists that has been incorporated in already conducted CBAs ('An increase of spatial/urban quality- An increased attractiveness of the centre') only this effect should be taken into account in the CBA. The purpose of this example is to indicate that when a spatial effect is incorporated in a CBA one should carefully consider in which form the spatial effect is molded. A spatial effect can be best molded in a form so that it can be monetized and so that double counting is prevented.

5.4 Conclusions

Transportation effects and spatial effects are the most frequent effects observed in already conducted CBAs of transportation projects and urban area development projects. Almost all spatial effects can be classified as an 'Elimination of nuisance by the use of infrastructure', 'Removal of intersections' and as '(Re)development of area'. The exception is that the spatial effect 'Value of lost view' ought to be categorized as 'Use of space'.

Most spatial effects will be reflected in the housing prices of adjacent real estate. Other valuation methods to monetize spatial effects are mainly based on the appreciation/valuation/expenditure of people and the fluctuation of specific costs.

The specific perceived spatial effects of Het Souterrain are difficult to unravel in a CBA. Four spatial effects fall (in full) under a spatial effect incorporated in already conducted CBAs. Many perceived spatial effects of Het Souterrain are aggregated effects. These effects may therefore fall (fragmentary) under multiple spatial effects as already incorporated in already conducted CBAs. The majority of the perceived spatial effects of Het Souterrain are incorporated in already conducted CBAs, often with a different name or in (an)other spatial effect(s). In the next chapter the perceived spatial effects which are not (yet properly) incorporated in already conducted CBAs will be discussed. The goal of the next chapter is to identify the gap between the perceived spatial effects of Het Souterrain and the spatial effects identified in already conducted CBAs, and to find an explanation why particular spatial effects cannot (yet properly) be incorporated in CBAs.

6. Gap between perceived spatial effects of Het Souterrain and spatial effects in already conducted CBAs

We analyzed in chapter 4 the perceived spatial effects of het Souterrain. That led to a better picture of the possible spatial effects of urban underground transportation infrastructure projects. In chapter 5 we studied 18 CBAs and identified in these CBAs the spatial effects and we analyzed how these spatial effects had been incorporated in already conducted CBAs. Furthermore, in chapter 5 the similarities have been depicted between the perceived spatial effects of Het Souterrain and the spatial effects incorporated in already conducted CBAs. That made it possible to analyze now the gap between the perceived spatial effects of Het Souterrain and the spatial effects in already conducted CBAs. Furthermore, it is explained why particular spatial effects cannot (yet properly) be incorporated in CBAs. It is important to know in what extent the results of this thesis can be generalized to other (future) cases and which lessons can be learned from this study. Therefore, at the end of this chapter the generalization of the results of this thesis to other cases will be discussed. This chapter provides answers to sub-questions 5, 6 and 7.

6.1 Perceived spatial effects not incorporated in already conducted CBAs

Two perceived spatial effects do not quite match with the spatial effects incorporated in already conducted CBAs. These are:

- Private investments have been made possible, improving the quality of the shops, offices and residential houses.
- Het Souterrain has given an impulse for the chain stores located in the Grote Marktstraat for improvement and (re)development of their real estate.

Four spatial effects which have been incorporated in already conducted CBAs are an indirect effect of these two effects:

- An increase in value of houses/An increase of quality of houses.
- An increase in value of offices/An increase of quality of houses.
- An increase of amenity value and recreational value.
- Real estate revenues/Positive real estate market effects.

These spatial effects do not completely picture the essence of both perceived spatial effects because, the private investment part in real estate, of both perceived spatial effects is not included in the four above-mentioned spatial effects . The two perceived spatial effects are more a result of another spatial effect. Both perceived spatial effects are quite similar, and can therefore be taken together. The (merged) spatial effect becomes: **The spatial development of real estate, resulting from private investments in this real estate.** This is a flywheel effect. An improved public space has resulted in extra private investments. The indirect spatial effects which are incorporated in already conducted CBAs are the result of this spatial effect.

Note that the real estate should be in the vicinity of the urban underground transportation infrastructure project. In addition, a condition for this spatial effect is that the urban underground transportation infrastructure project has led to an improved urban public space. This spatial effect is not (yet properly) incorporated in already conducted CBAs, but according to many respondents (3, 4, 5, 6, 7, 8, 11, 12, 14, 15, 16, 17 and 18) it is an important spatial effect of Het Souterrain.

The question can be asked whether this spatial effect actually is a welfare effect for the Netherlands and therefore should be included in the CBA. Effects which do not have an impact on the total economy of a country are called redistributive effects, because these effects ensure an improvement of the economy on one place and a decline of the economy on the other place. This is the reason that redistributive effects are not taken into account in CBAs (Faber & Mulders, 2012). The (merged) spatial effect might by a redistributive effect, if private investors will invest elsewhere in the Netherlands when they do not invest in real estate located in the Grote Marktstraat. Property developers (15, 17, 18) mentioned that if a Property developer does not invest in the (re)development of a particular real estate, this does not (per se) mean that this Property developer will always invest in other real estate. For each real estate, separately trade-offs are made. So, the spatial effect *'The spatial development of real estate, resulting from private investments in this real estate'* is not a redistribution effect and can thus be included in a CBA.

The CBA is a well-known and well-developed policy analysis tool in the Netherlands. If some spatial effects are not (yet properly) incorporated in already conducted CBAs it is highly likely that this is the result of issues that are difficult to overcome. In the next paragraph therefore the focus is on the problems of the incorporation of the spatial effect: *'The spatial development of real estate, resulting from private investments in this real estate'*.

6.2 Explanation why particular spatial effects are not (yet properly) incorporated in CBAs

According to the previous paragraph one perceived spatial effect of Het Souterrain is not (yet properly) incorporated in already conducted CBAs: *'The spatial development of real estate, resulting from private investments in this real estate'*. Two possible problems, which may explain why this spatial effect is not (yet properly) incorporated in CBAs, are:

- The unpredictability of private investments in specific real estate.
- The difficulty of attributing private investments in specific real estate to an individual urban underground transportation infrastructure project.

6.2.1 The unpredictability of private investments in specific real estate

The perception of respondent 5 is that it is very difficult to include spatial effects in ex-ante evaluation methods during the decision-making process, because spatial effects are situational and time-dependent. Spatial effects are according to respondents 9 and 12 difficult to estimate and predict, because most spatial effects are long-term effects. Mainly, spatial effects belonging to the category '(Re)development of area' take a long time before they materialize. In the long-term, external effects and social developments can influence spatial effects. External effects are defined in chapter 5.2: *effects that are unintentional and cause damage for third parties*. Examples of external effects and social developments are: changes in the economic situation in the city, changing of power and interests of critical actors and changing local, national or international political climate.

According to many respondents (3, 4, 14, 16, 17 and 18) it is difficult to predict to what extent private investors will invest in the (re)development of real estate as a result of the (re)development of an urban area. Respondent 18, a Property developer, states: *'Investments in real estate are required to at least maintain the value of the property when developments take place in the area.'* This quote implies that Property developers have to react to spatial policy of the municipality

Several Property developers (15, 17, 18) told me in the interviews that when some conditions are met by a municipality, the chance is larger that private investors will invest substantially in real estate. These conditions are:

- The municipality should create a high quality public space for Property developers to respond. For example, respondent 15, a Property developer mentions: *'It is very interesting to take on a large development of real estate, when a transition is done from a B1/B2 shopping area to an A1 shopping area.'* The same respondent explains that when the public space will not be developed, substantial private investments will not take place. In this situation private investments will be done in a much lesser extent. The creation of the spatial conditions in an urban area by the municipality results in the belief and the securing of trust in a particular location among Property developers.
- According to respondent 17 (a Property developer) there should be a good co-operation between the municipality and the Property developers. A good relationship between the municipality and the Property developers is instrumental for the development of an area. Respondent 18 states that relevant parties need to be involved to get as much as possible support for the development of an area. Relevant parties are the ones who have an interest in the development of a particular area. Relevant parties are for example the municipality, Property developers, residents' organizations, architects, and contractors.
- The municipality should have a clear persistent long-term vision/ambition based on the consistency of policy. The vision of the municipality should connect with the vision of the Property developers. This leads to a secure investing climate for Property developers.
- Respondent 17 mentioned that the vision of a municipality should be carried out. It should not only be a plan. Political willingness is needed to implement decisions. Officials need to be trained so that they can execute the vision and are able to cooperate with the Property developers, time needs to be made available by the municipality, and an open and honest official team should be available for consultation.

It is difficult to predict with certainty whether investments in particular real estate will occur as a result of an urban underground transportation infrastructure project. There are multiple unforeseen circumstances (external effects and social developments) that may lead to other outcomes. However, when a few conditions are met by the municipality, chances are larger that private investors will invest substantially.

6.2.2 The difficulty of attributing private investments in specific real estate to an individual project

This section describes to what extent a spatial effect can be attributed to an individual project. A spatial effect can only be fully included in the CBA of a project when this spatial effect is entirely attributable to it.

The perception of multiple respondents (9, 12, 16 and 18) is that it is difficult to attribute spatial effects to an underground transportation infrastructure project in urban areas. An urban underground transportation project is often part of a larger spatial development of an urban area. Multiple factors can influence the realization of a spatial effect. For example, Het Souterrain was one of the first projects aimed at an improvement of the public space. However, Het Souterrain played merely a part in the improvement of the public space of the centre of The Hague. Improving the spatial quality of

the centre of The Hague was the goal of the Nota 'De Kern Gezond' (municipality of The Hague, 1989), a larger plan. More factors which had an influence are for example: the Grote Marktstraat became a car free zone, the realization of the town hall in The Hague, the Chinese port in the Wagenstraat. It is thus impossible to say that a particular spatial effect can be attributed entirely to one project. The spatial effects in the centre of The Hague are a result of multiple spatial interventions in the centre of The Hague.

In addition to other projects which led to spatial improvements in an urban area, also unforeseen circumstances (external effects and social developments) can have an influence on the (spatial) outcome of an urban underground transportation infrastructure project.

Respondent 16 mentioned that you cannot know for sure whether private investments in real estate would not have been made when the tram had not been put underground. Also spatial developments would have taken place in the reference case. It is for example possible to make a transition from a B1/B2 shopping area to an A1 shopping area with the tram still on the ground. In this case private investors could have invested in real estate.

The figure below shows the relationship between an individual project and the realized spatial effects. The realized spatial effects are affected by multiple projects, external factors and social developments.

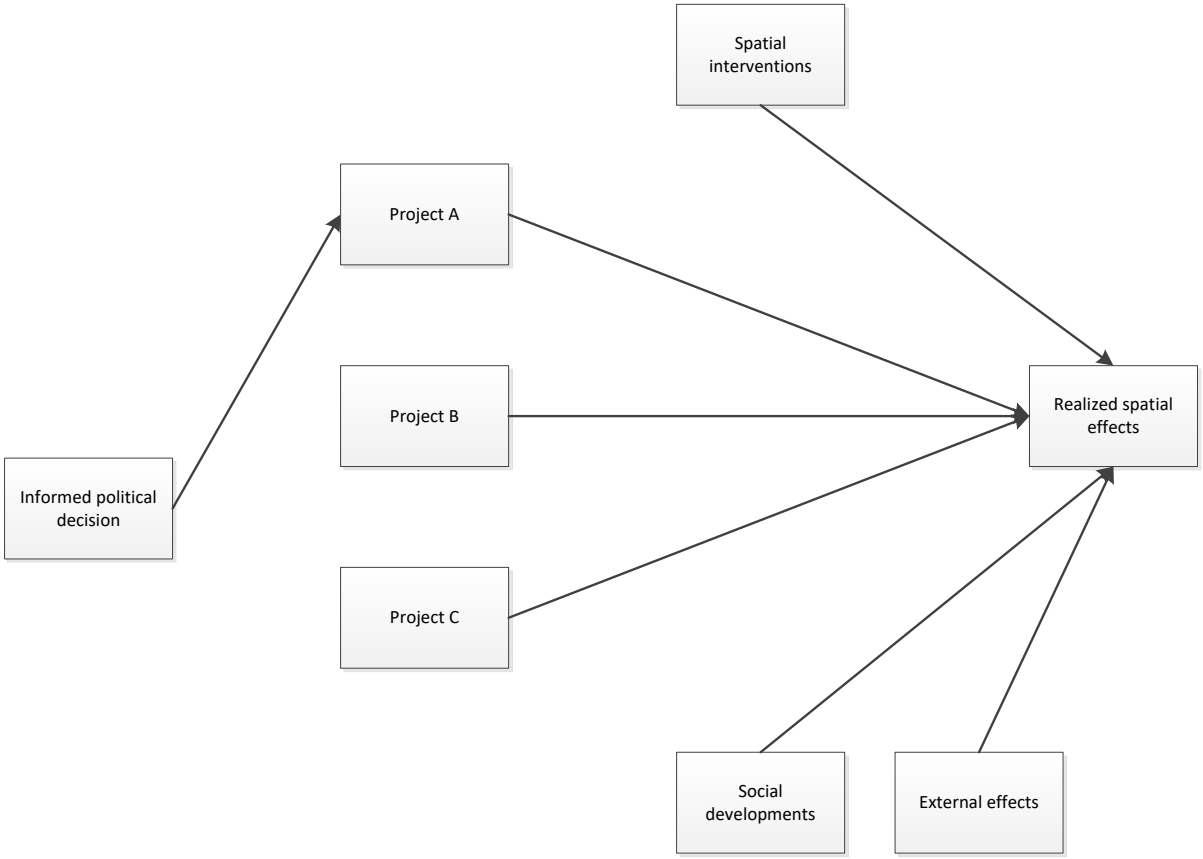


Figure 10: Visual representation of the relationship between an individual project and the realized spatial effects

According to multiple Property developers (15, 17 and 18) the size of private investment in particular real estate is among other things dependent on the quality of the public space. Property developers have invested in real estate located in the Grote Marktstraat. Several (re)developments have been

done since the realization of Het Souterrain, such as the redevelopment of the Amadeus project, the Passage, the Marquis and the Sythofcity complex. Multiple Property developers (15, 17 and 18) mentioned in the interviews that the improvement of the public space, to which Het Souterrain has played a major role led to large private investments of Property developers in real estate located in the Grote Marktstraat. They also mentioned that if the public space wasn't improved in this way, there would have been private investments, but not in the order of magnitude as they now have been made.

This section has made it clear that it is difficult to attribute the private investments in particular real estate entirely to an individual urban underground transportation infrastructure project. The total improvement of the quality of the public space in the centre of The Hague resulted in large private investments in adjacent real estate. But we can say with certainty that Het Souterrain contributed to the total improvement of the public space of the centre of The Hague.

It is difficult to include the spatial effect *'The spatial development of real estate, resulting from private investments in this real estate'* in CBAs due to the two problems discussed in this paragraph. It is important to know in what extent the results of this thesis can be generalized to other cases and which lessons we can learn from this study. Therefore, in the next paragraph the generalization of the results of this thesis to other cases will be further explored.

6.3 Generalization to other cases

Flyvbjerg (2006) states that one can often generalize results from a single case and that a case study can contribute to scientific developments. According to Flyvbjerg this depends on the case and in the way the case has been chosen. A carefully and strategically chosen case may add substantially to its generalizability. As has been described before, Het Souterrain is a typical underground transportation project, because it has improved both public transportation and the quality of the public space. Moreover, Flyvbjerg states that formal generalization is not the only way to gain and accumulate knowledge. If knowledge cannot formally be generalized, it does not mean that this knowledge cannot be part of the collective process of knowledge accumulation. Het Souterrain is a *general* urban underground transportation infrastructure project; that is why some important lessons can be of use for other urban underground transportation infrastructure projects.

Yin also did research on the case study as a research method (Yin, 2000). He states that one can generalize from case study to theory when the method of generalization is analytic generalization. Analytic generalization includes that a previously developed theory should be used as a template for comparison of the empirical results of the case study. If two or more cases support the same theory, replication may be claimed and the theory could be accepted as a scientific one. The theory to use when analyzing urban underground infrastructure projects is that the effects that are the result of such a project should be included in an ex-ante CBA of a similar project. When the finding of a case study is that a particular effect is the result of a particular project, the conditions have to be established under which this effect also is the result of another project.

Kennedy (1979) also did research on the generalization of single case studies. He states that someone who conducts a single case study should produce and share the findings of the case and that the receivers of these findings have to determine whether these are applicable to their own situation. Someone who conduct a single case study has to be very specific about the description of the attributes of the case.

What can be concluded from Flyvbjerg, Yin and Kennedy is that it is possible to generalize from a single case study and generate from that some important lessons. For each new case it has to be assessed whether these lessons are applicable in other cases. If a new case has the same characteristics as the single case study and the same conditions are present there is a fair chance that the lessons of the case study are applicable to this case.

An important finding of this thesis is that a perceived spatial effect of Het Souterrain is: **The spatial development of real estate, resulting from private investments in this real estate.** This effect has not (yet properly) been incorporated in already conducted CBAs due to the unpredictability of this effect and the difficulty of attributing private investments in particular real estate to an individual urban underground transportation infrastructure project. The question remains whether these findings can be generalized to other cases.

The Property developers interviewed for this research (respondents 15, 16, 17 and 18) mentioned the difficulty to generalize these findings to other cases. Multiple factors influence whether a Property developer will invest in real estate as a result of an urban underground transportation infrastructure project. These factors make it difficult to generalize that spatial developments of real estate, resulting from private investments in this real estate will emerge as a result of an urban underground transportation infrastructure project. We can therefore rule out that private investments always will emerge as a result of urban underground transportation infrastructure projects.

Yin (2000) states that a theoretical framework ought to state the conditions under which a particular phenomenon is likely or not likely to be found. It is more plausible to say that the chance is bigger that private investments emerge in adjacent real estate as the result of a particular underground infrastructure project if specific conditions will be met. These conditions are based on my own perspective studying the case Het Souterrain in-depth. It is possible that more conditions should be met. Other cases can provide an answer to the other conditions that should be met. The conditions I determined are:

- Real estate has to be present in the vicinity of the underground transportation infrastructure project. If real estate is not present in the vicinity of an underground transportation infrastructure project, it will not be possible at all for the Property developers to invest in this real estate.
- The underground transportation infrastructure project is built in a densely built-up area with economic potential. There has to be potential to build real estate in the area. This potential for example increases if an urban area is crowded with shopping public, if it is nice to live in this area, if the business climate is good, and when crime rates are low.
- From respondent 16 follows that the economy of a city/country should be healthy. The Property developers must have enough financial potential, making private investments possible from an economic point of view. In addition, Property developers have to make a return on the investments. When the economy is not thriving, it is more difficult for Property developers to collect sufficient revenues from the real estate.
- The underground transportation infrastructure project has to lead to a spatial development of the area. From the previous paragraph follows that it is a condition for the realisation of private investments that the urban underground transportation infrastructure project has led to an improved urban public space.

- From respondent 17 follows that there should be a good cooperative relationship between the Property developers and the municipality.
- From respondent 17 follows that the municipality should have a clear persistent long-term vision/ambition based on the consistency of policy. The vision of the municipality should have a connection with the vision of the Property developers. It is important that this vision will be carried out by the municipality and does not stay a plan. This leads to a secure environment to invest for Property developers.

7. Conclusion, Discussion & Recommendations for further research

This final chapter provides an answer to the main research question. In addition, the results of this research are discussed and recommendations are given for further research.

7.1 Conclusion

The following research question was key for the thesis:

What are the perceived spatial effects of Het Souterrain, are these spatial effect incorporated in already conducted CBAs and why can particular spatial effects not (yet properly) be incorporated in CBAs?

Spatial effects are '*Effects on the representation/embodiment/manifestation of the social functions (living, working, recreation and nature) in an urban area (residential areas, working places, areas reserved for leisure) as a result of underground transportation infrastructure'.* The perceived spatial effects of Het Souterrain are:

- A tram-free environment in the Grote Marktstraat has been realized, which is good for cyclists and pedestrians.
- The centre of The Hague has received an impulse and has got new, lively and vibrant.
- An enhanced, more attractive and safer (living) environment have been realized.
- An improved quality of the public space has been realized in the centre of The Hague.
- Private investments have been made possible, improving the adjacent real estate of shops, offices and residential houses.
- Het Souterrain has given an impulse for the chain stores located in the Grote Marktstraat for improvement and (re)development of their real estate.
- The shop and residential climate have got an impulse/An increased attractiveness of housing, offices and cultural facilities has been realized.
- The nightlife of the centre of The Hague has been boosted.
- Many small businesses have moved or have gone bankrupt due to the prolonged construction and poor accessibility.

Multiple spatial arguments have been used by the municipality of The Hague for the go-decision of Het Souterrain. These spatial arguments have been calculated via policy analysis tools but played a more qualitative role in the argumentation of the municipality. The transportation arguments were not sufficient enough for the go-decision of the project. Spatial arguments were necessary to get Het Souterrain realized.

The specific perceived spatial effects of Het Souterrain proved difficult to unravel in a CBA. Four spatial effects fall (in full) under a spatial effect incorporated in already conducted CBAs. Many of the perceived spatial effects of Het Souterrain are aggregated effects. These effects may therefore fall (fragmentary) under multiple spatial effects incorporated in already conducted CBAs. The majority of the perceived spatial effects of Het Souterrain have been incorporated in already conducted CBAs, often with a different name or in (an)other spatial effect(s). Two perceived spatial effects do not quite match with the spatial effects incorporated in already conducted CBAs:

- Private investments have been made possible which improved the quality of the shops, offices and residential houses.

- The parking garage has given an impulse for the chain stores located in the Grote Marktstraat to improve and (re)develop their real estate.

These perceived spatial effects are quite similar to each other, and can therefore be taken together. The (merged) spatial effect is called: *'The spatial development of real estate, resulting from private investments in this real estate'.*

Two possible problems, leading to an explanation why this spatial effect is not (yet properly) incorporated in CBAs, are:

- The unpredictability of private investments in specific real estate.
- The difficulty of attributing private investments in particular real estate to an individual urban underground transportation infrastructure project.

The unpredictability of private investments in specific real estate

It was established that it is difficult to predict with close certainty if investments in real estate will emerge as a result of an urban underground transportation infrastructure project. There are multiple unforeseen circumstances that may lead to different outcomes. However, when a few conditions are met by a municipality, there is a bigger chance according to multiple Property developers that private investors will invest substantially in specific real estate. These conditions are:

- A high quality urban public space should be created, which result in the belief and the securing of trust in a location by Property developers.
- There should be a good co-operation relation between the municipality and the Property developers.
- The municipality should have a long-term vision which result in a secure investing climate for Property developers.
- The vision of a municipality should be carried out.

The difficulty of attributing private investments in particular real estate to an individual urban underground transportation infrastructure project

According to multiple respondents (9, 12, 16 and 18) it is difficult to attribute private investment in particular real estate entirely to an individual urban underground transportation infrastructure project. Other projects and spatial interventions can have an influence on the spatial development of an area. In addition to other projects, also unforeseen circumstances (external effects and social developments) can have an influence on the (spatial) outcome of an urban underground transportation infrastructure project. The (extent of) private investments in adjacent real estate are one of the possible (spatial) outcomes of an urban underground transportation infrastructure project.

It is difficult to include the spatial effect *'The spatial development of real estate, resulting from private investments in this real estate'* in CBAs due to these two problems.

It is important to know in which extent the results of this research can be generalized to other cases and which lessons can be learned from this study. It is difficult to generalize the spatial effect *'The spatial development of real estate, resulting from private investments in this real estate'* to other urban underground transportation infrastructure projects. Multiple factors have an influence weather a

Property developer will invest in real estate as a result of an urban underground transportation infrastructure project. It can be ruled out that private investments always will occur as a result of urban underground transportation infrastructure projects. It is more plausible to argue that the chance is bigger that private investments will emerge in adjacent real estate as the result of an urban underground transportation infrastructure projects if certain conditions are met. These conditions are:

- Real estate has to be present in the vicinity of the underground transportation infrastructure project. If real estate is not present in the vicinity of an underground transportation infrastructure project, it will not be possible at all for the Property developers to invest in this real estate.
- The underground transportation infrastructure project is built in a densely built-up area with economic potential. There has to be potential to build real estate in the area. This potential for example increases if an urban area is crowded with shopping public, if it is nice to live in this area, if the business climate is good, and when crime rates are low.
- The economy of a city/country should be healthy. The Property developers must have enough financial potential, making private investments possible from an economic point of view. In addition, Property developers have to make a return on the investments. When the economy is not thriving, it is more difficult for the Property developers to collect sufficient revenues from the real estate.
- The underground transportation infrastructure project has to lead to a spatial development of the area.
- There should be a good cooperative relation between the Property developers and the municipality.
- The municipality should have a clear persistent long-term vision/ambition based on the consistency of policies. The vision of the municipality should have a connection with the vision of the Property developers. It is important that this vision will be carried out by the municipality and the does not stay a plan. This leads to a secure environment to invest for Property developers.

7.2 Discussion

In the first section of this paragraph a substantive discussion will be described of a way to incorporate spatial effects which are not (yet properly) included in already conducted CBAs. Therefore the following question is formulated for this section: How might spatial effects which are not (yet properly) included in already conducted CBAs, be incorporated in CBAs? The second part of this paragraph outlines the drawbacks of the research methods of this thesis.

7.2.1 Substantive discussion

A spatial effect can be included in an ex-ante CBA of an urban underground transportation infrastructure project, if this spatial effect has a high degree of certainty, can be predicted and if there is a causal relationship between the spatial effect and the development of an urban underground transportation infrastructure project. Spatial effects are difficult to monetize. According to Mouter et al. (2015) project effects which are difficult to monetize do not get as much attention in CBAs as project effects which are easy to monetize.

We have concluded in chapter 3 that is not necessarily a problem that spatial effects cannot be incorporated in CBAs, when these effects are considered by the decision-makers in the decision-making process via other ways . In addition, in chapter 4, the role of spatial arguments in the decision-

making process of Het Souterrain has been analyzed. We arrived at the conclusion that spatial effects were not included in the (quick-scan) CBA of Het Souterrain, but that spatial arguments played a more qualitative role in the argumentation of the municipality of The Hague. According to respondent 10 Het Souterrain would not have got a go-decision without these qualitative spatial arguments.

In chapter 6 we arrived at the conclusion that the following spatial effect has not (yet properly) been incorporated in already conducted CBAs*: 'The spatial development of real estate, resulting from private investments in this real estate'*. The focus of the discussion thus will be on this spatial effect. It is difficult to predict with a high degree of certainty if and to what extent investments in real estate will emerge as a result of an urban underground transportation infrastructure project. In addition, it is difficult to attribute private investments to an individual urban underground transportation infrastructure project. These two problems complicate the incorporation of the spatial effect mentioned at the beginning of this part in an ex-ante CBA for an urban underground transportation infrastructure project.

My recommendation is to make for a particular urban underground transportation infrastructure project an ex-ante evaluation of this spatial effect on basis of a scenario analysis, taking into account the unpredictability of private investments in specific real estate and the difficulty of attributing private investments to an individual urban underground transportation infrastructure project. Several scenarios are made in a scenario analysis. A scenario is a rich and detailed portrait of a plausible future world (Moniz, 2006). It is a plausible description of what might occur. A scenario is a policy analysis tool describing a possible set of future conditions. So, the essence of a scenario analysis is to obtain different future images. A way to incorporate the private investments in particular real estate resulting from an urban underground transportation infrastructure and to take into account the unpredictability and the complexity of the attribution of this spatial effect to an individual project is to make scenarios for this spatial effect. At least two scenarios should be made: a best-case scenario and a worst-case scenario. In the best-case scenario the spatial effect is maximally included and in the worst-case scenario the spatial effect is not included at all. It is possible to determine the bandwidth of the project results by calculating a best-case scenario and a worst-case scenario.

For each scenario a separate CBA should be made. The spatial effect could be incorporated qualitatively in the CBA. In the best-case scenario the effect should get a ++ or a +, and in the worst-case scenario the effect should get a 0. The worst-case scenario does not need to be monetized because the effect is 0 (euro). From a study of Mouter et al. (2015) follows that effects which are difficult to monetize have a relatively weak position in the CBA compared with effects which are easy to monetize. So, the best-case scenario better should be monetized.

In chapter 5.2 different valuation methods which could be used to monetize spatial effects have been mentioned. Unfortunately, none of the possible valuation methods could be used to monetize the spatial development of real estate, resulting from private investments in this real estate. My preferred method, to get an indication of the economic value of (potential) private investments in real estate, would be to interview existing and potential Property developers. During the interview the following question should be asked: How will the real estate develop when particular spatial developments are done by the municipality and what would be the increase of value of the real estate? It will be difficult to monetize this spatial effect. The possibility exists that Property developers will lie about their future intentions to get a project realized. It is also possible that a Property developer doesn't know yet if and

how much will be invested in real estate when a spatial development is realized by the municipality. The decision-making process of Het Souterrain has shown that spatial arguments have played a qualitative role and that without these spatial arguments Het Souterrain would not have received a go-decision. So, if it is difficult to monetize this spatial effect, this effect should be incorporated qualitatively in the scenario analysis and in the CBA.

Decision-makers are enabled to make a more informed political decision concerning an urban underground transportation infrastructure project when analysts provide them with the two kinds of scenarios and CBAs.

7.2.2 Drawbacks of the research methods

There are a few drawbacks of the research methods discussed in chapter 2. First, an in-depth single case study is conducted; while with a multiple-case study more possible spatial effects could be identified. Second, it is difficult to determine to what extent the results are generalizable to other projects. Besides that, when a quantitative method had been used for this thesis, realized spatial effects could have been determined and measured: this thesis only gives perceptions of perceived spatial effects. In response to the first two drawbacks I wish to state that the value of this thesis is that it gives an interesting first exploration of the possible spatial effects of Het Souterrain and that important lessons can be learned based on this in-depth case study. It is too much work for a Master thesis to study multiple cases and therefore an in-depth case study is carried out to learn very specific for one case.

Third, the main subject of study is the CBA. It is unfortunate that not an extended CBA was conducted during the decision-making process of Het Souterrain. Should an extended CBA be conducted, we would know the role of the spatial effects in this policy analysis tool. Note that (this information follows from respondent 10) a quick scan CBA had been made of Het Souterrain and in this CBA the spatial effects were not incorporated. In response to the third drawback it can be said that the respondents have been asked if and how the spatial effects would be incorporated in the CBA if an extended CBA had been made. From the interviews we know what the role of spatial effects would have been in a CBA if an extended CBA had been made.

Fourth, it might be that information provided by the respondents has been biased, subjective, not true or not relevant. Fifth, it is possible that an interview bias exists for some answers to questions that have been posed in order to verify assessments given by someone else. With interview bias is meant that an answer of a respondent can be influenced by the way the interviewer asks the question (Mouter, 2014). In order to keep the fourth and fifth drawback as small as possible, to multiple respondents the same questions are asked and the respondents were asked whether they agreed to certain assessments of another respondent in order to verify the validity of assessments.

7.3 Recommendations for further research

This study is based on an in-depth single case study. It is therefore difficult to determine to what extent the results can be generalised to other projects. But some important lessons can be learned from this study. With multiple cases, more spatial effects could be identified and the role of spatial effects could be analysed in different decision-making processes. In addition, multiple cases will give more information about conditions that should be met under which there are bigger chances that particular spatial effects are the result of a particular urban underground transportation infrastructure project.

My first recommendation for further research is to study multiple underground transportation projects in urban areas, to find the perceived spatial effects and their role in the decision-making process of the projects and to find the conditions under which the spatial effects are realized. On basis of multiple cases more specific statements could be made.

My second recommendation for further research is to study the perceived spatial effects of the multiple cases with a quantitative method to determine if the perceived spatial effects have been realized.

Multiple valuation methods of spatial effects have been discussed in this thesis. What is fundamentally missing in this study is that the valuation methods were not tested for the spatial effects that arise from underground transportation infrastructure projects. My third recommendation for further research is to monetize the spatial effects of urban underground transportation infrastructure projects on basis of the valuation methods mentioned in this thesis.

In the substantive discussion of this thesis in chapter 7.2.1 a way to incorporate *'The spatial development of real estate, resulting from private investments in this real estate'* in a CBA has been described. The question remains whether this will work. Testing this would provide an answer. My fourth recommendation for further research is to make two CBAs based on a best-case scenarios and a worst-case scenario for a particular urban underground transportation infrastructure project. The results of this analysis should be given to political decision-makers. These politicians should answer the following question: Has the result of the analysis led to more complete policy information and can a more informed political decision concerning this case be made?

In the substantive discussion in chapter 7.2.1 two problems with the recommended monetization method have been mentioned. The first is: The possibility exists that Property developers will not tell the (whole) truth about their intentions to get a particular project realized. The second is: it is possible that a Property developer does not yet know whether and how much will be invested in real estate after the municipality has realized a spatial development of a particular area. My fifth recommendation for further research is to determine ex-post which investments have been made and how much has been invested in real estate as a result of the (re)development of an area. The data given by the Property developers concerning their future investments could be compared with the results of the recommended research. The two problems mentioned in this section could due to the recommended research kept as small as possible.

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Figures and Tables

Appendix A: Ex-ante Cost Benefit Analysis (CBA)

In this appendix the role of CBAs in the decision-making process of (urban) transportation infrastructure projects is studied. In order to study the role of CBAs in the decision-making process of these projects, it is important to know what exactly a CBA is, how it is done and when a CBA should be carried out. The first section gives the theoretical background of this method. After we have established a clear definition of a CBA, the role of a CBA in the decision-making process of (urban) transportation infrastructure will be explained in the second section.

Theory Cost Benefit Analysis

A Cost Benefit Analysis (CBA) is a quantitative ex-ante evaluation method which assesses projects in an economic way. It is a policy analysis tool which gives important policy information to the policy makers (Mouter, Annema, & van Wee, 2013). Since 2000, using this method is mandatory in the Netherlands, during the decision-making process of large infrastructure public projects (Annema, Koopmans, & van Wee, 2007). A CBA has to be conducted, when a municipality applies for funding with the national government (above a financial threshold[32]) for a transportation infrastructure project. Unfortunately, an extensive CBA has not been conducted during the decision-making process of Het Souterrain, due to two reasons. The decision-making process of Het Souterrain started in 1989 and the construction of Het Souterrain started in 1996. During this period it was not mandatory to make a CBA during the decision-making process of transportation infrastructure projects. Moreover, in that period, there was little expertise by policy makers with the tool. Respondent 8 & 10 mentioned that a quick scan CBA had been made during the decision-making process of Het Souterrain. For this quick scan CBA, costs and benefits were entered in a software programme. It turned out that the outcome of this CBA was positive, i.e. the total benefits were larger than the total costs. It is questionable whether the data entered in the CBA were correct. Respondent 14 mentioned for example that the costs were deliberately aimed to low, because otherwise the project would not proceed. Unfortunately, I have not been able to trace this CBA so I could not check it.

In a CBA an overview is given of the benefits and the costs of a (transportation) project (van Wee & Rietveld, 2014). A project effect is a change of state with respect to an existing situation, as a result of a (transportation) project (project alternative) (Eijgenraam, Koopmans, Tang, & Verster, 2000). With the support of a CBA several project alternatives can be compared. A CBA is a tool which have to be used by public organisations. For the policy makers to make a systematic and rational choice between these project alternatives all project effects for the society have to be taken into account. A CBA gives policy makers and others involved insight into the distribution of the costs and benefits to the relevant actors. This is because the government should make a decision on base of the interests of all the relevant actors. CBAs have to be carried out by independent experts (CBA analysts) in order to ensure that the analysis is properly and rationally done.

There are different kinds of project effects: direct effects, indirect effects, external effects and redistributive effects (Eijgenraam, Koopmans, Tang, & Verster, 2000). Direct project effects of a transportation project are the effects of this project on the transportation market, such as number of

[32] A CBA is mandatory in the decision-making process of projects in the Netherlands when the funding by the Dutch government is above 225 million euro (for projects in The Hague, Amsterdam and Rotterdam), and is above 112,5 million euro (for projects in the rest of the Netherlands) (Ministry of Infrastructure and the Environment, 2012).

travellers, traveling time savings and traffic safety. Indirect project effects are derived from direct project effects. Indirect project effects are not benefits for the users and the operators of the project, but are benefits for other markets. For example, an improvement of the infrastructure in a particular area may to an improved business climate. External effects are effects which are unintentional. Negative effects cause damage for third parties such as noise disturbance and other effects for the environment. External effects can also be positive. Plane spotters are a good example of a positive external effect; some people enjoy watching how airplanes land and take off. CBAs are conducted by the national government and thus CBAs research the effects of a project on the whole country. Redistributive effects are effects that don't ensure an improvement of the economy in a country, because redistributive effects ensure an improvement of the economy on the one place and a decline of the economy on the other place. For this reason redistributive effects aren't taken into account in CBAs.

Project effects are monetized in the same unit (Euro) to compare the different project effects in a CBA. In a CBA the monetary value of the benefits are compared with the monetary value of the costs. It is possible that effects cannot be monetized. These non-monetized project effects get a subjective value in the CBA. From a study of Mouter et al. (2015) follows that effects which are difficult to monetize have play relatively weak role in the CBA compared with effects which are easy to monetize. For example, biodiversity and spatial quality are difficult to monetize and play a weak role in CBAs.

Costs and benefits occur at different moments. To deal with the time-issue, the values of the benefits and the costs are calculated as net present values[33]. A discount rate is used to calculate this net present value. Two indicators have been developed to define the result of a CBA. Both indicators present the difference between the costs and the benefits: the 'Return on investment' and the 'Cost-benefit ratio'. The 'Return on investment' is calculated by subtracting the total costs from the total benefits and the 'Cost-benefit ratio' is calculated by the following formula: total benefits/total costs. When the 'Return on investment' is greater than 0 and when the 'Cost-benefit ratio' is greater than 1 the project is economically efficient according to the CBA.

The role of a CBA

Rienstra (2008) studied the role of CBAs in the decision-making process of different types of projects. In his research 46 CBAs are analysed. 50% of the CBAs had a negative Cost-benefit ratio, almost all the projects which scored a positive CBA got a go-decision, and in 80% of the CBAs a go-decision for a project had been made. 75% of the projects with a negative Cost-benefit ratio still got a go-decision. From this, it can be concluded that the result of a CBA is not the final decision to implement a project. The decision to implement a project is a political decision. Other information, trade-offs, motivations and political interests also play a role in this decision. Eijgenraam et al. (2000) and Annema (2014) also mention that the outcome of a CBA is not a direct translation to the decision to construct a transportation infrastructure project. The final decision is a political decision. For politicians, other reasons besides the results of a CBA play a role for reaching a go/no-go decision. According to Annema political decision-makers do not always use CBAs in the decision-making process even if the quality of the CBA is high. Mackie (2010) finds and I quote: *'Transport policy is shaped mainly by politics – central and local government structures, the planning system, the availability of public finance, policy towards tolls, fares and charges or sources of sector revenue, attitudes to public transport revenue support,*

[33] Money has over time a different value due to interest and inflation. Net present values compensate for this.

privatisation and regulation.' The CBA is according to Mackie *'a useful tool within an overall policy context,* but no more than that.' So, according to Mackie in addition to the CBA many more factors play a role in the decision-making process. The value that is given to a CBA in the decision-making process is based on subjective value judgments of the individual. According to Mackie consensus about the value one gives to the CBA in the decision-making process of a project *'is unlikely to be achieved by reference to logic or rationality'.*

In the study of Annema (2014) is stated that civil servants and experts often use the CBA in the design phase or in the initial screening phase of a project. According his study the role of CBA outcomes in the decision-making process is vague. There are no more than clues that a CBA or parts of a CBA have an impact on the political decisions. Only clues, because CBA results are often not or not clearly mentioned as an argument in go/no-go decisions. In this study it is assumed by Annema that the CBA has an impact on decision-making related to design choices within a project. In the Netherlands the application of CBAs had some impact on political decisions for projects. Annema thinks that CBA information is very useful decision-making information which should be available during the decision-making process of transportation infrastructure projects. In the study of Annema follows, based on some Dutch case studies, that the use of CBAs in the decision-making process of transportation projects has been limited, but the Dutch case studies show some impact on go/no-go decisions and on changing original project proposals.

Eliasson & Lundberg (2012) researched the influence of CBAs on transport investment decisions based on data and experiences from the construction of the *'Swedish multi-modal National Transport Investment plan'* for 2010-2021. According to this study there is a relationship between CBA outcomes of a project and planners' rankings of investments. The outcomes of CBAs forced the investment designs to be more cost-efficient. So, according to the study of Eliasson & Lundberg CBAs have a role in the selection of projects during the planning process and CBAs help developing more cost-efficient investments.

Mouter, Annema & van Wee (2013) studied the attitudes towards the role of CBAs in the decision-making process for spatial-infrastructure projects on base of 86 in-depth interviews of key actors in the Dutch CBA practice. Almost all respondents agreed that a CBA ought to play a role in the appraisal of spatial-infrastructure projects and they prefer that the CBA should be used to support a go/no-go decision in the ex-ante evaluation of spatial-infrastructure projects over a situation in which no CBA is used. There is a lot of controversy between economists and spatial planners concerning the value that is and ought to be assigned to CBAs in the decision-making process. Economists believe that usually too little value is assigned to the use of CBAs in the decision-making process of transportation projects and spatial planners believe that usually too much value is assigned to the use of CBAs in the decision-making process of transportation projects. The perception of the 86 key actors in the Dutch CBA practice is that a CBA can have different positive roles in the decision-making process of transportation infrastructure projects:

- The use of CBAs ensures a better/more informed decision-making process. Due to these improvements of the decision-making process, the development of projects that have a negative impact on the welfare of a country is prevented.

- CBAs ensure contemplation, better decision-making and discussion regarding the usefulness, necessity and design of a project. This contemplation results in an improvement of the design of a project or results in the development of another project.
- A CBA give important standardized, objective and independent information to decision-makers concerning the order of magnitude of the benefits and costs, and to who these benefits and costs are distributed.
- A CBA contributes to the justification of decisions and makes the political decisions more transparent for others. Moreover, a CBA makes the policy options more transparent for decision-makers.

Based on six cases, Rienstra (2008) established subjective factors of the role of CBAs in the decision-making process of transportation infrastructure projects[34]. Rienstra identified five subjective factors:

- CBAs identify the effectiveness of projects. In joint projects with more governments and/or countries the CBA also has the function to achieve common insights regarding the effects of the project.
- CBAs could influence the design of a project when the CBA is used early in the decision-making process. With the help of a CBA the most optimal variant is achieved.
- CBAs are conducted as part of the substantive analyses of a project in which the project is substantively investigated and in which the effects of the project are identified. In the actual decision-making of a project, policy context and political context plays a larger role. The substantive part and the decision-making part influence each other and feed each other. Decision-makers are informed of the results of the substantive analysis and use this in their final decision. The decision-making process of a project is thus influenced by CBAs, but how this happens is not always easy to determine.
- In a number of projects, new developments were realized during the decision-making process of the project, like a strong decline of transportation or a decline of political support. Because of these developments the CBA became outdated and didn't have a relevant role anymore for the decision-making.
- The role of a CBA in the decision-making process is positive but not dominant.

The discussion paper about the summary and conclusions of the International Transport Forum ,*'Improving the Practice of Cost Benefit Analysis in Transport'* (International Transport Forum, 2011), states that the role a CBA in the decision-making process of transportation projects varies in time and place. The weight that is given to CBAs in the decision-making process is dependent on the broad governmental culture that is applied in decision-making. This culture is shaped by traditions, (general) culture, politics and geography. It is concluded in this paper that the CBA is a valuable tool for bringing structure, rationality and transparency to infrastructure decisions and strategic policy choices. CBA outcomes do not automatically lead to a decision and often CBAs outcomes are ignored by the decision-makers, but more consistent use of the CBA in the decision-making process of transportation projects would lead into better decisions.

[34] The conclusions of this study only apply to these cases, because the number of cases is too small. The findings of the study can be considered as important lessons.

Mouter & Pelzer (2013) identify three roles a CBA can play in the decision-making process of transportation projects. Two of them have not been mentioned before in this section:

- A CBA can be carried out in the problem analysis phase to identify what exactly the problem is that the project should solve.
- A CBA researches the veracity of the pro and contra arguments of a particular project.

According to a research by Mouter, Annema & van Wee (2012) based on interviews of key actors in the Dutch CBA practice, the CBA should be used in a virtuous way during the decision-making process. I.e. a CBA should be used while knowing the advantages and limitations of the CBA. The most important advantage of a CBA is that it provides objective and independent policy information concerning the benefits and costs of a project which result in a more efficient, effective, justifiable and transparent political decision. The most important disadvantage of a CBA is that CBAs are often incomplete, because project effects are uncertain, unknown or difficult to monetize.

Conclusions

Key-actors in the Dutch CBA practice mention that a CBA ought to play a role in the appraisal of spatial-infrastructure projects and they prefer that a CBA is used to support a go/no-go decision in the ex-ante evaluation of spatial-infrastructure projects over a situation in which no CBA is used. The use of the CBA in the decision-making process leads to a better decision-making process and in better decisions. Consensus about the value one gives to the CBA in the decision-making process of a project is not very likely to occur. The exact role of a CBA is in this decision-making process is not clear, because politicians hardly seem to use CBAs outcomes as an important source to support their go/no-go decision for a project and politicians also use other reasons besides the results of a CBA. So, the role of a CBA in the decision-making process is positive for the quality of the decision, but not dominant. The role of a CBA in the decision-making process varies in time and place and the weight that is given to a CBA in the decision-making process is dependent on governmental culture. The roles that a CBA can play in the decision-making process are:

- A CBA can be carried out in the problem analysis phase to identify what exactly the problem is that the project should solve.
- The CBA can be used in the design phase or in the initial screening phase (selecting projects during the planning process) of a project to get an as optimal as possible and cost-efficient project.
- CBAs produce important independent policy information concerning the benefits and costs and their distribution to the relevant actors. Decision-makers can use this when making a go/no-go decision for a particular project.
- A CBA researches the veracity of the pro and contra arguments of a project.
- CBAs ensure contemplation, better decision-making and discussion regarding the usefulness, necessity and design of a project. This contemplation result in an improvement of the design of a project or the development of another project.
- CBAs contribute to the justification of decisions and CBAs make the decisions more transparent for others. Moreover, CBAs make the policy options more transparent for decision-makers. In addition, CBAs bring structure and rationality to political decisions.
- CBAs identify the effectiveness of projects.

CBAs can play a significant role in the decision-making processes of transportation infrastructure projects, thus also for underground transportation infrastructure projects in urban areas. The CBA is an important tool for decision-makers. The role of a CBA is not dominant, because other factors also play a (and frequently a more decisive) role when a political decision-maker has to make a go/no-go decision for an (urban underground transportation infrastructure) project. A CBA should be used in a virtuous way. The most important role of a CBA is that it provides important policy information concerning the benefits and costs and the distribution of these project effects to the relevant actor. The decision-makers can use this information when making trade-offs for a particular go/no-go decision. A limitation of CBAs is that not all the (welfare) effects can be taken into account in a CBA. CBAs are often incomplete because project effects are uncertain, unknown or difficult to monetize.

Appendix B: Actor analysis

This appendix presents an actor analysis. The methods used in this actor analysis have been based on the article of Bryson (2004). The actors involved in the decision-making process of Het Souterrain and the actors influenced by Het Souterrain are the subject of this analysis. As has been described in the first chapter of my study, the municipality of The Hague is the problem owner in this case. This appendix means to give an indication which actors were important for the municipality of The Hague during the decision-making process and how the actors played a role in the decision-making process of Het Souterrain. The goal of this appendix is to know the behaviours, interests and goals (opposed or aligned), resources, means, powers and interdependencies of the relevant actors. First, the relevant actors are identified and a short description of the actors is given. Second, the interrelations between the actors are identified, by first mapping the formal relations. Third, the interdependencies between the actors are researched by means of their resources and dependencies of these resources. Fourth, it is determined what the powers versus interests are and whether the actors are (non)critical, (non)dedicated and have the same or conflicting interests and goals. At the end a conclusion has been formulated.

Identification of relevant actors

Table 8 shows an overview of the relevant actors during the decision-making process of Het Souterrain. The second column gives a description of the actors and in the third column the interests of the actors are described.

Table 8: Relevant actors

Actors	Description	Interests
Government authorities		
Municipality of The Hague	The municipality of The Hague is the principal of new transport infrastructure projects like Het Souterrain. The municipality has the overall responsibility for such a project. The municipality consists of political actors in the Municipal council and the Daily management[35] of the municipality who make both important decisions for The Hague and consists of the civil service. For this case study the department of Urban Development and the sub department Traffic are important.	The (main) interest of the municipality of The Hague is a faster flow of trams in the centre of The Hague and to get a solution for the traffic congestion on the crossing Spui/Grote Marktstraat. Another interest of the municipality was a solution for the car parking in the centre of The Hague. A third interest of the municipality was an improvement of the public space in the centre of The Hague.
Ministry of TPW	The Ministry of Transport, Public Works and Water Management (Ministry of TPW) is in 2010 merged with the Ministry of Ministry of Housing, Spatial Planning and the Environment into the Ministry of Infrastructure and the Environment (Ministry of I&E). The Ministry of TPW had a system responsibility (for the whole) for the	The interest of the Ministry of TPM was a good working public transport network in the centre of The Hague which ensures a good accessibility by public transport in the city. The public transport travellers should travel fast and comfortable in the city and it should be affordable for the users to travel. The Ministry of TPW had a lot of financial resources for

[35] In Dutch: College van burgemeester en wethouders

	public transport networks in the Netherlands. The Ministry of TPW ensured that public transport travellers could travel faster, more comfortable and affordable through the Netherlands with the possibility to travel with multiple modalities. Travellers should have the possibility for multiple transport modalities and therefore the different transport modalities (both public and private transport modalities) should be properly interconnected.	infrastructure projects. The Ministry of TPW provided a lot of funding for Het Souterrain. The funding was an important factor in the continuation of the project. The granting of the funding suggests that the Ministry finally had a positive interest for the project. But this has taken a long time, because according to respondent 10 there were pros and cons for the project.
Semi-public organization		
HTM	HTM is a carrier of passengers with trams, buses and RandstadRail in the region Haaglanden (HTM, 2015).	The interest of HTM is a good settlement/accessibility of the public transport in The Hague. Moreover HTM wants as many public transport travellers which results in as much as possible revenues. HTM had a positive interest in the project because due to the tram tunnel the travel times would decrease and the expected growth of the number of passengers could be settled due to the tram tunnel.
Interest groups		
De Kern Gewond	De Kern Gewond was an action group which was against Het Souterrain. De Kern Gewond represented the interests of small and medium sized businesses. This party consisted of business owners, Joris Wijsmuller[36], and Karel van Rijckenvorsel[37].	The interest of De Kern Gewond was a healthy economic situation for the parties they represented. Another interest of De Kern Gewond was a good traffic circulation through the centre of The Hague. De Kern Gewond represented small and medium sized businesses in the centre of The Hague. Due to the construction nuisance which was accompanied by a temporary bad accessibility many of the companies have left or went bankrupt (Wijsmuller, 2004). The traffic was moved from the Grote Marktstraat to the Amsterdamse Veerkade and this resulted in the demolition of 'De Blauwe Aanslag'. The Kern Gewond was thus not a supporter of the project.
Rover	Rover is an interest group for the public transport passengers. Rover is committed to the interests of all passengers in busses, trains, trams, metros and other public transport. This party aims to improve public transportation in the broadest sense (Rover, 2015).	Rover represents the interests of the public transportation travellers in the Netherlands. Interests are for example an efficient, affordable, comfortable and fast public transportation network in the Netherlands. According to Rover the tram also could be settled on the ground at the Grote Marktstraat and Rover had

[36] Joris Wijsmuller was an activist of the association 'De Blauwe aanslag' (De Blauwe aanslag was a squatters building in the Buitenom 212-216 along the Singelgracht).

[37] Karel van Rijckenvorsel was chairmen of the foundation Levi Lassen and founder of the Markthof.

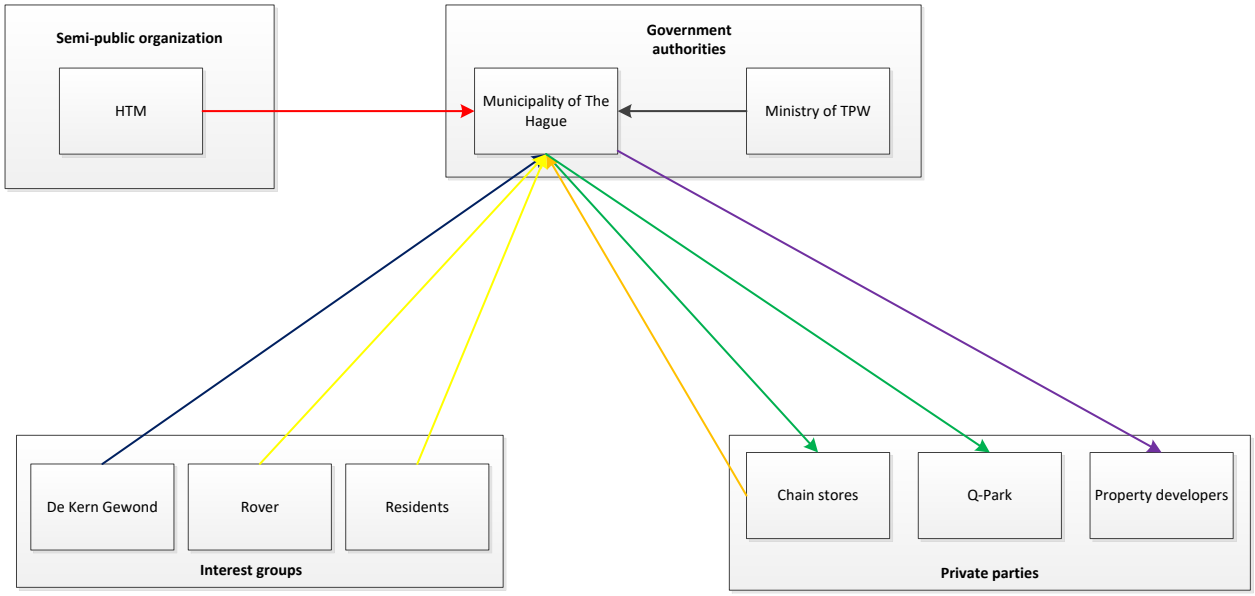
		multiple arguments against the tram tunnel.
Residents	Residents have suffered from the construction of Het Souterrain. This was limited since the wall-roof method as construction method was applied, whereby the major part of the construction was carried out underground, which didn't give any nuisance.	The interests of the residents are: a good accessible centre, parking facilities, a good quality of life, high value of houses, and a high quality of the public space. Residents want as limited as possible construction nuisance.
Private parties		
Chain stores	A few chain stores are for decennia located at the Grote Markstraat in The Hague: C&A, V&D and the Bijenkorf. These chain stores are good for the economy and the number of visitors of The Hague.	The chain stores have an interest in a good accessible centre and enough nearby parking facilities. Chain stores want as limited as possible construction nuisance. The chain stores were in the end in favour of Het Souterrain, because an underground parking was realized.
Property developers	Property developers have invested in real estate located in the Grote Marktstraat. Several (re) developments have been done since the realization of Het Souterrain. Such as the redevelopment of the Amadeus project, the Passage, the Marquis and the Sythofcity complex. Multiple Property developers (15, 17, 18) mentioned during the interviews that the improvement of the public space, in which Het Souterrain has played a major role has led to major private investments by Property developers in real estate located in the Grote Marktstraat. They also mentioned that if the public space wasn't improved in this way, there would have been private investments, but not in the order of magnitude as they now have been made.	Property developers have an interest in an as high as possible value and return on their real estate. A good accessible area and a good developed public space influence this value and return positively. During the construction of Het Souterrain the Property developers were against the project because the construction nuisance resulted in fewer visitors, shoppers and a fall in the value of the real estate. Multiple Property developers (15, 16, 17, 18) mentioned during the interviews that after the completion of Het Souterrain the Property developers were content with the realisation of Het Souterrain because the project led to an improvement of the accessibility and public space of the centre of The Hague, which led to an increase of the value of the real estate.
Q-Park	Q-Park is the owner of the parking garage and they conduct the daily management of the installations of the parking garage.	Q-park wants as much as possible people who park their cars in their parking, which leads to as much as possible revenue. Q-park is the owner of the parking garage and thus had a positive interest in the project.

From the table above follows that the municipality of The Hague, HTM, Property developers and Q-park had a positive interest in Het Souterrain, De Kern Gewond and Rover had a negative interest in Het Souterrain and the Ministry of TPW, chain stores and residents had doubtful interests in Het Souterrain.

Formal Chart

It is necessary to determine the formal relationships between the actors, because one can determine the dependences between the actors when the formal relationships are known. Formal relations are formal positions of actors, roles and responsibilities of actors, description of the main laws, regulations

and procedures, and specification of a formal relationship between actors. A picture of the formal relationships provides a good starting point for mapping the informal relationships between the actors. To achieve all this, a formal map has been created (see Figure 11).



Legend

Blue arrow: Lobby power and providing advice that is based on professional analysis
Red arrow: Strong advisors and intitiating plans in the Municipal council
Yellow arrow: Lobby power
Orange arrow:Threat power
Green arrow: Decentral rules and regulation
Purple arrow: Decentral rules, regulation and creating the conditions (nice public space + good infrastructure) for the real estate developers to invest
Black arrow: National rules, regulation and giving subsidy

Figure 11: Formal chart, municipality of The Hague

Interdependence of actors

Table 9 describes for each actor what resources they have.

Table 9: Actors and their resources

Actors	Resources
Government authorities	
Municipality of The Hague	The municipality determines the municipal policy (in the Municipal council) and implements this policy in the civil services. The municipality has the final responsibility for a (municipal) project and is the principal of such a project. The municipality has some financial resources, however limited, for the implementation of large projects. The municipality was the initiator of Het Souterrain and had therefore quite a lot of power.
Ministry of TPW	The Ministry of TPW determined national rules and regulations in the field of traffic and infrastructure. The municipality is bound to these national rules. The Ministry of TPW had a lot of financial resources for infrastructure projects. The Ministry of TPW provided a lot of funds for

	Het Souterrain. The funding was an important factor in the continuation of the project. The Ministry of TPW possessed thus quite a lot of power. The municipality was financially dependent on the ministry.
Semi-public organization	
HTM	At that time the power of HTM was quite substantial. HTM was at that time part of the municipality. HTM presented plans in the Municipal council, so they had some decisional power/influence. Moreover, HTM had lobby power and provided advice to the municipality which was based on professional analysis conducted by HTM. HTM thus had formal decisional power and knowledge power. According to multiple respondents (2, 9, 10 and 13) the advices of HTM were seriously taken into account by the municipality of The Hague and were even used as ammunition for the arguments of the municipality.
Interest groups	
De Kern Gewond	The power of De Kern Gewond was limited. They had lobby power and they gave advice to the municipality which was based on professional analysis conducted by professor Schiebroek and professor Witsen. De Kern Gewond didn't possess any decisional power. The municipality of The Hague informed de Kern Gewond mainly of decisions that already were taken. The advice that was given to the municipality wasn't taken into account properly.
Rover	The power of Rover was limited. They had lobby power (mainly through the media). Rover didn't possess any formal decisional power. The municipality of The Hague informed Rover mainly of decisions that already were taken.
Residents	The power of the residents was limited. They had lobby power. The resident didn't possess any formal decisional power. The municipality of The Hague informed the residents mainly of decisions that already were taken.
Private parties	
Chain stores	The chain stores had power during the decision-making process of Het Souterrain. The chain stores threatened to move to other cities if no adjacent parking garage was build. From multiple respondents (2, 5, 6, 8, 9, 11 and 13) follows that the parking garage (as part of Het Souterrain) was a deal with the chain stores. A parking garage is built for the chain stores to keep them happy for the disturbances during the construction of Het Souterrain. The chain stores thus possessed threat power
Property developers	Property developers can decide to (re)develop particular real estate. From interviews in this research (14, 16, 17 and 18) follows that the decision of a Property developer to (re)develop a particular real estate, and the extent to which investments are made is dependent on the spatial conditions that the municipality provide, the relationship with the municipality and the vision that a municipality has. The chance is high that a Property developer will invest a lot in the (re)development of a particular real estate, if the spatial conditions are very good, the relationship with the municipality is fruitful and the vision of the municipality is clear and static. When it is clear in advance that Property

	developers won't invest in the (re)development of real estate the municipality should rethink if an investment in the public space is economic profitable.
Q-Park	Q-park is a private company and owner of the parking garage of Het Souterrain. Moreover, they conduct the daily management of the installations of the parking garage. Q-Park didn't have a role in the decision-making process of Het Souterrain.

Then, it must be determined whether an actor is a critical actor to the municipality of The Hague on the basis of substitutability and dependency on the resources the actors have. An actor is critical when the resources at its disposal can have an influence on the goals of the municipality of The Hague. The importance of the resource is determined on the fact if the resource of an actor can have a high or low impact on the goals of the municipality of The Hague (positively or negatively). Table 10 shows the importance of the actors' resources and whether an actor is a critical actor.

Table 10: Resource dependency and critical actors

Actors	**Important resources**	**Substitutability**	**Dependency**	**Critical actor**
Municipality of The Hague	Big	No	Yes	Yes
Ministry of TPW	Big	No	Yes	Yes
HTM	Big	No	Yes	Yes
De Kern Gewond	Limited	Yes	No	No
Rover	Limited	Yes	No	No
Residents	Limited	Yes	No	No
Chain stores	Big	No	Yes	Yes
Property developers	Big	No	Yes	Yes
Q-Park	Limited	Yes	No	No

Table 11 shows a Power versus Interest grid. The actors that are important for the municipality of The Hague are the ones that have a high power and a high interest.

Table 11: Power versus Interest grid

Interests / **Power**	**Low**	**High**
Low	Q-Park	De Kern Gewond Chain stores Rover

		Residents
High		Municipality of The Hague Ministry of TPW HTM Chain stores Property developers

Table 12 shows two distinctions: if the actors are a dedicated actor or a non-dedicated actor (a lot or little interest) and if the interests and goals are aligning or opposing to the interests and goals of the municipality of The Hague.

Table 12: Dedicated/non-dedicated actors, same/conflicting interests and goals

	Dedicated actors		**Non-dedicated actors**	
	Critical actors	**Non-critical actors**	**Critical actors**	**Non-critical actors**
Same interests and goals	Municipality of The Hague Ministry of TPW HTM Chain stores Property developers			Q-Park
Conflicting interests and goals	Ministry of TPW Chain stores	De Kern Gewond Rover		Residents

Conclusion

During the decision-making process of Het Souterrain quite a lot of actors were involved and Het Souterrain influenced some actors. So, it was a multi-actor system with actors in the public sector (municipality of The Hague and Ministry of TPW), a semi-public organization (HTM), actors in the private sector (chain stores and Property developers) and interest groups (De Kern Gewond, Rover, residents). The Ministry of TPW was the most important actor for the municipality of The Hague, because of the funds the ministry provided. The funding was crucial for the continuation of the project. The chain stores were important to the municipality due to their threats to move to other cities, if no adjacent parking garage was built, while the project was being implemented. The parking garage (as part of Het Souterrain) was a deal with the chain stores. So, the chain stores possessed some decision-making power concerning the parking garage. HTM had the power to initiate ideas at the Municipal council. So, HTM had some formal decisional power. Moreover, HTM advised the municipality based on professional analysis. The results of the analysis were not looked at by the municipality on an independent way and were used as ammunition for the arguments of the municipality. The other interest groups did not possess any formal decision-making power. They were informed about

decisions already made. These interest groups had some lobby power though . Advices of De Kern Gewond, based on professional analysis, were ignored by the municipality. Property developers positively reacted on the improvement of the public space in the Grote Marktstraat. Het Souterrain was a part of the improvement of the Grote Marktstraat. Property developers have (re)developed some real estate located in the Grote Marktstraat, on base of the spatial conditions that were provided by the municipality, the good relationship with the municipality and the clear and static vision of the municipality.