A comparative analysis of station area evaluation models in the Dutch practice of Transit-Oriented Development

Master Thesis
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Acknowledgement

First and foremost I would like to thank my supervisor dr. ir. Wendy Tan for guiding me through this challenging process with enthusiasm, motivation, and always helpful feedback. Second, I want to express my gratitude for those who were open for interviews; these interviews opened up a world of information and were inspiring conversations. Third, I want to thank my fellow students, and in particular, Maarten, Geoff, Edgar, Lara, Kirsten, Tantri and Hanneke, for supporting, inspiring, and being there for me throughout the thesis period. Final gratitude goes out to my parents, friends and family.

Jeroen Bekink
19 August, 2017, Groningen

Abstract

While Transit-Oriented Development (TOD) and land-use and transport integration are high on the agenda of many governments, knowledge about the role and the components of station area evaluation models is not that evident. These models were retrieved from the same forward-thinking node-place model, and they seem to have a prominent place in the Dutch context of TOD. The focus of this research is therefore on how these different models are put together and where, how, and why they are used by the coordinating governmental bodies in three well-known cases in the Netherlands. Information is gathered on the cases of Randstad Southwing, the province of Noord-Holland, and the former Arnhem Nijmegen City Region by combining document analysis and semi-structured interviews. In a comparative research, the differences and similarities between the builds and the role that these models play in their processes are unveiled. The results show that all three models are highly quantitative in their components, and to offer more realistic representations of station areas, chances lie in the qualitative research. However, if the models are due for further deepening, is strongly dependent on the role they are fulfilling in the process, be they analytical instruments or merely inspirational or communication instruments.

Keywords: *Transit-Oriented Development; Land-use transport integration; Station area (re)development; Policy evaluation; Node-place model; Randstad Southwing; Province of Noord-Holland; Arnhem Nijmegen City Region*

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List of abbreviations

TOD	Transit-Oriented Development
NS	Dutch Railways (Nederlandse Spoorwegen)
VMT	Vehicle Miles of Travel
MRDH	Metropolitan area Rotterdam Den Haag (Metropoolregio Rotterdam Den Haag)
RS	Randstad Southwing (Zuidelijke Randstad)
NH	Province of Noord-Holland (Provincie Noord-Holland)
AN	Arnhem Nijmegen City Region (Regio Arnhem-Nijmegen)
HOV	High Quality Transport (Hoogwaardig Opebaar Vervoer)
OVK	Public transport node programme (Programma OV-knooppunten)
OV	Public transport (Openbaar Vervoer)
GIS	Geographical Information Systems

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1. Introduction

In many cities and metropolitan areas around the world the integration of transport and land-use development is high on the agenda (Peek, Bertolini & De Jonge, 2006; Tan, Janssen-Jansen & Bertolini, 2014). Along the principles of Transit-Oriented Development (TOD) planners and policy-makers are trying to concentrate new- and redevelopments around existing or new infrastructure nodes and concentrating new infrastructure nodes around already existing and dense developed areas (Curtis, 2012). The rationale behind this integration, however, may differ from case to case, from region to region, and from country to country. In other words, the problems and challenges aimed to solve through TOD can be environmental, social, or economic of nature, but are often an intertwining combination of those. Governments around the world invest a great deal in TOD, but the concept of TOD is also different per case, as well as the definition for TOD (Singh et al., 2014). There is no unifying evaluation model for TOD or a standardised model for implementing TOD (Carlton, 2009). The way that station area evaluation models are constructed, and how they are used can be of an influence of how public resources are allocated and invested, and therefore making it a crucial part of legitimising the use of public funds (Peek et al., 2006). This research aims to analyse and compare station area evaluation models in the context of TOD in the Netherlands. To do so, we are using a policy cycle model to compare three different cases within the Netherlands. The policy process is often a complex whole, especially for an outsider, and through this policy cycle, it is possible to simplify a policy process, and to identify where station area evaluation models are used in the TOD planning process. This is also of high importance because comparing the station area evaluation models isolated from their processes would not do them right.

The TOD principle is concentrating mixed-use developments around public transportation nodes on a regional level, and the consensus amongst planners is that cities or metropolitan areas will become more or remain accessible in a world of growing urbanisation. A car-based society comes with a lot of negative effects such as traffic congestion, air pollution, greenhouse gases, energy consumption, traffic accidents, social inequities, and other environmental concerns such as noise and soil pollution (Cervero, 1998). TOD claims to offer a solution to a variety of these problems. Through providing a dense combination of housing, business, and leisure, and integrating these areas with a variety of alternative transport choices, in the form

of public transport, walking and cycling, it would make for a less car-dependent city or metropolitan area (Tan, 2013). These alternative forms of transportation are widely considered as being both more sustainable and environmentally friendlier than car-based travel (Curtis, 2012; Tan, 2013). Some even claim that TOD contributes to a reduction in car-based travel (Cervero, 1998; Curtis, 2012). In this line of reasoning, TOD provides a more environmentally sustainable form of urban development by both reducing the need to travel and facilitating a modal shift away from a car-based society (Curtis, 2012).

Many claims are made that the primary objective of TOD policies is to reduce the regional and global environmental impacts of car use. While others argue that the rationale behind pursuing TOD is more socioeconomic of nature, deriving from the benefits of agglomeration, increased accessibility, resource efficiency, and the improvements that TOD offers for the economic and social functions of urban areas (Bertolini, 2013; Chatman, 2013; Tan, 2013; Kamruzzaman et al., 2014). Additionally, many governments feel the urgency of a shift towards less car dependency, because their cities and metropolitan areas are rapidly approaching or already experiencing traffic gridlocks (Peek et al., 2006; Kuiken, 2016). TOD is, therefore, an attractive policy strategy and a widely embraced concept among many politicians and planning departments in various cities and regions worldwide (Tan, 2013). It has also gained a lot of policy attention recently in the Netherlands, and thus there is also an urgency to analyse, evaluate, and understand TODs (Planbureau voor de Leefomgeving, 2014).

1.1 Problem definition

Within TOD there are different ways of pursuing and also many different ways of evaluating. Governments around the world are experimenting and investing in multiple policy alternatives with the aim of reducing car-induced externalities, and it is hard to tell which of these policies and investments are doing their job and which are wasting precious city resources (Peek et al., 2006; Salon, 2009; Jansen-Janssen & Smit, 2014). A prominent part of evaluation in TOD is evaluation on the level of station areas, and insights into the complex dynamics of station area developments seem necessary for effective action; there is a need to better understand station area evaluation models, their roles, and the differences between them (Peek et al., 2006).

We can state that the concept of TOD has been rediscovered in Europe (Bertolini, 1996; Bertolini & Spit, 1998). And this rediscovery is due to technological innovation, institutional change (e.g. privatisation of transit companies), a growing urge for sustainable development patterns, and other shifts in spatial dynamics in the contemporary society (Bertolini & Spit, 1998; Bertolini, Curtis & Renne, 2012; Pojani & Stead, 2015). There is convergence in TOD approaches internationally, while at the same time there are also many differences in how TOD is being viewed, pursued and practised (Curtis, 2012). Planning cultures in each country are unique, and there are major differences in the way planning is conceived, institutionalised and carried out (Friedmann, 2005a in Booth, 2011). Moreover, cities and metropolitan areas alter from each other in their density, but also in the way they are historically constructed (Winnips & Price, 2013). However, while these aspects are likely to be of influence on the way that TOD is pursued, it does not mean that inspiration or learning cannot take between different places (Spaans & Louw, 2009). Policy makers in cities, regional governments and nations can learn from how their counterparts elsewhere responded, while facing similar issues (Rose, 1991). Many cities, regions and countries are using TOD strategies, and many of the arguments for pursuing TOD are the same despite the use in different contexts (Curtis, Renne & Bertolini, 2009).

Furthermore, some TOD cases are based on practitioner experience and observations, while others are more theoretically grounded. Different contexts and perspectives have given us multiple views and variations on TOD. In some cases station area (re)development is derived from Bertolini's (1999) node-place model, while others find their grounding in, for example, Cervero & Kockelman's (1997) 3D's (Density, Diversity & Design). According to Carlton (2009), there is no clear definition of TOD or agreement on desired outcomes; there are no standards or systems on which to judge the success or failure of a TOD. And ultimately, there is not a "one size fits all" approach to TOD (Austin et al., 2010). Cases in the Netherlands seem to divert between using the name Transit-Oriented Development (TOD) or referring to the policy strategy as "Knooppuntontwikkeling" (freely translated as node-development) or merely referring to station-area (re)development.

Different discipline-contexts such as economic, engineering and social science have provided conflicting answers to the discussion if TOD is sustainable, cost-efficient or justified and why TOD should be implemented (Tan, 2013). According to van Uum (in Bertolini, 2013), there are also multiple ways of viewing a node, namely: traffic planning viewpoint, engineering viewpoint, architectonic-spatial planning viewpoint and cultural-sociological viewpoint. Therefore, discussions on the integration of land use and transport planning can range from measuring development and economic values to less tangible qualities such as spatial aesthetics and sense of a place (Cervero, 1998; Curtis, 2012; Chatman, 2013). Carlton (2009) mentions that TOD has been confused with multiple definitions and evolutionary precedents often confused with other ideas and regularly moulded into whatever form fits the users' needs. While there still is an ongoing debate and discussion about the actual benefits of TODs, proponents are still widely promoting the supposed benefits (Tan, 2013).

Within TOD there are many different ways of evaluating and comparing station areas, and in the Netherlands, this, for example, results in differences in how Bertolini's (1996) node-place model was operationalised and used (Peek et al., 2006). But there are also differences in how the process and end goals are monitored and evaluated. However, evaluation models are and have been essential tools to help governments allocate resources in a certain way before, during, or after policy implementation. There is an urgency to understand and research TOD evaluation frameworks, and as Renne et al., (2005 in Singh et al., 2014) state, there is a lack of understanding, and public investment in infrastructure is often made without fully understanding its outcomes. It, therefore, can lead to little or no improvement in sustainability or other motives. The same can be seen in the way that most research is focused on transit rider-ship and probable effects on land value, while other aspects have been underexposed in evaluation (Cervero et al., 2004).

The idea that governments and planning departments are roughly executing the same policy principles through TOD, having similarities and differences in their processes, creates an ideal environment to learn from each other's cases and inspire each other. However, until now, no clear comparison has been made between the use of station area evaluation models in land-use and transport integration in the Netherlands.

1.2 Research objective

A comparison is set up to make learning and inspiration possible between the different ways of evaluation in TOD in the Netherlands. Within that comparison, station area evaluation models are analysed. The research aim is to give insight into how indicators, measurements and evaluation models, in TOD, are constructed and used in a set of different national cases. The focus of this research is on the evaluation done by coordinating governmental bodies in TOD in the Netherlands; pursued on a regional, city or metropolitan level. We are therefore focussing on the governmental bodies that fulfil a coordinating role. These entities operate on a higher scale level than the municipal level and vary between provinces, city-regions and other forms of partnerships. A framework is designed using theory on policy evaluation strategies and previous research on TOD evaluation. Within this study, we make use of a policy cycle model to put the different station area evaluation models in a comparative framework. This comparison is made to gain knowledge about the various ways that station area evaluation models are used within land-use and transport integration in the Netherlands. The reason for that is that evaluation can help planners and policy makers critically review and justify the right choices and policy investments (Bressers, 1993; Peek et al., 2006). The empirical data for this research came from an academic literature analysis and policy document analysis in combination with interviews. Because the primary information sources are largely policy documents, the research is heavily relying on these documents, However, they should not be analysed on their own, as they are part of a larger policy process. Interviews with policy advisors, makers and experts are therefore conducted to deepen and strengthen the research.

The main research question following on the objective is constructed as following:

“How do station area evaluation models of Transit-Oriented Development play a role in coordinating land-use transport integration in the Dutch context?”

A set of sub-question have been formulated to answer and support the main research question:

1. What are the different forms of policy evaluation for Transit-Oriented Development in literature?

The first sub question focuses on policy evaluation research, and what policy evaluation, in general, can exist of. Researched is what forms of evaluation there are, and how this is viewed in general TOD literature.

2. How are station area evaluation models of Transit-Oriented Development constructed and used in coordinating land-use transport integration in the Dutch context?

This question focuses on researching the origin and constructs of station area evaluation models and how they are applied in the Dutch context of TOD.

3. Where are station area evaluation models of Transit-Oriented Development embedded in coordinating land-use transport integration in the Dutch planning process?

This sub question will research where in the process different form of evaluation takes place; this will serve a deeper insight into indicators and evaluation models.

4. What are the differences and similarities in station area evaluation models in coordinating land-use transport integration between the selected Dutch cases?

In the final sub question, the differences and similarities between the chosen cases are analysed, and these differences and similarities provide insights in the use of indicators and station area evaluation models in the Dutch context.

1.3 Academic relevance

The aim of this research is to connect theory on evaluation with TOD in practice, and through connecting these, building theory on how evaluation is done in the Dutch practice of land-use and transport integration. This research will, therefore, contribute to theory building in the methodological process of implementing TOD in the Netherlands. To come to a fuller appreciation of the complexities of modern interdependent challenges, multiple forms of policy-relevant knowledge and perspectives are essential, and eventually can be vital for understanding the reasons for successful policy interventions (Head, 2008). While the proposed benefits of TOD can be compelling, many projects worldwide do not live up to their full po-

tential, and there remains a widespread lack of understanding the nature of TOD and the challenges that TOD faces (Belzer & Autler, 2002b). Additionally, to increase the probability of making the best possible choices in policy making, analysis of evidence is of high importance (Campbell, 2002; Head, 2008). The evaluation of policy processes can be of fundamental importance for learning (Bressers, 1993). And in addition to that, the use of ex-ante, ex-post, and process evaluation is fundamental in finding what works within a certain policy. Linked components of ex-ante and ex-post evaluation are key to an efficient, effective and coherent policy cycle (Mergaert & Minto, 2015). In other words, there is a growing need for research and data on spatial development, which serves as a basis for planning proposals and actions to be taken (Faludi & Waterhout, 2006). This study contributes in an academic fashion by offering empirical evidence on the grounding and construction of indicators and station area evaluation tools, and additionally, how they play a role in the process of coordinating land-use and transport integration in the Netherlands.

1.4 Societal relevance

The concentration of urban development around public transportation nodes is seen as something that contributes to multiple policy goals (OV-Bureau Randstad, 2013). These policy goals are however not all big, broad economic, social or environmental goals, but also smaller scaled improvements such as improving environmental ills, health and safety issues, and social inequalities that add up to the liveability of a city region (Belzer & Autler, 2002a). By reducing car-dependency within city areas, the environmental effects of car usage can be reduced, which means an improvement in air quality on a local scale, but also the impacts of greenhouse gases can be reduced, which would confine long-term negative effects of a car based society (Belzer & Autler, 2002a). While using TOD to structure the city area, it is said to improve accessibility for both its citizens and businesses and multiple studies suggest that sprawling and car-oriented development patterns result in inequality within society (Kawabata & Shen, 2006). These development patterns would present more difficulties for inhabitants without cars to access economic opportunities (Kawabata & Shen, 2006). It is widely acknowledged that shaping the urban environment can be used in such a way that public resources including urban land, infrastructure, and energy can be utilised more efficiently (Curtis, Renne & Bertolini, 2009). And additionally, qualitative aspects of the urban environment such as walk-ability and liveability could also be improved (Curtis, Renne & Bertolini, 2009). Because these developments are often stimulated or financed by public funds, it could

also be said that there is a need to legitimise these investments. Curtis et al. (2009, in Singh, 2014) mention that to legitimise the use of these public resources, there is a need to quantify and demonstrate the effects of TOD to all the actors involved, it would be favourable to show how policy on TOD is pursued. Additionally, with urbanisation being one of the biggest human trends, and many of the cities and metropolitan areas already experiencing congestion and gridlocks, there is a need to remain accessible to sustain daily life (Peek et al., 2006; Zhang, 2016). While it is questionable that means of public transportation will solve congestion, governments still have a responsibility to offer an alternative for car-based transportation, and making sure their regions do not come to a standstill.

1.5 Research outline

This research starts with a literature review on general policy evaluation theory, alongside with a literature review on TOD evaluation in chapter two. A reflection will be given upon different perspectives in TOD, differences in evaluation criteria, and the complexity of evaluating TOD policy. In chapter 3 an elaboration of the chosen research strategy, research methods, case choice, data collection and the analysis can be found.

The second part of the study will be an elaboration on empirical evidence, and this will be set out in chapter 4, 5, 6 and 7. Firstly, Chapter 4 introduces the Dutch context and will elaborate on the Node-place model. Chapter 5, 6, and 7, respectively, describe and analyse the Randstad Southwing case, the Province of Noord-Holland case, and the Arnhem Nijmegen City Region case. In chapter 8 there will be a comparison of the empirical evidence gathered in chapter 4, 5, 6 and 7. Chapter 9 will provide an answer to the main research question, and summarise the relevance and limitations of the research, reflect on the theory, methodology, the findings and the research process, and finally propose recommendations for further research.

2

2. Evaluating Transit-Oriented Development

This chapter serves as an underlying framework that is used to analyse and compare TOD policy in practice; it, therefore, explores multiple different forms of evaluation and indicator use from a theoretical perspective, which results in a framework that can be used to classify and order different evaluation methods of TOD. A theoretical perspective on policy evaluation is therefore outlined to analyse and organise how TOD evaluation is constructed in practice. The scope in this is not purely on the station area evaluation tools, but on grasping the larger process to identify their role. Additionally, this chapter provides background and context on how TOD is evaluated in academic literature.

2.1 The demand for evaluation

Stripped down to its very essence, government policies are attempts from governmental institutions to fix or reduce particular societal problems and improve their practices (Bresser, 1993; Janssen-Jansen & Smit, 2014). To what degree policy influences problems, often remains the question. Policy-evaluation can offer answers to this question, and effective evaluation can lead to improvement and the delivery of successful projects in the future (Bressers, 1993; Msila & Setlhako, 2013). To analyse TOD policy in practice, we are using a general public policy evaluation analysis to get a background of what public policy evaluation is, and can be.

The demand for research on spatial development issues seems to be growing, and data or evidence seems to be considered of high importance in planning (Faludi & Waterhout, 2006). Multiple cases and sources indicate a growing need for research and data on spatial development, which serves as a basis for planning proposals and actions to be taken, or justifying actions or proposals (Faludi & Waterhout, 2006). According to Campbell (2002), there is a need in planning for processes that will increase the possibility of policies producing desirable outcomes. In other words, there is a need for data and policy evaluation; a need for the knowing if the right buttons are being pushed. A first distinction in policy evaluation that Bressers (1993) makes is between ex-ante and ex-post evaluation. As effective evaluation, both ex-ante and ex-post are linked together, this can lead to improvements in projects, and it is perceived of high importance for the successfulness of policy-making (Msila & Setlhako, 2013; Minto & Mergaert, 2015). The following time-dependent evaluation forms are distin-

guished (Bressers, 1993; Buitelaar, Sorel, & Opdam, 2009):

- Ex-ante
- Ex-durante
- Ex-post

What distincts TOD or node-development from other compact city development, is the clear focus on the public transportation factor. And many researchers are trying to point out a relation between concentration of developments around station areas and lower rates of car use (Cervero & Kockleman, 1997; Handy, Cao & Mokhtarian, 2005; Chatman, 2013). From the quantity of different researches on different factors that have an influence on transit rider-ship or lower rates of car use, we can conclude that there are in fact many factors or reason that influence citizens in their daily modal choice. Through TOD policy, governments are trying to either actively attract citizens to make a switch toward public transport, or simply offering them the choice. In order to do so, there are certain strategies or investments that governments use around station areas to make them a more attractive option, these factors vary between investment in walk-ability, cyclability, frequency of transit connections, quality of transit connections, clustering buildings near transit, mixing uses, but also in providing accessibility by car (Cervero, 2002; Chatman, 2013). Additionally, a higher transit rate amongst citizens living near a station area does not necessarily mean they own or use personal vehicles less and serve a reduction in VMT per capita (Cervero, 2002; Chatman, 2013). There is not necessarily a causal relationship between for example mixed-use, pedestrian-friendly designs and a reduction in VMT per capita, Cervero and Kockelman (1997) propose a relationship between the both, but the results must be interpreted as being associative rather than causal, there is a relationship, but they do not indicate cause and effect.

Cervero (2002) demonstrates that compact, mixed-use, and walk-friendly urban environment can significantly influence citizen's modal choice, but despite all the research being done, studies have failed to adequately specify relationships for purposes of drawing inferences about built environment factors in shaping mode choice. Furthermore, it is increasingly recognised that mixed land-use and higher density can encourage transit riding, but it does not necessarily mean that it a rise in transit use will occur, let alone lowered rates of car use

(Cervero, 1998). Additionally, not only misconceptions are made in regard to transit rider-ship or car usage, but also misconceptions are made in regard to how station area developments influence each other (Smit, Janssen-Jansen & Tan, 2014). A station area with good accessibility through public transportation does for example not automatically lead to quality developments around station areas, and also here a correlation can be found between the two, but it does not imply a positive causal relationship (Smit et al., 2014). And building on these, they both also do not necessarily lead to growth in transit rider-ship (Tan, Koster & Hoogerbrugge, 2013).

It is likely to assume that a combination of all the above mentioned factors have influence on how a station area functions, however it remains a complex process to distinct which factors are of more importance than others. And therefore it can also be very complex to point out the contribution of certain parts of policy (Bressers, 1993). Within the node-place model a set of these factors have been combined into a model, that can be used for the exploration of (re) development potential of station areas in an urban region and therefore improving chances for public transport-oriented development (Bertolini, 1999).

2.2 Different levels

TOD as it is defined, consists of a set of nodes that exist within a corridor (Tan, 2013). Visually represented as circle around a station, and these circles vary in radius (700 metres - 1200 metres or more), depending on the policy. The node or station area is therefore usually not defined as an TOD by itself, but TOD is being pursued on a scale that transcends the municipal or node-level. Curtis (2012) argues that TOD provides an environmentally sustainable form of urban development by reducing the need to travel, concentrating different functions around a node, as well as facilitating a modal shift away from the car, showing that nodes are perceived to be interdependent and not isolated entities (in order to compete with the car, a network is necessary). Based on this idea, we can divide TOD in two layers, the layer of the node and the layer of the corridor (see figure 2.1). The node and corridor are two different entities while at the same time being mutually dependent on each other (a node would be nothing without the corridor, and the corridor would be nothing without its nodes).

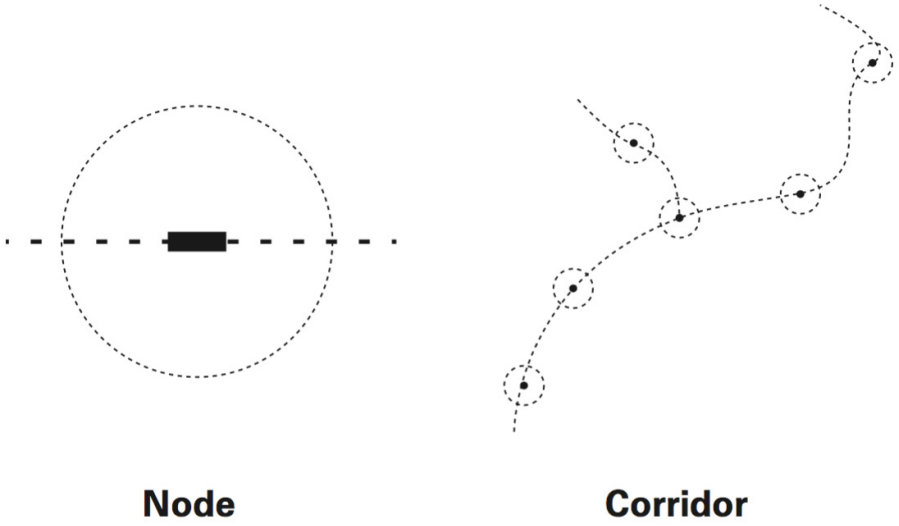


Figure 2.1. Visual representation of TOD on a node-level and corridor-level (Tan, 2013)

Belzer & Autler (2002a) mention that TOD involves a broad array of actors, and with this broad array of actors, also different goals are brought to the table. On the level of the corridor we can identify coordinating bodies of government and transit agencies. While on the level of the node transit agencies can also have their goals, furthermore, municipal governments, project developers, lenders, community groups, and possibly more stakeholders are to be found. A challenge for coordinating levels of government could therefore have problems with the lack of definitional clarity, whereas it could be so that there is no agreement or uniform idea about what TOD policy should accomplish from a functional viewpoint (Belzer & Autler, 2002a; Singh, 2014). It could be so that certain outcomes were not explicitly included in project goals, but it could also be the case that certain outcomes can be very complicated to point out, and without a clear functional definition, it is harder to make a balance between competing goals (Belzer & Autler, 2002a). The first distinction that Bressers (1993) makes in his article is the policy area where evaluation takes place. Taking this into account, it can also be that different stakeholders in the TOD process have different values, motives and end goals. Most transit agencies that pursue or join in the practice of TOD have the aim to produce higher levels of transit rider-ship, and making a bigger profit is often in their best interest (Renne, 2009). The same goes for project developers who are usually aiming to deliver a return on their investment while planning agencies, on the other hand, might look for a reduction in car-dependency and traffic congestion (Renne, 2009). The measuring of TOD success is dependent on the perspective of disparate stakeholders. Different individuals with diverging,

normative and personal views on the world produce and implement policies and plans, and the policy process, therefore, is a complex whole (Hajer, 2005, in Tan, 2013).

2.3 Criteria of evaluation

Reusser et al. (2008) mention that despite the node-place model's benefits, limitations can also be identified in the form that indicators may be limited or lacking in their coverage of certain important aspects, and enhancing these indicators may for example be done through expert interviews or questionnaires. Bressers (1993) makes a distinction in the way that criteria are used in evaluation, in some types of evaluation the goal is the main criterion and therefore the focus is mostly on to what degree this goal is reached, which leaves the actual influence of the policy out of the equation. When we focus on to what extent the policy contributes to the end goal, we can speak of the research of effectivity (Bressers, 1993). The research of effectivity does not solely focus on measurements and observations, or to what extent certain developments have been made; it also focuses on the analysis of the causal relationship between the implemented policy and the developments that have been made (Bressers, 1993). Furthermore, the aim can also be to not only to measure effective policy is, but also to explain how or why a policy is effective (Bressers, 1993). Regularly, these explanations are coupled with a benefit-cost ratio, and often these benefit-cost ratios are a central part in the research of effectivity (Bressers, 1993).

Bressers (1993) indicates that evaluation research can be classified based on the chosen subject, based on the used criteria, but also on the approach in observations. In theory usually, a distinction is made between a quantitative and a qualitative approach, while in policy evaluation practice it is often a combination of elements from both approaches (Bressers, 1993). Moreover, it is also said that combining these elements can serve as mutually reinforcing for a comprehensive view on the matter (Bressers, 1993). On the one hand, it is possible to unravel a statistical relationship between the policy and alterations in for example the target group that is being studied. On the other hand, it is also possible to conduct in-depth interviews amongst the target group to find out how policy instruments have influenced the behaviour of the members of this group (Bressers, 1993). A combination of these methods aimed to answer the same evaluation questions is said to counter the weaknesses of the individual method, while being more expensive than a single method, a mixed-method approach improves validity and reliability of resulting data (Bressers, 1993; Abiwitz & Toole. 2010).

However, mixed-method requires expertise on multiple research method, skills and funds for extensive data collection are time-consuming and cost-intensive (Bryman, 2012). Nonetheless, the advantage of triangulation is that it presents a more complete picture of empirical reality (Bryman, 2012).

To determine how policy evaluation takes place within practice, and what the role of station area evaluation tools is in that evaluation process, certain aspects have been categorised. Bryman (2012) mentions that it is worth making a distinction between an indicator and a measurement. Measurements are relatively straightforward, can be quantifiable, and are used to refer to things that can be counted unambiguously and in a reasonably direct way. Indicators, on the other hand, are somewhat less direct and are used to define concepts that are not as directly quantifiable as measures. For example in the case of a station area (re)development, accessibility is often used as an indicator, but it cannot be counted unambiguously. Different models can use for example the same node and place indicators of a station area, but the operationalisation or measuring of the values can differ, and lead to fundamental differences (Peek et al., 2006).

- Indicator
- Measurement

Another way of categorising indicators or measurements is by the way of qualitative and quantitative (Bressers, 1993, World Health Organization, 2002). To demonstrate the difference, a few characteristics are set out in table 2.1, based on Bressers (1993).

Table 2.1. Quantitative and qualitative approach (Bressers, 1993)

Quantitative approach	**Qualitative approach**
Numerical (how many?)	Qualitative data (how and why?)
Objective analysis and results	Subjective analysis and results
Aimed on effects	Aimed on process
Assumes stable reality	Assumes dynamic reality
Data collection by statistical analysis	Data collection
Data collection with closed questions	Data collection with open questions

While a distinction can be made between a quantitative and a qualitative approach, research-

ers can also draw upon a combination of both (Abiwitz & Toole. 2010)

- Qualitative
- Quantitative

Bertolini (1999) defines that accessibility as an indicator is not just a feature of a transportation node, but it is also a feature of a place of activities and maybe even more important, it is also something that is being perceived by the user. To operationalise these indicators, they are often subdivided, and translated into measurements. Furthermore, some indicators are descriptive, defining what is happening in a contemporary fashion, while performance indicators are linked to a reference value or policy target, illustrating how far the indicator is from the desired or undesired level (World Health Organization, 2002).

As mentioned earlier, discussions on land-use and transport integration range from measuring development and economic values to less tangible qualities as spatial aesthetics and sense of a place (Cervero, 1998; Curtis, 2012; Chatman, 2013). Some indicators and performance measurements are relatively easy to gather data for, while for others it is more difficult (Renne & Wells, 2005), and for some, it is debatable how they can be 'measured' or in what time-span they should be measured. Another distinction that can be made is the one between measurable 'hard' indicators, and on the other hand, the 'soft' indicators, whereas some indicators exist merely out of quantifiable measurements, 'hard' indicators. And the 'softer' indicators include personal values or lean on personal definitions or observations (Brons & Rietveld, 2009)

Bressers (1993) refers to these differences in indicators as qualitative and quantitative data. Quantitative data can be expressed in numerical terms; it can be counted and compared on a scale, while qualitative data is often harder to measure, count, and express in mathematical terms. However, it can be argued that something 'soft' as comfort can also be expressed in numerical terms. We therefore, make the distinction between the quantitative-qualitative scale and the soft-hard scale.

- Soft
- Hard

Indicators and measurements play a significant role in policy-making process as they turn data into relevant information for decision-makers and the public; in other words, they help to simplify a complex array of information (World Health Organization, 2002). In some cases of research it seems very clear to use either a quantitative or a qualitative approach, while in other cases, it could also be that they mutually strengthen each other in a mixed-method (McLafferty, 2003; Abiwitz & Toole. 2010). Quantitative forms of research may point out certain aspect of behaviour, and examine the reasons behind these aspects of behaviour, while the qualitative method can often provide a more thick description of behaviour (Bryman, 2012).

Belzer & Autler (2002a) find that in TOD the majority of existing definitions are physical, they focus on a limited and often hard set of characteristics such as density next to transit, which serves as an incomplete picture of the whole. Cervero et al. (2004, in Renne 2009) mention roughly the same, most previous studies on evaluating success in TOD are focussed on a narrow set of aspects, such as travel behaviour and vehicle ownership, property value and markets, and urban and regional design. In the evaluation of public transportation and its quality, the focus is generally on hard indicators like punctuality, frequency and travel cost. While soft aspects like comfort, social safety and information provision seem inseparable and offer a potential for a cost-effective improvement (Brons & Rietveld, 2009; Geurs & Klinkenberg, 2014). In particular, the accessibility and the design of stations provide opportunities (Brons & Rietveld, 2009; Geurs & Klinkenberg, 2014).

Another categorisation that can be made, is between the evaluation of contents, processes and effects of policy (Bressers, 1993). These three categories could be evaluated isolated from each other, but according to Bressers (1993) this is rarely the case.

- Content
- Process
- Effect

2.4 The Policy cycle

According to Howlett & Giest (2015), it is useful to analyse policy through policy cycles for many reasons. As many suggest, a policy process can often be chaotic and unordered, especially from an outside perspective. The policy cycle can be used to bring a system into something that is otherwise hard to structure, let alone compare. Breaking down policy into a policy cycle is a descriptive way of simplifying something complex, whereas policy processes are more than merely policy documents; they are an interplay between many processes and actors. Or in other words, policy process is deeply politicised, and it involves both numerous stages and stakeholders while being heavily influenced by previous initiatives (Howard, 2015; World Health Organization, 2015).

In this research, the policy cycle is not a normative explanation of how a TOD policy process is ought to be; it is merely used as a time-line and a way of grasping something complex and making it comparable. Ecoinformatics (n.d.) describes the policy cycle as a simplified way of visualising the policy process, and while it should not be assumed that the policy process and therefore also the policy cycle is a linear and circular process, it can be helpful to understand links between phases. And while the policy cycle does not only offer a way of showing order in something chaotic to the reader, it also helps the researcher to grasp his head around the gathered data better. The cycle is used to distinct different types of evaluation from each other and observing where they are used within the cycle. Evaluation in its essence can be defined as the systematic assessment of outcomes of a program or policy, with the aim of improving a program or policy (Weiss, 1998). Evaluation is the assessing or detecting performance of a specific phenomenon by certain criteria (Bressers, 1993).

Within the policy sciences, there are many ways of dividing a policy process into stages, depending on how extensive one's reflection goes. Therefore these policy cycles vary in being divided into four to eight stages. However, many of the policy cycle frameworks mention that monitoring or evaluation is a distinct phase in the policy process, while we would argue that evaluation and monitoring take place throughout the whole process, and is not only subordinate to a single phase in the process. Freeman (2013) for example also distincts stages of monitoring and implementation or practice evaluation, however, the act of ex-ante evaluation would be ignored in this sense. Policy evaluation is not a process that can be seen as isolated

from other policy processes, and it does not necessarily take place after the policy implementation, it can rather be seen as an aspect of the stages of policy process (Bressers, 1993).

An important distinction in evaluation therefore can be made by ways of time-dimensions, by the use of ex-ante evaluations, content, process and effects can be evaluated before the policy is put into action (Bressers, 1993). The European Commission (2001) defines ex-ante as a process to gather information and analysis that helps in defining objectives, and making sure that goals are reached. Ex-post evaluation can be defined as the assessment of content, process , and effects after it has put into effect (Bressers, 1993).

The World Health Organization (2015) describes a four staged policy cycle that can be identified from beginning to end in the following stages: agenda setting, policy formation, policy implementation, and policy review. Within these four stages the following is identified:

- Agenda setting (identify the problem, conduct research, set agenda)
- Policy formation (develop policy options and strategies, negotiate, formulate policy)
- Policy implementation (implement and enforce policy)
- Policy review (monitoring, evaluation and reporting)

Based on the description by the World Health Organization (2015), monitoring and evaluation takes places only in the policy review phase. However, we use the policy cycle as a means to identify when and where station area evaluation models play a role in TOD practice. And in relation to the whole policy process, within the four stages, multiple forms of evaluation can be identified. In the agenda setting and formulation phase ex-ante evaluation can take place, monitoring can be done in the implementation phase, and ex-post evaluation can be done in the policy review phase. In other policy cycle models the phase policy evaluation is often present, and this problematic and confusing as it implies that only one phase is inherent with evaluation. We, therefore, use the policy model as proposed by the World Health Organization (2015), and while slightly different naming and forms of the policy cycle model exist it is also arguable that it is in its essence more of the same. The policy cycle as described by the World Health Organization (2015) is slightly altered based on Bressers's (1993) statement that evaluation is not isolated and does not necessarily take place after policy implementation, the following four stages can therefore be identified:

- Agenda setting (identify the problem, conduct research, set agenda)
- Policy formation (develop policy options and strategies, negotiate, formulate policy, ex-ante evaluation)
- Policy implementation (implement and enforce policy, monitoring)
- Policy review (ex-post evaluation and reporting)

The above mentioned stages with evaluation options are visualised in figure 2.1

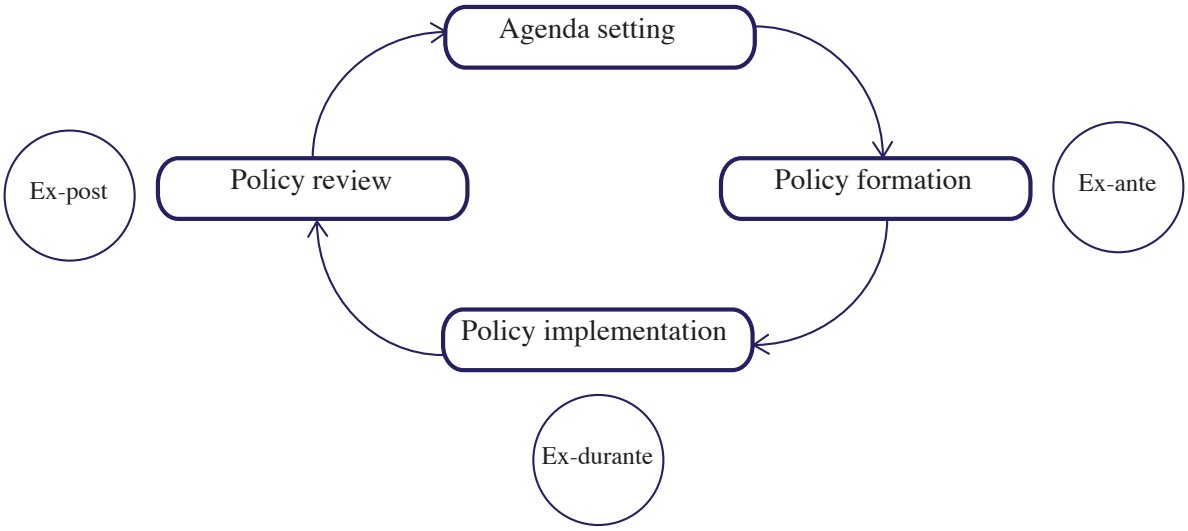


Figure 2.2. Evaluation in the policy cycle (based on World Health Organization, 2015).

2.5 Conceptual model

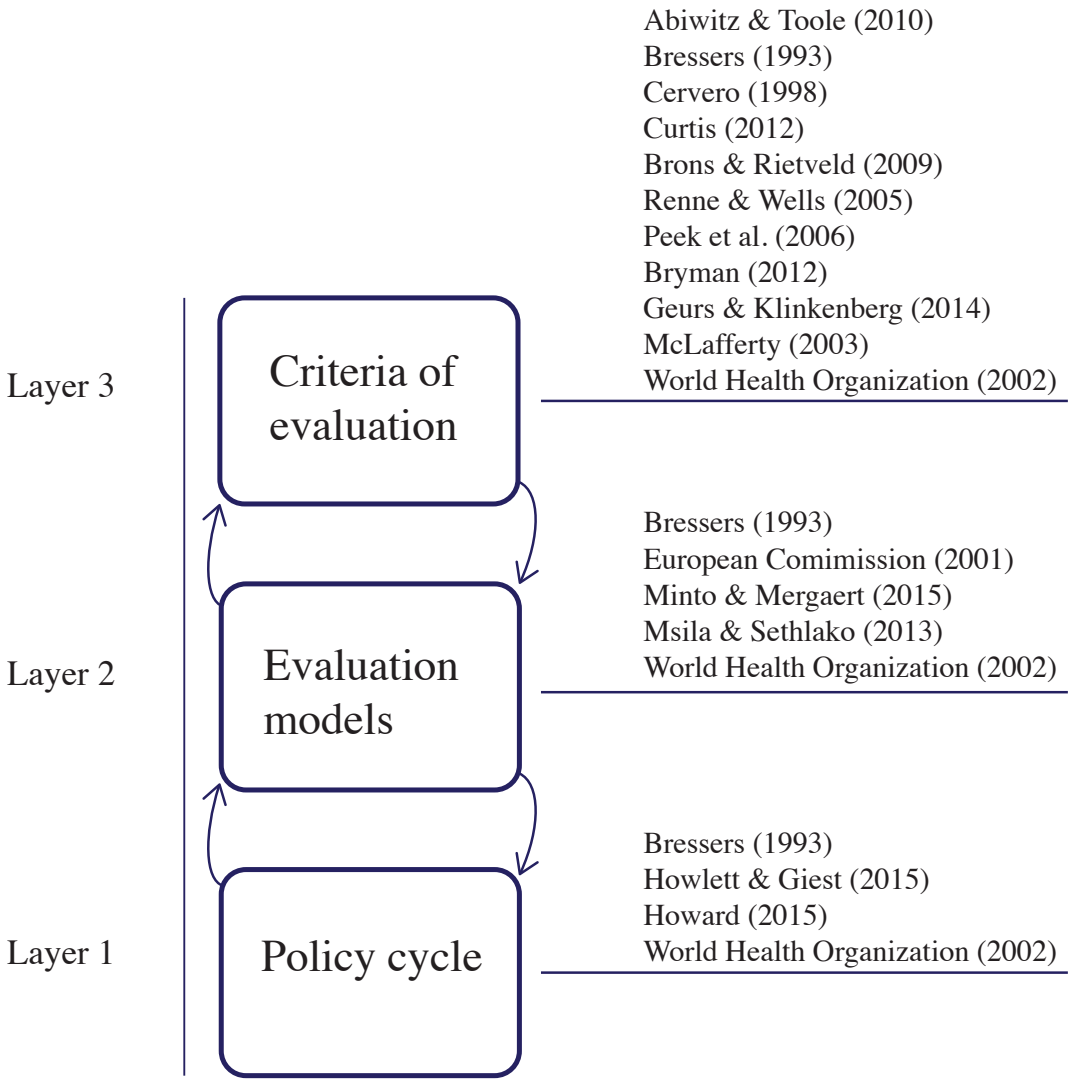


Figure 2.3. Conceptual model (Author, 2017)

The conceptual model exists out of the three layers that come forth from the theory. These three layers will be used to analyse the station area evaluation models in the Dutch practice of TOD.

3

3. Methodology

In this chapter, the used research methods are discussed. This research makes use of a comparative research strategy to find differences and similarities in the station area evaluation models of TOD in the Dutch national context. First, the proposed research strategy is elaborated on. Secondly, the research methods are explained and discussed, and finally, the data collection and analysis is described.

3.1 Research strategy

A cross-case national research method is chosen because TOD as a phenomenon is not limited to a single case or context. As mentioned before, TOD is a widespread phenomenon, which is being practised in many cities, regions, and nations. The challenges to counter or problems aimed to solve are neither unique to a single country or metropolitan area. Policy-makers in cities, regional governments and nations can learn and gain inspiration from other policy-makers that have the same or similar end-goals and are dealing with or facing the same issues (Rose, 1991). However, differences or similarities between TOD cases can be a result of their case-specific contexts, and the interest, therefore, lies in understanding the TOD phenomenon, and the used indicators, evaluation methods in their case-specific contexts. Planners always operate in a specific cultural context, and spatial planning activities take place within a framework of formal and informal established objectives, tools, and procedures (Janin Rivolin, 2012). Moreover, planners operate in a specific national system and planning culture at the same time, and it is said to involve multiple processes of both vertical and horizontal interactions (Janin Rivolin, 2012).

Berting (1979, in Booth, 2011) describes a set of reasons for undertaking comparative research: the development of theory, the explanation or interpretation of social phenomena, the description of social reality, the understanding of the effects of policy intervention, and the evaluation of policy processes. This research touches upon all five of the undertakings, whereas analysis helps in building theory on the matter. It searches to explain or interpret parts of the social phenomenon of TOD. It aims to improve the description of social reality and intends to make steps towards trying to understand the effects of TOD policy interventions and the evaluation of these policy interventions.

Comparative research is often concerned with applying theories and searching for empirical evidence across time and space, and as a public policy-maker there are roughly three ways of dealing with problems: turn to the national past, speculate about the future, or to seek lessons from current experience in other places (Rose, 1991). As problems aimed to counter or challenges to face through TOD are usually immense and long-term problems and challenges, and at the same time issues that only recently are gaining more and more attention (e.g. climate change, growing urbanisation). The option to seek lessons from current experiences in other places is a straightforward choice, *"It is the desire to know how others make and implement policy and to see whether there are policies and practices that might be borrowed from other places"* (Booth, 2011, p.14).

3.2 Context selection

The Netherlands is chosen as a national context by multiple arguments. First of all, TOD, or referred to as 'Knooppuntontwikkeling' has seen increased popularity within local, regional, and national governments (Bertolini et al., 2012; Provincie Noord-Holland & Goudappel Coffeng, 2010, in Tan, 2013). Secondly, the Netherlands has a rich history of planning, and a rich history of land-use and transportation plans and policies that show many similarities with the principles of TOD (Tan, 2013). Third, the integration of urban development and infrastructure in the Netherlands has been perceived as a 'best-practice' for decades, while the translation of the TOD concept into practice has also been marked with failures (Hall, 1995, in Smit, et al., 2014; Pojani & Stead, 2015). Additionally, within the Netherlands, the node-place model as a station area redevelopment tool has been widely used and operationalised in different ways in different cases (Peek et al., 2006), which makes up for a solid base for comparative research. Despite the strong planning system and the many policies at various governmental levels, the Netherlands is also a case where many implementation difficulties are experienced (Tan, 2013). Even though the Netherlands has a history of preceding policies on integrating land-use and transport planning policies, many practitioners and policy-makers pessimistic about the outcome of plans that promote sustainable development (Francke, 2010, in Tan, 2013). Jorritsma et al. (2010, in Tan, 2013) for example observe increased road congestion, reduced transit use and insignificant emission reduction, which is according to Tan (2013) in contrast to examples in the United States, Australia, Asia and elsewhere in Europe.

Additionally, the Netherlands is perceived as an example of many, which is demonstrated by

the high number of international “policy tourists” (Pojani & Stead, 2015). Foreign researchers often study Dutch policy on land use and infrastructure, but not their policy outcomes (Smit et al., 2014). Internationally, the Dutch policy is often perceived as successful, while Dutch policy-makers and researcher perceive it as not as great as expected (Smit et al., 2014). Thus, making the Netherlands an interesting study area. Finally, as mentioned in the research strategy, there is also a convenience motive behind the context choice. While it is widely acknowledged that a comparative research should be able to justify the choice of cases on theoretical grounds rather than on convenience grounds, in reality, they both have their influence on the case selection. It is also a practical issue to concentrate on a certain context or specific set of cases as this minimises travel, eases access, reduces costs, and hence making it do-able (O’leary, 2004). Through constraining the research to a national border, as to one’s native country, it makes policy-documents and interviews more accessible, and the research more feasible. Additionally, it helps in making the researcher initiate an appropriate level of ‘in-depth-ness’, creating a feeling for how the object of study withholds itself in their specific context. The focus in this study is mainly on the station area evaluation models, however, comparing these models isolated from there policy process would result in an incomplete comparison, as the role and use of the models would not be able to be identified clearly.

3.2.1 Case selection

Within the Netherlands, a set of three case studies has been chosen. Three cases with a similar grounding regarding evaluation models are chosen to find out what the differences and similarities are between the constructions of indicators and evaluation models in the Dutch context

In the Netherlands, a specific number of cases pursue TOD policy or node-development. In this research, we focus on the coordinating parties on a strategic level in TOD. While municipalities everywhere throughout the Netherlands can take part in station-area development, and it remains debatable what that exactly is, we define the research only to the cases that pursue this on a larger scale and in collaboration and cooperation with other municipalities and a coordinating party. The criteria that were used for case selection are presented in table 3.1.

Table 3.1. Case selection criteria

Selection criteria	RS	NH	AN
Actively is or was recently pursuing TOD or node-development.	Involved in the Stedenbaan programme from 2006 until present (2017).	Involved in the OVK programme since 2013 until present (2017).	Was involved in OV/RO knooppunten programme from approximately 2006 until 2015.
Evaluation model is based on the node-place model.	Node-place diagram based on node-place model.	Vlindermodel based on node-place model.	Vliegermodel based on node-place model.
Use of indicators and evaluation models is publicly available	Data publicly available.	Data publicly available.	Data publicly available.
Coordinating governmental body is pursuing the policy	Stedenbaan bureau coordinating TOD or node-development in the RS.	Province of Noord-Holland coordinating TOD or node-development in the province.	Arnhem Nijmegen City Region coordinating TOD or node-development in the City Region.

The most evident cases within the Dutch context that fitted these criteria are the Randstad Southwing, the Province of Noord-Holland and the former Arnhem-Nijmegen City Region. Within this research, these cases together make up for the Dutch-context.

3.3 Research methods

A mix of methods is proposed, to provide an answer to the main research question. First of all, to gain data about how indicators and evaluation models are constructed in different cases, a document analysis is used. Academic literature is used to set up background on the grounding and operationalisation of the node-place model. After that, policy documents from the different case studies are used to set up the first analysis. Because this research aims to compare different cases of policy evaluation, the research is heavily dependent on document analysis. Bowen (2009) mentions a set of limitations that come with the use of document analysis. First, it can be the case that documents do not provide the researcher with enough detail, whereas documents are often produced for some other purpose than research, and are independent of a research agenda, and therefore might not provide enough information to answer a research question fully. Second, a researcher should be cautious of an incomplete collection of documents, which suggests 'biased selectivity' (Yin, 1994, p.80). Thirdly, it could be very tempting to assume that policy documents reveal something about an underlying social reality (e.g. the role of indicators or evaluation models) and that these independently represent the reality of a certain organisation (Bryman, 2012). Bowen (2009) backs this by mentioning that researchers should not simply throw passages from available documents in their research reports, but rather also strive to find the meaning of the document and how it contributes to the issues that are being researched.

To counter the issues that Bryman (2012) and Bowen (2009) mentioned, document analysis is often used in combination with other qualitative research methods as means of triangulation (Bowen, 2009). Yin (1994, in Bowen, 2009) mentions that the qualitative researcher is expected to consult multiple sources of evidence (at least two), to seek convergence and corroboration through the use of different data sources and methods. A combination of different research methods used to answer the same research question is often stressed as the best way to conduct research (Bressers, 1993). A triangulation approach is said to increase credibility, thoroughness, validity, the strength of the research, and helps with avoiding bias (Bowen, 2009; Bryman, 2012). A combination of both document analysis and interviews counters the limitations that a stand-alone document analysis would offer, whereas interviews can be used to provide the details that certain documents lack. Furthermore, interviews can offer data; viewpoints or standpoints that force the researcher to move out of one's research bubble and

be open towards other views on the matter. In this specific case of research, it is, therefore, a logical step to combine a document analysis with interviews. Moreover, document analysis is not used as a stand-in for other kinds of evidence, but it serves more like a foundation or base for further research that is enriched with empirical evidence found in interviews (Bowen, 2009).

Specifically focused on the research question, we are aiming for two things to be filled in: how are indicators and evaluation models constructed and what are their roles? To give both more body and depth, we are combining multiple sources of evidence. Thus, to study how indicators and evaluation models are constructed and find its place in the planning process, we have to analyse the bigger picture in which these find its place. Referring to the policy cycle, we are also obliged to look into what else takes place in the four phases. As often assumed, evaluation is strongly connected to the problem definitions and goals that are meant to be reached (Bressers, 1993).

3.3.1 Why Document analysis?

As a research method, document analysis is particularly applicable in qualitative case studies, as they can often provide rich descriptions of a single phenomenon, event, organisation or programme (Bowen, 2009). Bowen (2009) recognises the immense value of documents in case study research and its usefulness as a stand-alone method for specialised forms of qualitative research. Often, documents might be the only necessary or available data source (Bowen, 2009). It can also be the case that information contained in documents might raise new questions that can be a very important part of the research (Bowen, 2009). Additionally, documents provide a "means of tracking change and development" (Bowen, 2009, p.30), meaning that it is possible to analyse documents, periodic, and final reports to get a good impression of how an organisation, policy, or programme progressed over time (Bowen, 2009).

Moreover, an important advantage of document analysis is that documents are non-reactive, they are stable, and are not altered over time, hence, making them very suitable for repeating research (Bowen, 2009). In this research on of the two pillars in gathering information is through document analysis, the data and foundation needed to answer the research questions are for a large part available in policy documents. Additionally, it is a low-cost research meth-

od to obtain data as part of a process that is unobtrusive and non-reactive (Bowen, 2009).

Bowen (2009) also mentions that the concern about how many documents should be involved is a legitimate question, but the concern should not be about how many documents should be involved, but rather about the quality of the documents and the evidence it contains. The amount of documents involved in the document analysis in this research is based on a set of variables: per case, the amount of documents used is limited to what the programme per case provides in documents. This, however depends on the context, historical construct, and phasing of the programme.

3.3.2 Why semi-structured interviews

In addition to document analysis, researchers often draw upon a set of other research methods in order to strengthen their findings. In this research, interviews are conducted with the goal of avoiding bias by merely using the researcher's insights on policy document analysis, and mistakes or misinterpretations by the researcher can be pointed out or examined. Additionally, the interviews can add new information and fill in the blanks that could not be filled in through the document analysis method. Within this study in-depth semi-structured interviews are conducted to gather more information about the case studies in their contextual environment. Through semi-structured interviews, there is a great interest for the interviewee's point of view, and it might lead to insights into what the interviewee considers to be relevant and important (Bryman, 2012). In qualitative interviewing, there is no need to standardise the way in which the interviewee is dealt with, but instead, it tends to be flexible, and it, therefore, offers room for the interviewee to emphasise certain aspects (Bryman, 2012). An advantage of this method is that the interviewee often offers rich and detailed answers, which can help to offer more thorough and comprehensive insights (Bryman, 2012). Interviewees can also help the researcher through giving them access to new sources of information, such as documents or recommending other persons for further interviews (Yin, 2009). In line with the comparative method, semi-structured interviews offer room for detail and contextual differences (Lijphart, 1975; Bryman, 2012).

3.3.3 Control session

Because large parts of this research are based on document analysis, it can become a process that might be a very individual practice. In other words, a researcher can follow a certain path

but might figure out that the choices made are influenced by its biased view on a matter. A control session is held with two independent academic experts from within the TOD field, to avoid this.

3.4 Research criteria

Researchers often set up a set of research criteria to assure the quality of the research (Bryman, 2012). In both qualitative and quantitative research it is often stressed to use reliability and validity to maintain this quality (Bryman, 2012). However, there has been a lot of debate on if using quality criteria such as validity, reliability, and generalisability in qualitative research are appropriate (Walby & Luscombe, 2016). Guba & Lincoln (2005, in Tracy, 2010) mention that some of the leading qualitative scholars have criticised universal quality criteria. Tracy (2010) argues that validity, reliability and generalisability have only limited value for qualitative researchers. The use of these criteria in qualitative research can lead to unrealistic expectations as they were built for quantitative and natural sciences (Walby & Luscombe, 2016). For example, validity assumes that research tries to measure something by correlating variables that are quantifiable (Tracy, 2010). Reliability assumes that conditions of research are controlled and held constant, and it is concerned with whether the results in a study are repeatable (Tracy, 2010; Bryman, 2012). It implies that the element under study is relatively static, while in qualitative studies this is often not the case (Tracy, 2010). Generalisability presumes that the research that is done has to be extrapolated to a wider population, and findings have to be applicable beyond their random sample (Tracy, 2010).

Thus, these criteria are suitable for natural sciences and quantitative social science, but they seem less appropriate for qualitative social research (Walby & Luscombe, 2016). This research is highly qualitative as it focuses on an in-depth study of the construction and role of certain evaluation tools. While it remains debatable what would be appropriate for what research, it is important that the researchers are aware of the wide supply of quality criteria, and additionally argue for why they use a certain set of quality criteria in their research (Cameron, 2011). Based on these arguments, this research makes use of the eight criteria for qualitative research that Tracy (2010) proposes:

- Worthy topic
- Rich rigor
- Sincerity

- Credibility
- Resonance
- Significant contribution
- Ethical
- Meaningful coherence

To clarify for the reader what these are, and how they are incorporated into the research, a brief explanation for each criterion is given, and a short example is showed to make clear how it is accomplished and where in the research it is tackled. The table with research criteria can be found in Appendix 4.

3.5 Data collection and analysis

The data collection in this research took place in three main phases; the first phase is focused on academic literature analysis on the node-place model. The second phase is focused on a policy document analysis, and the third phase is focused on semi-structured interviews. The document choices are based on expert consultation, interviews, skimming, reading, and interpretation. Figure 3.1 presents an overview of how the data-collection process took place, loops back from semi-structured interviews represent new data retrieved through the interviews in the form of academic literature or policy documents.

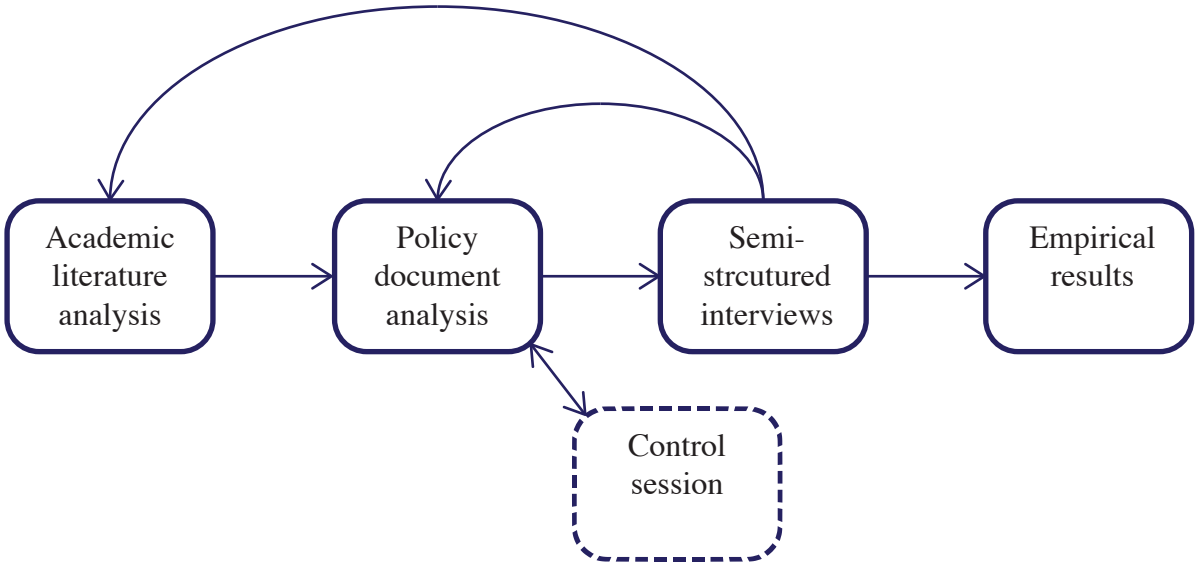


Figure 3.1. Visualisation of the data collection

3.5.1 Document analysis

The documents used in this research are chosen on the base of multiple arguments; firstly, an expert on TOD in the Netherlands is consulted to find important documents and books that are related or part of TOD policy in the Netherlands. Secondly, based on the documents and books retrieved, the most prominent cases are chosen. Following upon the case selection a desk research took place on policy documents used by the governmental institutions chosen in the case selection. While some of the documents were accessible through internet and experts at the beginning of the process, other documents were retrieved through practical and academic experts during the interviews. The document analysis in this research involved different phases of analysis. It involved skimming (superficial examination), reading (thorough examination), and interpretation (Bowen, 2009). This research started with a phase of skimming through policy documents and important books in all three cases, using keywords and codes, and additionally consulting experts to find the right documents and books.

This process of skimming includes the scanning of documents and books and saving raw data through highlighting or copying data into separate documents for each case. The main point is to select the right sources of data. The next phase, reading (thorough examination) digs deeper into the selected documents and books, and instead of only copying and highlighting, this phase also includes filtering what is important inherent to the research question and what is not, this is done trough a phase of coding (see Appendix 3). This process, therefore, includes both elements of content analysis and thematic analysis. Content analysis is used to organise information into categories related to the questions of research (Bowen, 2009). Thematic analysis involves pattern recognition within the retrieved data; in other words, it is taking a closer look at the retrieved data and performing coding and category construction (Bowen, 2009). The last step in document analysis is the interpretation of the data, meaning that once the data has been coded and coupled with the right phases of the policy cycle, we can interpret and analyse what this data means, and after that use it in comparing.

Several academic articles are used to analyse the node-place model, and this serves as the first chapter in the empirical analysis. Table 3.1 shows the list of academic articles used to analyse the node-place model and the operationalisation of the node-place model. These articles were gathered through a combination of desk research, snowball sampling, and advice of academic

experts. These articles were chosen on the basis of providing information on the grounding and operationalisation of the node-place model. The analysis of the node-place model is used to link the evaluation models that are used in the three cases.

Table 3.2. List of academic articles on node-place model operationalisation

#	Article/Thesis	Journal/University	Author, (Year)
0.1	Nodes and places: complexities of railway station redevelopment	European Planning Studies, 4(3), 331-345.	Bertolini, L., (1996)
0.2	Spatial development patterns and public transport: the application of an analytical model in the Netherlands.	Planning Practice and Research, 14(2), 199-210.	Bertolini, L., (1999)
0.3	Stationslocaties in vergelijkend perspectief; verkenning van de toepassingsmogelijkheden van een modelmatige operationalisatie van het begrip stationslocatie.	Universiteit Utrecht.	Serlie, Z., (1998)
0.4	Positionering van stationslocaties in de regio's Amsterdam en Utrecht.	Universiteit Utrecht.	Serlie, Z., (1998)
0.5	Knoop of plaats? Naar een operationalisatie van het begrip stationslocatie.	Universiteit Utrecht.	Zweedijk, A., (1997)

The next phase of data collection involves policy document analysis. With a set of criteria, three policy programmes are chosen in combination with the policy documents that are used to analyse the policy. These criteria are found in table 3.2.

Table 3.3. Policy document selection criteria

Selection criteria	
a) Involves information on land-use and transport integration	d) Involves information on policy evaluation in the form of a monitor
b) Involves information on the TOD or node-development programme	e) Involves contextual background on the case
c) Involves information on station area development evaluation model	

The criteria in table 3.3 are coupled with the policy documents and books in table 3.4.

Table 3.4. List of policy documents/books

#	Case	Document/Book	Author, (Year)	Research criteria
1.1	RS	Ruimte en Lijn. Ruimtelijke verkenning Stedenbaan 2010	Atelier Zuidvleugel, (2006)	(a, c)
1.2	RS	Monitor StedenbaanPlus 2013	Netwerk Zuidelijke Randstad, (2013)	(b, d, e)
1.3	RS	Monitor Stedenbaan 2014	Netwerk Zuidelijke Randstad, (2014)	(b, d, e)
1.4	RS	Monitor Stedenbaan 2015	Netwerk Zuidelijke Randstad, (2015)	(b, d, e)
1.5	RS	Monitor Stedenbaan 2016	Netwerk Zuidelijke Randstad, (2016)	(b, d, e)
2.1	NH	Maak Plaats! Werken aan knooppuntontwikkeling in Noord-Holland	Provincie Noord-Holland & Vereniging Deltametropool, (2013)	(a, c)
2.2	NH	Monitor OV-knooppunten	Provincie Noord-Holland, (2016)	(b, d, e)
2.3	NH	Het Vlindermodel 1.0	Vereniging Deltametropool, (n.d.)	(c)
2.4	NH	Het Vlindermodel 2.0	Vereniging Deltametropool, (n.d.)	(c)
3.1	AN	Regionaal Plan 2005-2020	Stadsregio Arnhem Nijmegen & Provincie Gelderland, (2006)	(a, e)
3.2	AN	Openbaar vervoer in een nieuw perspectief–Masterplan Openbaar vervoer 2008-2020	Stadsregio Arnhem Nijmegen, (2008)	(a, e)
3.3	AN	Knooppunten! Bereikbaarheid en ruimtelijke ontwikkeling op knooppunten van openbaar vervoer.	Stadsregio Arnhem Nijmegen, (2011)	(a, b, c)

Because not all of the retrieved data is digitally available, no analysis software is used. Instead, filtering of information has been done through three separate word documents, first by the simple means of copy pasting, and after that filtering it down to the relevant information. After the thorough examination, three tables were set up, one for every case, and with four different phases. These phases are linked to the policy cycle that is used to organise data.

3.5.2 Semi-structured interviews

Interviewee selection

The interviews in this research were conducted with practical experts and an academic expert. Within the three cases at least two practical experts were chosen, and in addition to the practical experts, an academic expert was interviewed to deepen the background, context, and information on the node-place evaluation model. In this research seven interviews were conducted with the idea of having a two-sided view and a rich and thorough description of every case. Since none of the cases finds itself in the policy review phase at the time of the research, interviewees are selected for their contribution in the three-preceding phases. To select the interviewees a set of selection criteria were formulated in table 3.5 below.

Table 3.5. Interviewee selection criteria

Criteria for practical expert 1	Criteria for practical expert 2
Civil servant of the coordinating party/ Engaged with the coordinating party	Civil servant of the coordinating party
Involved in TOD policy making	Involved in TOD policy implementation
Involved in the agenda setting/policy formulation phase	Involved in policy implementation phase
Knowledge of the use of evaluation models within the case	Knowledge of the use of evaluation models within the case

Interviewee sampling

In the very first phase of interviewee sampling, policy documents were used to identify certain key figures in TOD policy making. These key figures were noted down and discussed with a TOD expert, through this discussion, the researcher was pointed towards other key figures and possible interviewees, and through the TOD experts network the researcher was provided with multiple contacts and contact details. Interviewees were selected following upon this session, based on table 3.5. The interviewees were contacted by email, telephone or a combination of both. While getting in contact with key figures, also snowball sampling took place, trough certain interviewees other interviewees were pointed or redirected as experts on the matter. The process of gathering interviewees can be viewed in figure 3.2. Out of respect to those participating, the interviewees have kept anonymously. The interviews were held during March 2017 until May 2017. All the interviews conducted in this research are built on

an interview guide. The interview guides are based on the policy cycle as referred to in figure 2.2. Because the semi-structured interview leaves room for the interviewee in how to reply, questions may not exactly follow up the way that is outlined on the schedule, and questions may be asked based on things said by the interviewee (Bryman, 2012). As referred to before, the policy cycle is used as a means to structure data and to make it comparable from case to case. Therefore the policy cycle is at the same time part of the interview guide. The interview guide for the semi-structured interviews can be found in Appendix 1. To be as transparent and honest (parts of sincerity) as possible, the interviews are transcribed and are available upon request. For further information see contact details in Appendix 2.
Additionally, because the interviews involve three different case studies, the focus between cases can differ, as there are differences between contexts, scales, time-scales, phasing, approaches, and frameworks. In other words, there can be 'gaps' in policy documents in context (a), while context (b) thoroughly elaborates on this specific part in their policy documents, which can influence the direction of the interview. The data that is retrieved from the document analysis as referred to in table 3.4 is used to specify certain research questions. This data is also brought along to get the interviewee's view on the retrieved info.

While for every case specifically two interviewees were selected based on their involvement in different stages in the policy cycle, the involvement of interviewees also overlaps, and the involvement for some of the interviewees takes place in more than one of the cases. Therefore some interviewees also hand out information about other cases. Table 3.6 gives an overview of the interviewees that took part in this research. All the interviews span between 45 to 90 minutes, and take place at the by the interviewee requested location.

Table 3.6. List of interviewees

Code	Interviewee	Location	Duration (minutes)	Date
I_1	Interviewee 1	Den Haag	70	28-03-17
I_2	Interviewee 2	Den Haag	86	03-04-17
I_3	Interviewee 3	Rotterdam	50	30-05-17
I_4	Interviewee 4	Haarlem	85	22-03-17
I_5	Interviewee 5	Amsterdam	62	19-05-17
I_6	Interviewee 6	Arnhem	55	24-04-17
I_7	Interviewee 7	Amsterdam	63	17-05-17

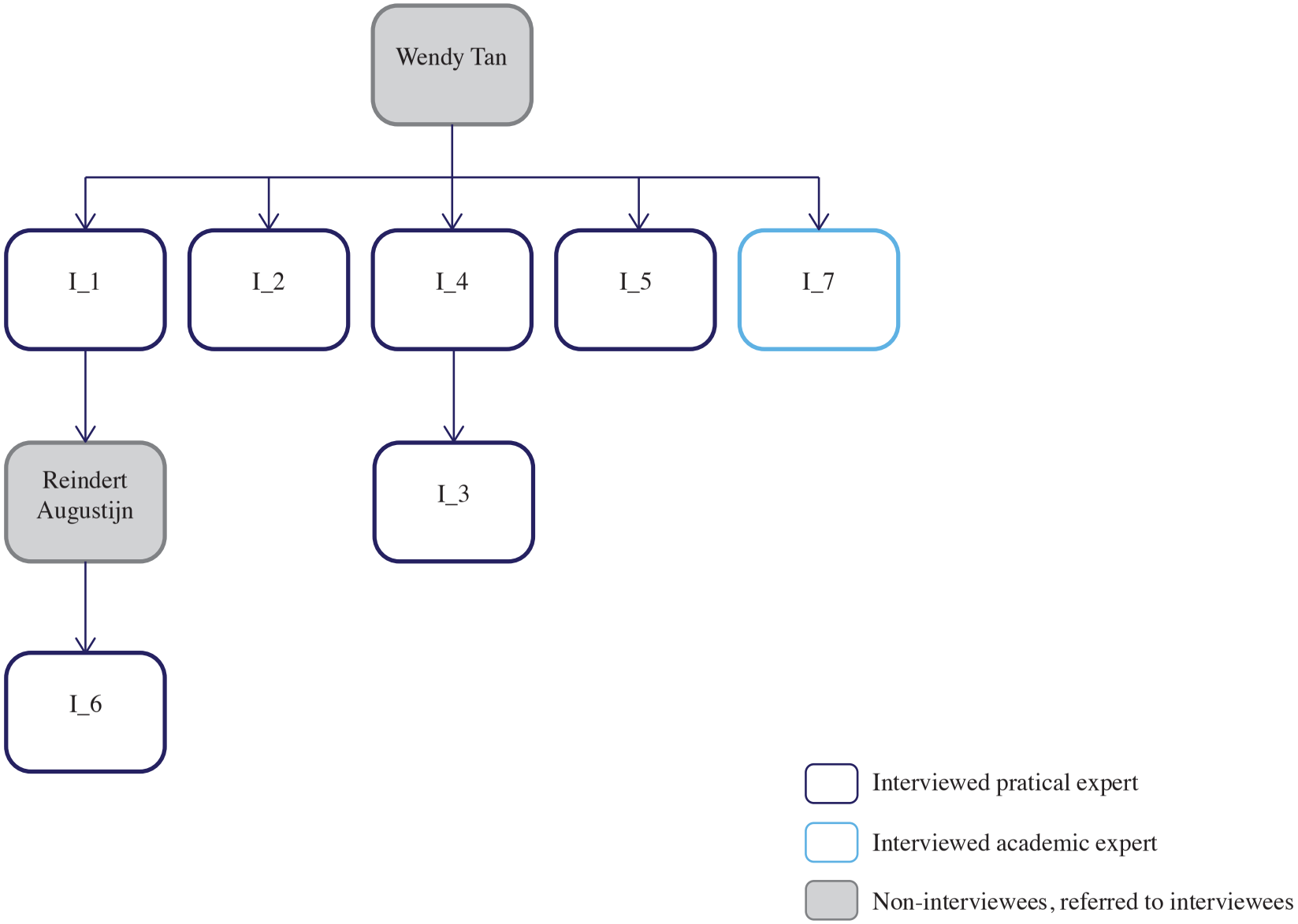


Figure 3.2. Scheme of the interviewee sampling phase

Interview analysis

The interviews are recorded on an audio recorder and transcribed through ExpressScribe software as soon as the interviews were conducted. The first step in the coding analysis was through a deductive coding process based on the policy phases in the policy cycle. This step makes use of printed versions of the interview transcripts, and based on the policy cycle, fragments of text are assigned to phases through using colour codes, which also can involve more than one phase/colour. Additional to the coding of phases, short key words are used in the first round of coding, this step is also often referred to as the process of 'open coding' (Saunders et al., 2015).

For further processing and analysing the interview data, Atlas.ti software was used. The Atlas.ti software allows the researcher to code qualitative data, and therefore retrieve information systematically from the interview transcripts. As mentioned before, interviewees were sometimes involved in more than one case, or dispose of knowledge of more than one case, and this information can be valuable. Therefore the interviewees are not grouped and bound to one fixed case. The researcher used one or more codes for selected text fragments to create order in the interview transcripts. These codes are labels categorise sentences or larger text fragments. Labels or codes indicate certain meanings, ideas and concepts, and serves as the basis for analysis. The coding process that took place in Atlas.ti is a hybrid of both deductive and inductive coding whereas it is so that the researcher had certain codes and themes already prepared, but along the analysis process new codes and interesting takes and turns pop up. Parts of the coding scheme were therefore based on what was found in theory, while other codes came forth out of the empirical research, some came forth out of the policy document analysis, while others were inspired by the interviews.

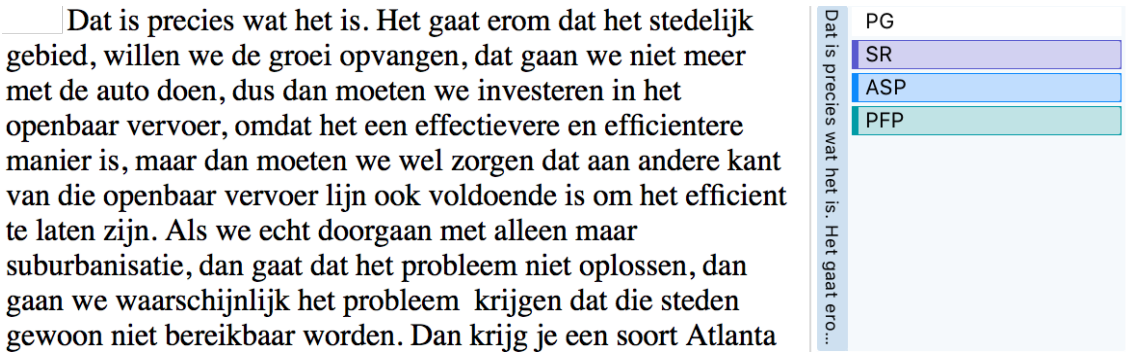


Figure 3.3. Example of applying codes

The goals of these codes are to find important meanings, returning, and important elements within the interview transcripts (Mortelmans, 2001). Figure 3.3 illustrates how coding has been done in Atlas.ti. The text fragment has been linked to four codes, ASP and PFP refer to the agenda setting phase and the policy formation phase, PG refers to the policy goal, and SR refers to the Southern Randstad case. The text fragment, for example, holds information about the Southern Randstad case, while covering both a problem definition (which is linked to the agenda setting phase) and a policy goal definition (which is linked to the policy formation phase). For the complete code-listings see Appendix 3.

The process of coding both on paper and in the Atlas.ti software might seem as double the work, but it is also argued that the process of reading on paper is often more precise, and in that sense, the data will be processed better (Mortelmans, 2001). Besides, analysing in this 'double' sense also minimises the chance of overlooking important elements. Throughout the coding process, Atlas.ti combines all fragments of text throughout all the interviews that are linked to the same codes and then gives an overview of all the different insights from the interviewees on the same matters in their specific case or context.

The next phase in interview data analysis is often referred to as 'axial coding', meaning the search for connections and relations between the data that is retrieved from the interviews through open coding (Saunders et al., 2015). It is also the act of comparing text fragments with the same codes with the goal of finding differences and similarities (Saunders et al., 2015).

As a final step in coding, a 'selective coding' process took place. This final step intends to combine the main theories that come forth from the coding process, and this does not mean that all the information that has been coded is used in the next phase. Through comparing and once again searching for what is important inherent to the research question, the interview data is once again filtered. This phase is mainly meant to make connections and relations between main categories, while the previous phases are more engaged with connecting sub categories on a lower abstraction level (Saunders et al., 2015).

3.5.3 Comparative analysis

For understanding the evaluation models in the policy process, the focus is not only on how they are constructed but also on their role and function in the process. The research is subdivided into three layers, to provide the adequate scope. There are three layers we can distinct based on the theory; the first layer is the policy cycle, the second layer are the station area evaluation models which are to be found somewhere along the policy cycle, the third layer exists of criteria of evaluation, the parts that make up for a station area evaluation model. The variables and elements that are used in the empirical research to construct compare, and analyse the different forms of policy evaluation are retrieved from the theoretical framework. These variables and elements are used as follows:

Within the first layer station area evaluation models were placed along the policy cycle within the case, identifying if where the station area evaluation model is used, and if it is used in more than one phase. Through the combination of policy document analysis and semi-structured interviews contextual information is obtained, which can be used to link a policy process to the appropriate phases, alongside with the mentioned problem definition, the formulation of the policy (policy goals), and other contextual factors. Based on this a station area evaluation model can be categorised in ex-ante, ex-durante, ex-post or a combination of them. Within the second layer the station area evaluation models are set up next to each other with reference to the role they play in their policy processes.

And within the third layer, the builds of the station area evaluation models were categorised under indicators and measurements. As mentioned in paragraph 2.3, an indicator cannot be counted unambiguously and is a stand in and often combination of what is measured in data. Through setting out the distinctions between indicators and measurements in tables we created a comparable overview, which is analysed through the below-mentioned factors:

- Qualitative/quantitative
- Soft/hard
- Content/process/effect

3.6 Scope and limitations

One of the biggest constraints of the comparative research method is that it is heavily dependent upon the cases that are selected, which makes for only partial generalisations (Lijphart, 1975). The comparative method in this study can, however, serve as an addition to theory building on station area evaluation models. Sartori (1991) mentions that case studies cannot confirm a generalisation, but heuristic and systemic case studies do provide an ideal soil for the conceiving of generalisations, in other words, it is first and foremost not part of theory controlling, but of theory building. Smelser (1967, in Lijphart, 1975) identifies the problem of comparative research as it makes use of data, which cannot be controlled experimentally and the number of cases is too small for statistical analysis to make sense. It is therefore very complex to point out causal relationships while using the comparative method. Nonetheless, this research is qualitative of nature, and is not searching for a causal relationship between two factors. Instead, this study is focused on an in-depth qualitative analysis and comparison between three cases.

Furthermore, parallel analysis of case studies involved in the practice of TOD presupposes independence, while they are likely to be part of a bigger interdependent system (Rose, 1991). Cases of TOD are likely to influence and interact with each other. Moreover, Friedmann (in Booth, 2011) for example observes a world where the economy and information exchange is globalising, and where international exchanges between planners and policy-makers are multiplying. Because this information exchange, interaction, and interdependence are complex processes, it is sometimes hard to point out to what extent cases are influencing each other. It is important to keep in mind that the cases in the Netherlands are not completely independent and isolated. And in addition the interviewees chosen for specific cases are also not independent and isolated.

Another limitation of this study focuses on the coordinating side of the TOD practice. It can be argued that the study should also include local municipalities and private parties to get an even more comprehensive view of what the role of indicators and evaluation models are. Due to time-constraints, the focus of the research does not incorporate these parties and governmental bodies.

In terms of limitations, problems were experienced with finding the right interviewees. Interviewees that were selected through the selection criteria were sometimes open to an interview, but it simply could not take place due to busy schedules. The first research design did not involve semi-structured interviews but was merely based on a policy document analysis. Therefore, because the interview aspect was added later, time-constraints shaped the choice of interviewing only two persons per case, while research wise, rich-rigor and credibility would have been improved with more than two interviewees. Within this research, none of the three cases is to be found in the policy review phase, and therefore there is no use in analysing this phase that in two cases is yet to come. This phase is therefore left out in the analysis. For the case of AN, the policy review phase will not be reached and therefore also not analysed.

3.7 Ethical considerations

The information used in this research is for a large part publicly archived and readily available, a substantial part is based on policy documents and plans that are freely and publicly available through governmental websites. All the documents used are developed by or in collaboration with these governmental institutions. While it is highly debatable what or what is not sensitive material (Bryman, 2012), it can be assumed that the material used for the document analysis is not sensitive. Within the interviews, the foundation is to be as ethically responsible as possible, and while it also is debatable what is ethically responsible, we strive to handle the interviewees with as much respect as possible. It might be a possibility that certain interviewees are not willing to share parts of information, and that is respected, interviewees can refuse to answer questions, change topics, and end the interview at all times. Firstly, while arranging the interviews, the interviewees are proposed the question if the interviews could be recorded, if not, this would be respected. The same question is once again asked face to face before the interviews take place. Before conducting the interviews, the interviewees are provided with an email summarising the research and stating the goal of the research. In this same email, more information is offered if needed or wanted. The interviewee remained anonymous in this research. After the interviews are conducted, transcribed, and coded, the interviewee is given the possibility to make changes, revoke, or revise the raw quotations that the interviewer is proposing to use. After the study is completed, the interviewees are offered the final version.

4

4. TOD in the Netherlands

In this chapter, an introduction is given on the Netherlands as a context for the three cases that are analysed. The background is provided on policies based on the principles of TOD, as well as background on the node-place model, its operationalisation, and briefly the use of the model in the Dutch land-use and transport integration.

4.1 The Netherlands

The Netherlands as a country has a long past and rich history regarding land-use and transport integration, and also, the Netherlands also has a long history of making policies to steer modal shift towards non-car modalities (Smit et al., 2014). However, until the Fourth Memorandum Spatial Planning (Vierde Nota Ruimtelijke Ordening) policy, land-use and traffic policies were made on the scale of 'Stadsgewest', which was in fact somewhat bigger than one municipality, a large city or several municipalities combined (Rijpers, 2007).

Past policies were aimed to concentrate new developments in areas that are easily accessible through public transportation, for example, the 'stedelijke knooppuntenbeleid', the ABC-location policy, and the better-known Vinex policy are all clear examples (Smit et al., 2014). These policies arose to counter the negative effects of a car-based society, such as urban sprawl, traffic congestion, air pollution, greenhouse gases, energy consumption, traffic accidents, social inequities, and other environmental concerns such as noise and soil pollution (Cervero, 1998). Within the Fourth Memorandum Spatial Planning Extra (Vierde Nota Ruimtelijke Ordening Extra), however, an upping in scale was made towards networks.

The more recent attempts to integrate land-use and transport in the Randstad Southwing and Arnhem Nijmegen City Region came forth from the WGR-law, which made it possible to arrange partnerships between layers of government both horizontally and vertically (Kagie-Schreuder, 2006). Furthermore, it opened up a variety of possibilities between municipalities, provinces and others to work together to face infrastructure and mobility problems bigger than one governmental body itself (Kagie-Schreuder, 2006). The WGR-law later resulted in obligatory partnerships between multiple municipalities named 'Plusregio's'. One of the most important tasks that these Plusregio's fulfilled was traffic and transportation planning in

the area, as the awareness arose that cities or municipalities are not isolated but part of a larger interconnected system. In 2015 the Plusregio's were disestablished, and therefore some of the regional partnerships that were made completely dissolved, others, however, made place for new non-obligatory forms of partnerships (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2013). In some cases, the traffic and transportation management tasks were relocated to the provincial level. Nonetheless, these Plusregio's raised awareness that in some regions traffic and transport should be arranged on a higher scale level than the municipal, very much in line with the principles of TOD or Node-development that was or is pursued in the Randstad Southwing, the province of Noord-Holland, and in the Arnhem Nijmegen City Region. However, in the end, the municipalities remain responsible for the land-use development in their areas (Rijpers, 2007).

As mentioned before, the development or redevelopment of station areas is not something new, and within the mid 90's station area development was something that happened all over Europe (I_7, personal communication, May 7, 2017). Bertolini (1996) came up with the Node-place concept. The Node-place concept considered a station area not to only be a 'node' or station with mobility-relevant aspects, but it also includes the nearby station surroundings; it is at the same time a 'place' in the city, and they are affected by both global and local dynamics. The node function describes transport activity and the connectedness of the station with other places of interest, while the place function describes the quantity and diversity of possible activities at or around the station (Reusser et al., 2008). This node-place model inspired TOD policy-makers and researchers to operationalise it further to their own needs, and the stakeholders view of the problem (Peek et al., 2006).

4.2 The Node-place model

4.2.1 Operationalisation of the Node-place model

Because of the growing popularity of development and (re)development of station areas and policy strategies based on the principles of TOD, there was a growing need to understand these station areas better. There was a need for understanding these developments and projects in the process, meaning that they should be perceived as node and place at the same time. The node-place model in its first essence was intended to summarise the dynamics of a station area, purely a conceptual model. Bertolini's (1996) article reasoned along the line of integrating the node in the place and its interrelating strategies. He mentions that the ambiv-

alence of station areas may be a source of tensions, but could also be a stimulant for synergy (Bertolini, 1996; Peek et al., 2006).

There are many efforts to pursue TOD at the scale of the urban region, as it is seen by many as a promising approach to cope with unsustainability challenges. However, there was a scarcity of analytical tools to help identify potential on a regional scale (Bertolini, 1999). Bertolini (1999) stresses the idea that an accessible area is not only one where many different people can come (node), but also the number and diversity of activities that take place in that area (place). Based on this principle he developed the node-place model. Bertolini (1999) also adds the idea that station areas are part in a system of both complementary and competitive nodes and places, as they are all alternative locations in a certain region, and they belong to a certain transport network. In that instance, we could also state that there is a certain hierarchy between theses different areas, and through that, there is also a difference in development potential (Bertolini, 1999). The idea of node versus place was after that developed in an x-y diagram (See figure 4.1)

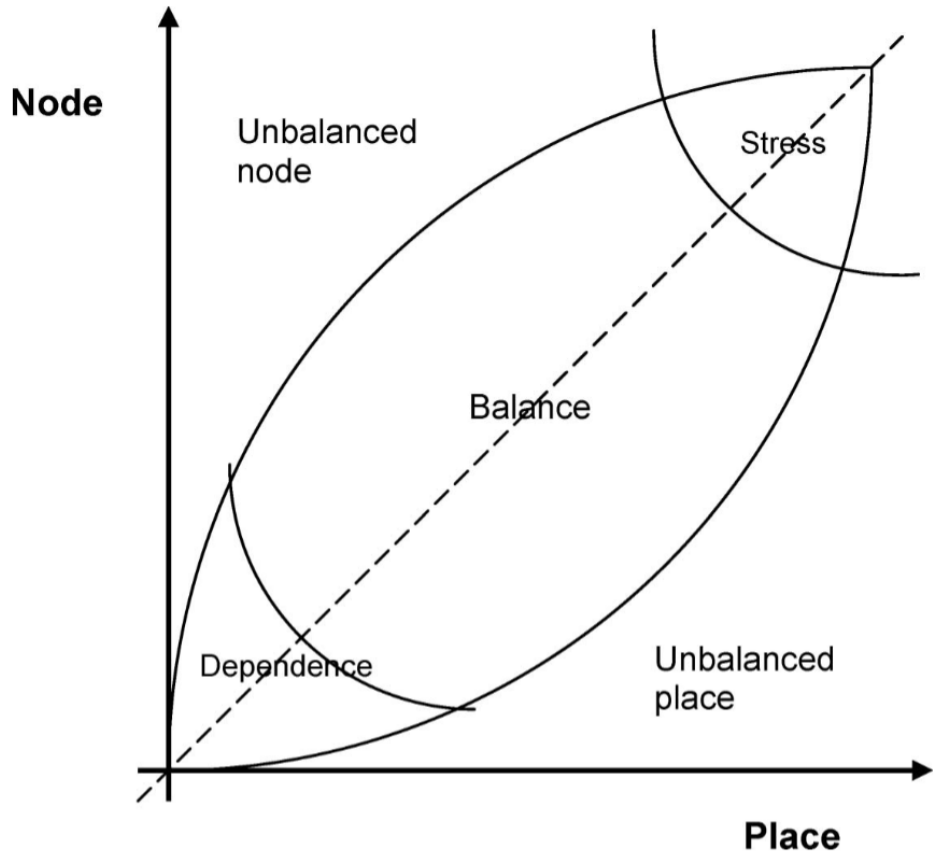


Figure 4.1. The node-place model (Bertolini, 1999)

Within the model, the x-value corresponds to the place function of an area, and the y-value corresponds to the node function an area has (Bertolini, 1999). He refers to the place function as the intensity and diversity, and ultimately the realisation of the potential for physical human interaction, as the more activity there, the more interaction takes place. The node function is referred to as the accessibility of an area, and also, therefore, its potential for physical human interaction, as the more people can get there, the more interaction can take places (Bertolini, 1999). Within figure 4.1, we can also identify four ideal-typical situations, namely 'stress', 'dependency', 'unsustained node', and 'unsustained place'. To make the node-place model usable, Zweedijk (1997) and Serlie (1998) operationalised both the node and place indicator using a multi-criteria analysis (Bertolini, 1999). The first operationalisation of the node-place model is set out in table 4.1.

Table 4.1. The first operationalisation of the node-place model (Serlie, 1998b; Bertolini, 1999).

Node-index		**Place-index**	
Indicator	Measurement	Indicator	Measurement
Accessibility by train	Number of directions served	Intensity	Walk-able radius of 700 metres
	Daily frequency of services		Number of residents in the area
	Amount of stations within 45 minutes of travel		
Accessibility by bus, tram and underground	Number of directions	Diversity	Number of workers per each of four economic clusters
	Daily frequency		Degree of functional mix
Accessibility by car	Distance from the closest motorway access		
	Parking capacity		
Accessibility by bicycle	Number of free standing bicycle paths		
	Parking capacity		

In table 4.1 the node-index is subdivided four accessibility indicators, accessibility by train, accessibility by bus, tram and underground grouped, accessibility by car, and accessibility by bicycle. The accessibility by train is combined with three measurements, the number of directions it serves, the frequency of trains, and the amount of other stations that can be reached within 45 minutes. The accessibility by bus, tram, and underground is translated into two measurements, the number of directions and the daily frequency on a weekday. The accessi-

bility by car is combined out of the distance from the closest motorway access and the parking capacity. The parking capacity is subdivided into five different classes as shown below in table 4.2.

Table 4.2. Car parking capacity classes (Serlie, 1998b)

Class	Free parking	Paid parking
--	None	None
-	None	Few (parking area)
0	Few (10-100)	None
+	None	Many (parking garage)
++	Many (>100)	None

Because of the lack of reliable data, parking is roughly classified into the five different classes. Assuming that a parking garage contains more parking spaces that regular parking area and free parking have a bigger impact on accessibility than paid parking (Serlie, 1998b).

The accessibility by bicycle is combined in the number of free-standing bicycle paths together with the bicycle parking capacity. The free-standing bicycle paths are bicycle paths within 50 metres from the bicycle parking areas, which continue for a minimum of 200 metres and are free from cars (Serlie, 1998b). Within the parking capacity, a rough distinction was made between if the bicycle racks were full or not, the bicycle parking facility is 'not full' when there are racks available, bicycles outside of the racks are not taken into account. Table 4.3 shows the five different bicycle parking classes as developed by Serlie (1998b).

Table 4.3. Bicycle parking capacity classes (Serlie, 1998b)

Bicycle parking	Class
Unguarded and full/No specific storage	--
Unguarded (not full)	-
Unguarded + guarded (both full)	0
Unguarded + guarded (one of both full)	+
Unguarded + guarded (both not full)	++

The place-index as described in table 4.1 exist out of the intensity indicator and the diversity indicator. The intensity indicator exists out of the number of residents, which is estimated on the base of houses and the average home occupation. The station area as defined by Serlie (1998b) is the area within 700 metres from the main entrance of the railway station, or the

station-square if there is not a distinct station building. Within these 700 metres, barriers on foot are taken into account, and those areas that are not within 700 metres are not taken into account. The diversity indicator is combined out of the number of workers per each of four economic clusters within 700 metres from the station. The degree of the functional mix is build up as follows: three types of users are distinct from the location, those who live, those who work, and those who make use of services (visitors); this follows the following formula:

$$\text{Degree of functional mix} = 1 - (((\max-\min)/\text{total}) + ((\max\text{-1 after min})/\text{total})))/2 \quad (1)$$

When the number of inhabitants is equal to the number of those working, and the amount of those working is equal to those making use of services, the value is one. Serlie (1998b) however, also mentions that the measurement is debatable for two reasons, the formula does not take into account the number of visitors, and it also does not take into account how the activities are spread within the 700-metre radius. Serlie (1998b) mentions that it is of importance to assign weights to the different criteria in the node-place model. However, in this operationalisation the indicators were granted the same weights, meaning they are all assumed to be equal in importance in this research.

The way that the node-place model is operationalised in this sense is very quantitative of nature. All six indicators within both the node- and place-index are quantitative measurements. And while they can be presumed to be 'hard' data, some of the measurements are debatable and very 'rough'. The way that parking and bicycle capacity is measured might not be very accurate, but merely an imprecise estimation. The six indicators are all inherent with the content, and the model does not contain process or impact indicators or measurements.

4.2.2 Role of the Node-place model

The node-place model, as shown above, was used to research the position of station area locations while comparing each other. The first operationalisation was therefore very useful, as it made the node-place model useful in practice for the first time. In its essence, the node-place model is a way of looking; it is a simplification of reality and a way of structuring debate around (re)developments around station areas. In other words, it is a conceptual model that can help in exploring the potential for (re)developments in station areas in an urban region

(Bertolini, 1999). However, in Bertolini's (1999) article he also mentions that the operationalisation of the mode-place model requires further refinement as the qualitative aspects of the station area, a more in-depth analysis per station, context sensitivity, and process factors are currently not included. The node-place model might make it seem as balance is the goal, but it does not have to be the goal, there are different ways of operationalising, mostly dependent on the goal one is trying to reach, and also dependent on the data one has access to (I_7).

4.2.3 Link to later models

The transparency in how indicators are operationalised and measured is of high importance, and therefore also openness in what is missing in the evaluation models (I_7). The Node-place model was first based on what was seen in practice; the Vlindermodel and also others, however, used the idea of typologies, and in that sense in a normative way, certain ideal-type station area situations are offered (I_7). What is however often missed in how contemporary models are operationalised, is the sense of a place and also the way a node is experienced, whereas citizens also experience the public transportation itself (I_7). We could say that there are two things that are of importance in the evaluation models, that is, on the one hand, the extra dimensions that can be offered on the soft side, refining and deepen. On the other hand, it is working from the problem definition, working from the goal (I_7). What is often also missing in TOD policy is that it is not working from an issue, and if it is not clear what issue one aims to clear, then a goal can never be reached (I_7).

The function of evaluation models like the Node-place model is and will be to structure debate around TOD (I_7). However, these models could also serve other purposes, but only if there is clarity about the problem definition and the goal, as often it is also assumed that integration between transport and land-use development is the policy goal, while it is a means to reach a deeper goal (I_7). And as long as it is not clear what the problem is that is aimed to solve through policy, who's problem it is, and what the benefits from solving it are, it will be likely to have an insignificant contribution (I_7).

Within the Netherlands, station area evaluation models are very much based or retrieved from the node-place model. They are variations on the node-place model and attempts to systematically organise different indicators together (I_5, personal communication, May 19, 2017). These models differ from each other in the way that they are constructed and operationalised,

but also in the way that they are embedded in the policy process, and therefore the role can also differ.

5

5. Randstad Southwing

In this chapter, the collected data for the Randstad Southwing (RS) case is presented. The background will be given on the RS and the Stedenbaan programme that is executed in this region. Within the Stedenbaan programme, principles of TOD are pursued, and with that programme, a station area evaluation model and a monitor are used as part of policy evaluation. These evaluation tools are placed in the policy process along the policy cycle and after that analysed in how they are constructed and what their role is.

5.1 Randstad Southwing background

Through the Stedenbaan programme, a non-obligatory partnership exists between multiple municipalities, regions, cooperative bodies, the Zuid-Holland province, and transit agencies. This programme focuses on a more efficient use of the current rail network through an integrated mobility and land-use task (Rijpers, 2007). The concept of Stedenbaan transcends the municipal and regional level and combines multiple regional partnerships in its programme, and this was perceived as necessary to face future housing and mobility challenges in the Randstad Southwing (Rijpers, 2007). The Stedenbaan-network encompasses the corridor 'Oude Lijn' from Hillegom through Leiden, Den Haag, and Rotterdam to Dordrecht, the 'Goudse lijnen' in between Gouda and Den Haag, and Gouda and Rotterdam (see Figure 5.1). The Stedenbaan-network encompasses the corridor 'Oude Lijn' from Hillegom through Leiden, Den Haag, and Rotterdam to Dordrecht, the 'Goudse lijnen' in between Gouda and Den Haag, and Gouda and Rotterdam (see Figure 5.1).

The Stedenbaan-network encompasses large parts of the province of Zuid-Holland, with the focus on municipalities linked to the railway-network. In 2006, Stedenbaan started as a programme-bureau and the tasks that this programme-bureau had varied from representing the realisation of the concept, connecting the different parties within the Stedenbaan network, bringing together policy-making and executing within the common ground of land-use development and transportation. Along the way, the programme-bureau became too much of an own entity, and it was decided to bring it back to one single coordinator. This coordinator had the task to bring the partners together, and make them take their responsibility in the process; the responsibilities were given back to those involved (I_1, personal communication, March 28, 2017).

Figure 5.1. The Stedenbaan-network (Netwerk Zuidelijke Randstad, 2014).

5.2 Agenda setting phase

Within the agenda setting phase, we are identifying the problem definition or challenges that are the main motive behind the TOD or node-development policy that is being pursued in Stedenbaan. The main idea or goal behind the Stedenbaan policy is the improving the public transport network, and there does not seem to be a hard problem that needs direct solving.

> *"There is not really a problem in the sense of not working in an integrated way, or not maximising integration, is that a problem? In all these parts they are doing what has been agreed upon, so the problem as we defined it, is that we just wanted to use our transport network in a more efficient way, our problem is that we wanted to increase the frequency of trains, we want a better network"* (I_2, personal communication, April 3, 2017).

There is, however, a worldwide urbanisation trend going on, and according to predictions this will continue, and this huge urbanisation task is not going to be accommodated through car transport (I_2). In other words, the Stedenbaan policy is aimed to improve the overall network to accommodate future growth in urbanisation.

> *"We are observing a growing pressure on these city areas, and this pressure will only increase due to the necessity of economic growth, and if we want to accommodate this, we will have to do more than only thinking in the old fashioned ways of the car"* (I_2).

The underlying motive however in keeping up with the growing pressure and keeping the region accessible is economical of nature. Stedenbaan surfaced from the spatial economic interest in connectivity for the economic development of the region (I_1). It means that it is of high economic importance to remain accessible as an area, in the economic competitiveness of the RS, connectivity is a crucial factor (I_1). Additionally, there are several places along the Stedenbaan-network that are not used to their full potential, resulting in withholding citizens a choice in mobility, and places remaining less economically attractive than they could have been (I_1).

5.3 Policy formation phase

Within the policy formation phase, the programme-bureau researched in collaboration with NS what is necessary to make it attractive for NS to increase the frequency of trains on the corridor of Oude Lijn (I_1). Therefore one of the main aims is to intensify the amount of passengers that make us of the Stedenbaan network (Netwerk Zuidelijke Randstad, 2014). Subsequently, it turned out to be in all the stakeholders best interest to increase the frequency of trains. Therefore, an agreement was made in 2006, which was divided into sub-agreements. These include a sub-agreement on land-use development in which it is agreed upon that within the area of influence of the stations along Stedenbaan there have to be 25.000 to 40.000 housing developments, combined with a certain amount of square metres office space (I_1).

> *"The goal was to realise between 25.000 and 40.000 housing developments nearby station areas, and through these housing developments, it is expected that the transit rider-ship will grow, and that will lead to a higher train frequency as the NS is willing to increase the frequency if it does"* (I_2).

The second sub-agreement is on the mobility chain, and in its essence, that means the goal of

having no shortages in the network (I_1). The third sub-agreement encompasses the quality of station areas, and this is mostly translated in the form of management contracts (I_1). The goal that is strived for is improving the public transport network; it should function as one regional transport network, and not as disparate lines, as in the end it is about the passenger's experience (I_1; I_2). While these goals are inherent to strengthening the area economically. *"People should be able to reach as many places as possible, that all adds to a better functioning economy, that is the goal"* (I_2).

However, the goal might also differ depending on the audience:

> *"On the public transportation side you inform that coherence with the spatial development side helps with improving the public transportation, and on the spatial development side, it was more the story that through an integrated approach the public transport will improve and therefore it will become a more interesting location for establishing"* (I_1).

5.3.1 Node-place diagram (construct)

The station area evaluation model that was used in Stedenbaan was designed by Atelier Zuidvleugel and derived from the node-place model by Bertolini (1999). *"Remodelled into a diagram"* (I_1), and operationalised by Atelier Zuidvleugel (2006). The Node-place diagram looks as following:

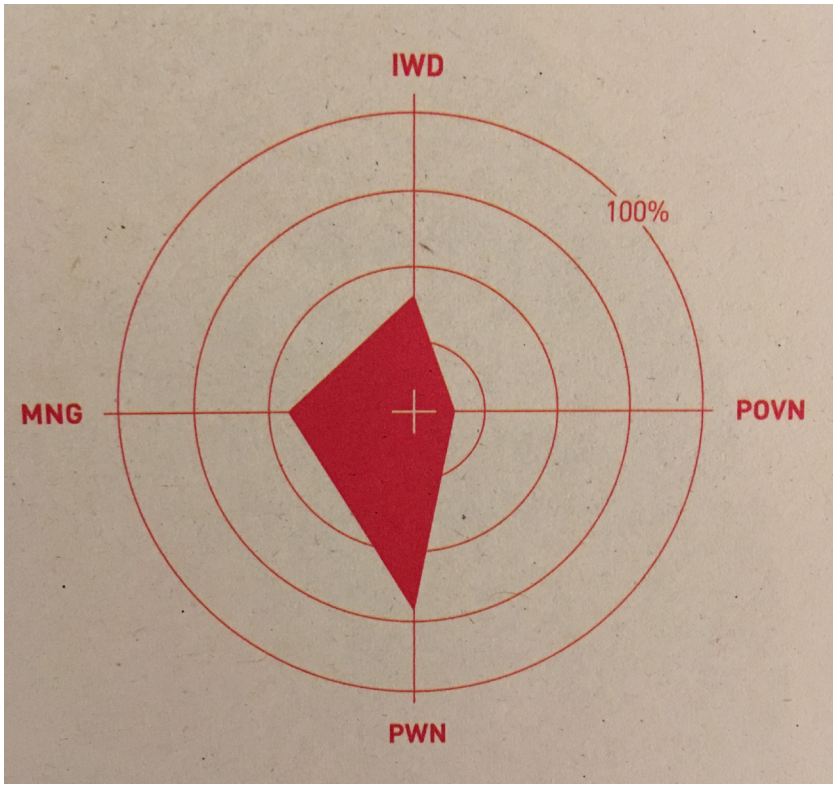


Figure 5.2. The Node-place diagram (Atelier Zuidvleugel, 2006).

The operationalisation can be found in Appendix 5. Based on the table in Appendix 5 we can subdivide the Node-place diagram into four indicators. The node- index exists of the position a station area has in the public transport network (POVN) and the position a station area has in the road network (PWN). POVN and PWN both exists out of a connection-value and an access-value (which we categorise as sub-indicators), the connection value in POVN is based on the amount of different modes that are present in a station area, through the presence of different modes a station area gains points. In this sense, faster modes of travel are valued higher in the point ranking system. The following modes are distinguished:

- High-speed rail (score: 200)
- Intercity train (score: 100)
- Connected to the Stedenbaan network (score: 75)
- Light rail (score: 50)
- Regional bus (score: 50)
- Local bus/tram (score: 25)

The access-value in the POVN indicator is based on the number of directions a mode serves, the more directions a mode serves, the more points it gains in the ranking system. However, it remains unclear exactly how points can be earned. The connection-value in PWN is based on the presence of the provincial roads, and motorways; points can be earned through presence, meaning it is better accessible by car. The closer the presence of both provincial road and motorway delivers more points. The following options are measured:

- Provincial roads within a 3200-metre radius (score: 25)
- Provincial roads within a 1200-metre radius (score: 50)
- Motorways within a 3200-metre radius (score: 50)
- Motorways within a 1200-metre radius (score: 100)

The access-value in PWN adds to this by measuring the amount of directions one can travel from that certain node. The following points can be earned:

- Provincial roads within a 3200-metre radius per direction (score: 5)
- Provincial roads within a 1200-metre radius per direction (score: 10)
- Motorways within a 3200-metre radius (score: 10)
- Motorways within a 1200-metre radius (score: 15)

The place-index exists of population and worker density (IWD) and the degree of mix (MNG). In turn, these indicators are again subdivided into sub-indicators. We can break down the IWD indicator into the population density based on the amount of inhabitants per hectare within a 1200-metre radius around the station area, and the amount of workers per hectare

within a 1200-metre radius around the station area.

Finally, the MNG indicator is translated into the percentage of mixed-use, meaning that divides the amount of housing and business in a percentage, based on the postal codes around that station area. An equal amount of workers and inhabitants within a 1200 metre radius around the station area is expressed in a full 100%. A 0% stands in for a complete mono-functional area. No distinction is made between workers or inhabitants in that sense, meaning 0% can mean both a mono-functional work area or a mono-functional housing area.

The way that indicators are operationalised is quantitative of nature. Within public transportation, there is a deepening as regard to the operationalisation of the node-place model by Bertolini (1999). While in Bertolini's model there was a distinction between trains on the one hand and bus, tram, and underground on the other, the node-place diagram makes a distinction between high-speed rail, intercity trains, and light rail, and on the other hand between a regional bus, and local/bus tram. Instead of measuring the 'accessibility', they are grouped under the position in the public transportation network. The daily frequency of the services is not taken into account, as are the amount of stations that are reachable within 45 minutes of travel. Instead, the presence of different modes is valued through the point system.
The number of directions served by these modes is translated into the access-value and valued through the point system.

The role of the bicycle is not taken into account in the node-place diagram. The accessibility by car differs from the node-place model in the way that it only focuses presence of regional ways and motorways, and the amount that one can travel in, parking facilities are not taken into account. There is, however, a deepening compared to the node-place model in the way that the connection value is measured, as not only motorways are valued, but also the regional ways and their presence are measured in two different radiuses. The evaluation model exists out of content indicators, and no process or effect indicators are involved. The indicators imply that they are granted the same weights, meaning they are all assumed to be of equal importance in this research.

5.3.2 Node-place diagram (role)

The station area evaluation model helped in the process of Stedenbaan concerning inspiration

and eye opening; the node-place diagram was used in sessions with municipalities and external experts (I_1). At this time in the process, it offered a different way of thinking, policy makers from both the spatial and the infrastructure sides came together and decided to make agreements together (I_1; I_2). The model was helping in a way that it makes one look at the city from a different perspective, thinking from inside the station area, what the role of the node is in the city (I_1). *"We could describe it as a communication instrument towards municipalities. It was never a leading or compulsory tool towards municipalities"* (I_1).

> *"Within the session, we had the municipality of Rotterdam with the station of Lombardijen. The interesting part was that within this session, the municipality realised that there were four different land-use development plans within that same station area, and all four of these plans were in fact back to back, meaning they were all focused on their own part. And after that session, the municipality changed their perspective from station area towards the land-use plans, instead of the other way around. In that sense it works as an eye-opener, that's what you reach with these kinds of sessions, and these things do not tend to happen during daily business. And that's where this kind of images help, as inspiration"* (I_1)

In other words, the model helped in making clear to the municipalities the idea that the programme-bureau had with the region, and at the same time, it was an introduction to working in an integrated way, combining land-use and mobility.

Later in the process, the Vlindermodel (see paragraph 6.3.1) was used to capture the station areas in a model once again, this was because the research on evaluation models continued, and the Vlindermodel offered an improved way of schematising the station areas. *"We also used it again, it was a clearer way of presenting what we have at these station areas, but still a communication instrument"* (I_1). A valuable tool nonetheless, but the model itself is not the end-goal, it was mostly used to look at nodes together with the municipalities involved and figure out what type of node a station area is (I_2). But the node-place diagram and Vlindermodel are not used in the monitor, and it is not a monitoring instrument.

> *"It could work as an analysis model, but from my perspective, it is way more impor-*

tant as a communication instrument or tool. It is, however, a good model, and it offers a lot of handles for what to do on a node-level, and therefore it is possible to use it in communication towards the municipalities" (I_2).

The model is a tool on the level of a node, and the idea exists that it can be used as a monitoring instrument on the node-level, but to test and measure this is more of a scientific matter (I_2).

5.4 Policy implementation phase

5.4.1 Monitor (construct)

The policy formation phase largely existed out of making agreements, and these were made in such a way that they could have a place in the monitor as well (I_1). Additionally, the housing development and transit rider-ship indicators are long lines, and therefore it is good to hold on to them for some time (I_1).

"We used these indicators because these are the ones we agreed upon, these are the elements we wanted to make agreements on. These are big components of what we want to reach. And the last agreements were made in 2009, and from then on, we never discussed these agreements anymore, we just started working on them, and if you don't discuss them, no other goals will develop that we should monitor" (I_1).

While in the node-place diagram a certain identity is outlined, it is not monitored in that way. The Stedenbaan monitor is based on four different aspects, or four indicators (Netwerk Zuidelijke Randstad, 2013; Netwerk Zuidelijke Randstad, 2014; Netwerk Zuidelijke Randstad, 2015; Netwerk Zuidelijke Randstad, 2016):

Based on these characterisations we can make the statement that the main goal or effect to be measured is the development in transit rider-ship, while the other indicators/measurements are inherent to the transit rider-ship development (Netwerk Zuidelijke Randstad, 2014; Netwerk Zuidelijke Randstad, 2015). While the mobility chain by name might suggest that it is involved with improving the whole mobility chain, it is merely focussed on the occupancy rates in bicycle storing and car-parking. The quality of the station area indicator involves process indicators but does not involve a soft customer experience factor.

It is acknowledged that it is complex to point out a relation between a station area project and the outcome of a collective approach, but through monitoring it is aimed to give an insight on how goals are attempted to reach (Netwerk Zuidelijke Randstad, 2014).

5.4.2 Monitor (role)

The function of the monitor in itself, however, should not be overestimated (I_1). As it is said that the most important process of the monitor is putting data together with the partners in Stedenbaan and basing conclusions is the most important process of the monitor (I_1).

> *"Every year we make that book. However, I don't have the idea that anyone ever uses that book after it is presented. What always remained hard was using that monitor to steer the process"* (I_1).

In other words, the steering power of the monitor remains limited, it is not a compulsory steering analysis tool, and it remains a communication tool due to contextual factors and political influences (I_1).

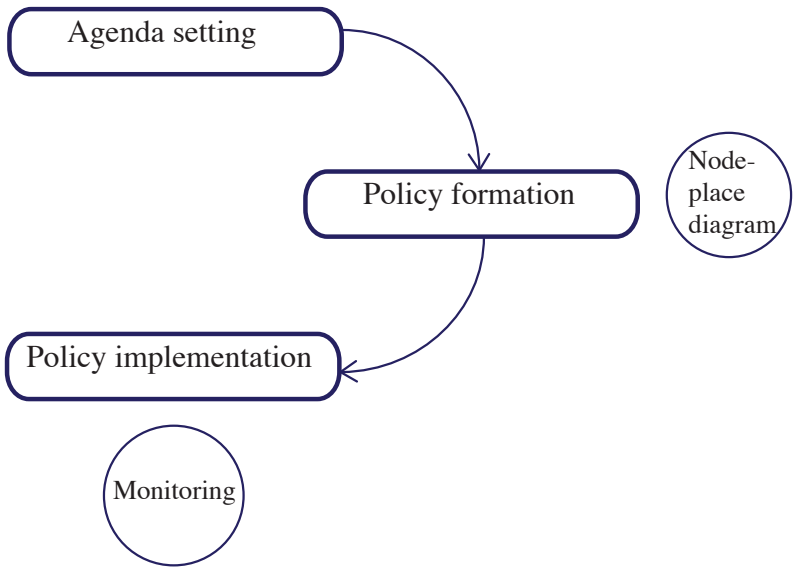
5.5 Findings

While the time-span for the Stedenbaan programme is set to take place until 2020, and the policy review phase is not yet reached, some predictions can be made. Through the monitor for example it was possible to conclude every year that Stedenbaan came close to the business case or the goal that was set in the policy formation phase, namely the higher transit rider-ship that will lead to the goal of a frequency increase of trains by the NS.

> *"In that sense you could say that Stedenbaan is basically a successful project, we have arranged the tracks that are necessary to increase the frequency of trains, and when these tracks are there, the NS will up the frequency. So basically we have reached the goal that we have set, that is also a reason to enter a new phase"* (I_1).

It can be concluded that the Stedenbaan programme exists mostly out of ex-ante evaluation and monitoring. The ex-post evaluation that will take place would be focussed on if the goal

was reached, and not on the interpretation of how effective the policy was in contributing to the goal, and which parts of the policy were effective regarding cost-benefit. The station area evaluation model does not have the role of combining ex-ante and ex-post evaluation, as station area (re)development is not the goal. However, this is indirectly contributing to the



greater goal, see figure 5.3.

Figure 5.3. Use of the Node-place diagram in Stedenbaan policy (Author, 2016)

6

6. Province of Noord-Holland

In this chapter, the collected data for the Province of Noord-Holland (NH) case is presented. The background will be given on NH and the OV-knooppunten programme (OVK) that is executed in this region. Within the OVK, principles of TOD are pursued, and with that programme, a station area evaluation model and a monitor are used as part of policy evaluation. These evaluation tools are placed in the policy process along the policy cycle and after that analysed in how they are constructed and what their role is.

6.1 Noord-Holland Background

The OVK is one of the programmes in the structural concept in Noord-Holland for 2040. Through the OVK, the province of Noord-Holland is striving to intensify the use of urban areas, sustain cultural landscapes, and make better and more efficient use of current infrastructure (Provincie Noord-Holland, 2016). To make this happen, a collaboration between municipalities, transit agencies, businesses, and the province is of crucial importance (Provincie Noord-Holland, 2017). Within NH all the 60 train stations and four large bus stations are considered as being public transportation nodes, or OV-knooppunten. NH focuses on node-development, and through that, goals are short travel times, nearby green landscapes, nearby services, quick routes to stations, less air pollution, and the preservation of cultural landscapes. In 2014 the province wanted to concentrate housing and business developments within a 1200 metre radius from the stations, and 50% of all housing should be developed there (Provincie Noord-Holland, 2017). In 2016, however, the province changed the 1200-metre radius to a 10-minute bike ride, as in this wider area, a larger percentage of the housing can be developed, and the province can capitalise the diverse housing demands (Provincie Noord-Holland, 2017). The network that NH focuses on can be divided in two main corridors, namely the Zaancorridor which runs from Amsterdam to Heerhugowaard through Zaanstad, Uitgeest, Castricum, Heiloo and Alkmaar. And the Kennemerlijn, which runs from Haarlem to Uitgeest through Bloemendaal, Santpoort Zuid, Santpoort Noord, Driehuis, Beverwijk and Heemskerk (see Figure 6.1) (Provincie Noord-Holland, 2017).

Figure 6.1.The Noord-Holland OVK network (Provincie Noord-Holland & Vereniging Deltametropool, 2013).

6.2 Agenda setting phase

Within the agenda setting phase, we are identifying the problem definition or challenges that are the main motive behind the TOD or node-development policy that is being pursued in NH. The OVK is grouped under sustainable land-use, as there has been an observation that space around the station areas can be used more efficiently than has been done so far, and this focuses on all sorts of different functions: housing, business, and leisure (I_4, personal communication, March 22, 2017). *"The idea is that these places are very accessible, and they could be utilised more efficiently. So, mainly it is about sustainable land-use"* (I_4). In addition to the idea of sustainable land-use however, the province also has to deal with high pressure on the housing market, and high urbanisation also plays a role (I_4).However, in the Kennemerlijn corridor there was a clear problem as the frequency of trains is under pressure (I_4). The NS lowered the frequency of trains on that line:

"The response there was somewhat like "wow, what is happening". And then we respond to that with stating that if you don't want the service to increasingly impair, you will have to work on those nodes. In that sense you can contribute. Instead of randomly developing, work on those nodes from spatial and mobility perspective, improve that first and last mile. In that sense you can make sure it will not further impair, we cannot guarantee that the NS will increase the frequency again, but you can at least deliver a solid base" (I_4).

Clearly the NS has a commercial point of view, and they have their own business case, and in order to keep the network on the same level, there is urgency for transit rider-ship (I_4). However, the goal is not to force a modal shift trough the OVK policy:

"We cannot force citizens to use public transport; instead we want to offer them a choice, we want the public transport to be attractive, a logical alternative. We want to have it as an option. And that is often interpreted in a wrong way; node development is not going to solve congestion, that is nonsense" (I_4).

The idea lives that the growth in car use might stagnate a bit, but claims that cars are decreasing through node-development are not right (I_4). As node-development is also not something that is isolated and is going to solve problems bigger than itself (I_4). However, a lot has been done on the roads, and putting a little more emphasis on the public transport side would be the right thing to do (I_4).

6.3 Policy formation phase

The main challenge that follows out of the agenda setting is a better and efficient use of the current public transport infrastructure (I_4). Through countering that challenge, the province is aiming to work on the length of travel times, nearby green areas and services, quick routes to stations, less emissions, and preservation of cultural landscapes (Provincie Noord-Holland, 2017).

Within the policy formation phase, NH collaborated with Vereniging Deltametropool to research how station areas can be used more efficiently (Provincie Noord-Holland, 2017). Therefore, the station area development model that was used in OVK was designed in col-

laboration with the Vereniging Deltametropool, derived from the node-place model and node-place diagram used in Stedenbaan (I_4). The idea was to compare station areas based on the most important statistics and numbers (Provincie Noord-Holland & Vereniging Deltametropool. Further improvements and deepening were made with reference to the older models. All the stations were therefore examined and analysed with GIS and other datasets delivered by the province and municipalities (I_3). The Vlindermodel (see Figure 6.2) is based on a node- and place-index (‘knoop‘ versus ‘plaats’).

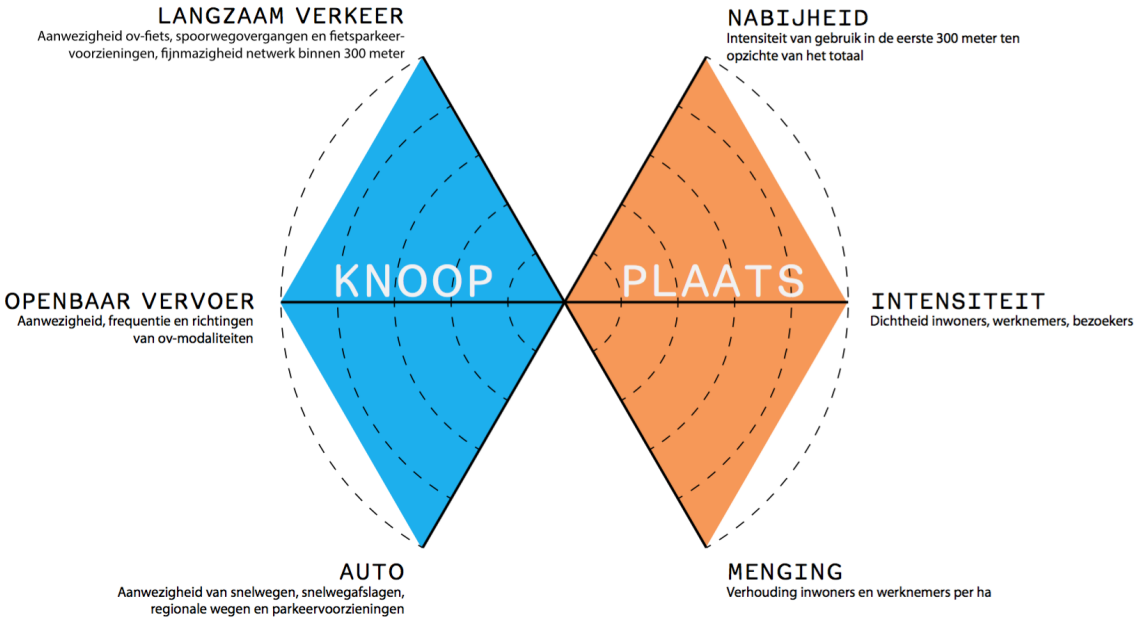


Figure 6.2. The Vlindermodel (Provincie Noord-Holland & Vereniging Deltametropool, 2013).

6.3.1 Vlindermodel (construct)

The Vlindermodel is divided in six indicators; how they are operationalised can be seen below in Appendix 6. We can identify a clear node and place distinction within the Vlinder-model. The node-index is subdivided into three indicators: the position in public transport network, the position in road network, and as an addition on the model by Atelier Zuidvleugel (2006), the position in slow traffic network. A formula is then build upon a set of measure-ments in which points can be earned.

The position in slow traffic network looks as following:

$$\text{Score (OVF + SO + (PF/IU)} \quad (2)$$
$$\text{x 100) + (Number of LW x 1.5)}$$

The measurements include:

- OVF = presence of OV-bicycle (score: 25)
- SO = presence railway crossing within 300-metre radius (score: 50)
- PF = number of bicycle storage racks
- IU = transit rider-ship in amounts
- PF/IU x 100 > 30 (score: 50)
- PF/IU x 100 > 15 (score: 25)
- LW= local roads within 300-metre radius

The indicators are mainly put in place to indicate how a station area is doing regarding bicycle accessibility. Regarding the node-place model, the accessibility by bicycle has changed, whereas the node-place model focused on the number of free-standing bicycle paths (within a 700-metre radius) and the parking capacity in absolute numbers. The Vlindermodel does not focus on free-standing bicycle paths in a 700-metre radius but on the number of local roads within a 300-metre radius and the ability to cross to the other side of the tracks within 300 metres of the station. Additionally, it does not only focus on the absolute number of bicycle storage racks but on the number of bicycle storage racks in reference to the amount of transit rider-ship in a station, the more bicycle racks per person in percentages (higher than 15% or 30%), the more points are earned. The OV-bicycle was not taken into account in the node-place model, as the OV-bicycle made their entry in 2003.The position in the public transport network includes eight measurements in the formula:

$$\text{Score (HSL + IC + SPR + MR + ST + TS)} \quad (3)$$
$$+ \Sigma(\text{F x R x 0,2 x Score})$$

The measurements include:

- HSL = presence high-speed rail (score: 125)
- IC = presence of intercity train (score: 100)

- SPR = presence of local train (score: 75)
- MR = presence of metro or R-net (score: 50)
- ST = presence of regional bus (score: 75)
- TS = presence of tram and/or city bus (score: 25)
- F = frequency per hour
- R = amount of directions served

Whereas the node-place model focused on the bus, tram, and underground, the Vlindermodel incorporates more modes and has a better-defined distinction between modes. There is a distinction between a regional bus, metro and tram. Also, a difference is to be found in high-speed rail, intercity trains and local trains. Per mode, the sum of frequency and a number of directions served are added to the score of the presence of a mode. The position in the road network is defined as following:

$$\text{Score } (SA + S + RW1 + RW2 + (PA/IU) \times 100) + \Sigma(R \times 0{,}5 \times \text{Score}) \quad (4)$$

The measurements include:

- SA = presence motorway exit in an 1200 metre radius (score: 75)
- S = presence motorway in an 3200 metre radius (score: 50)
- RW1 = presence regional highway in an 1200 metre radius (score: 25)
- RW2 = presence regional highway in an 3200 metre radius (score: 10)
- PA= amount of parking spaces
- IU = transit rider-ship in amounts
- R= amount of directions
- (PA/UI) x100 > 5%= score 50
- (PA/UI) x100 > 2.5%= score 25

The Vlindermodel combines roughly two things that are on the one hand the presence and amount of directions of motorways and regional ways within two radiuses (1200-metre and 3200-metre). The amount of parking spaces are divided by the number of transit rider-ship,

and for more parking spaces per passenger, more points can be earned. The place-index exists of the density of inhabitants, workers, and visitors, the ratio of inhabitants and workers per hectare, and the intensity of use in the first 300-metre radius compared to the 1200 metre radius. The intensity of the use in the first 300 metres is translated in the following formula and uses six measurements:

$$(((IW + WN + BZ)\ 300\ M) / ((IW + WN + BZ)\ 1200\ M)) \times 100 \quad (5)$$

- IW = inhabitants
- WN = workers
- BZ = visitors

The formula measures the amount of inhabitants combined with workers and visitors within the first 300-metre radius compared to the 1200-metre radius in a percentage. This shows how much the station area functions as a centre in the surroundings. A high score can be interpreted as most of the activities find its place nearby the station, while a low score shows that most of the activities are situated outside of the first 300 metres (Provincie Noord-Holland & Vereniging Deltametropool, 2013). The density of inhabitants, workers, and visitors is measured through the following formula:

$$(IW + WN + BZ) / IG \quad (6)$$

- IW = inhabitants
- WN = workers
- BZ = visitors
- IG = area of influence in hectares

The density is an absolute combination of the amount of the three categories of people divided by the area of influence. The higher the score, the higher the intensity of use, while a lower score implies low intensity of activities. The ratio of inhabitants and workers per hectare is translated in the following formula:

$$1/N \Sigma \text{ (Minimum (IW, WN) / Maximum (IW, WN)) x } 100 \quad (7)$$

- IW = inhabitants
- WN = workers
- N = amount of squares 100x100 metres

Through the formula, the ratio between inhabitants and workers around the station area is measured. A high ratio implies a high mix of inhabitants and workers, meaning that they are evenly distributed. However, to prevent that on one side of the tracks there is a 100% inhabitant distribution, while on the other side there is a 100% worker distribution, resulting in a high mix, the small 100x100 metre squares are used (Provincie Noord-Holland & Vereniging Deltametropool, 2013).

The indicators used in the Vlindermodel are all focussed on content, no process or impact indicators are involved. The indicators used in the Vlindermodel are however an improved representation of what a station area is compared to the node-place model. The accessibility of bicycles is represented in a better way, instead of only focussing on the number of free-standing bicycle paths within a 700-metre radius, the Vlindermodel focuses on all roads that are accessible for bicycles within a 300-metre radius, a more direct radius. Additionally, the parking capacity is not represented in absolute numbers but in relation to the amounts of transit rider-ship. The position in public transport network is represented through the distinction between different modes, instead of the distinction between train, bus, tram, and underground. The frequency of these transport modes is combined with the amount directions it serves. The accessibility by car is represented in the position in the road network. Within the formula two radiuses (1200-metre & 3200-metre) are involved, combined with both regional- and motorways. In the node-place model, this was focused merely on the distance from the closest motorway access. On the other hand, it is the number of parking spaces relative to the transit rider-ship. Compared to the node-place model it gives a better overview of how much parking spaces are needed. The place-index in the node-place model is focused on intensity and diversity in the area. The difference with the Vlindermodel, however, is that intensity in

the Vlindermodel is measured in the first 300-metre radius compared to the 1200 metre radius around that, and this gives an overview of how a station area functions as a centre compared to what happens around, which is of high importance (I_3, personal communication, May 30, 2017; I_4). The combination of inhabitants, workers, and visitors is used in the Vlindermodel to measure this. The intensity in the whole of the radius around the station is measured in the Vlindermodel through combining inhabitants, workers, and visitors, and dividing it trough the area of influence in hectares while the node-place model only focuses on absolute numbers in residency.

Another difference, however, is that in the node-place model a walk-able radius of 700 metres is mentioned, but within this 700 metres, barriers are taken into account, parts that cannot be reached within 700 metres from the station are not taken into account. Within the Vlindermodel analysis, however, it assumes that barriers are not taken into account, and a radius of 1200 metre is drawn around the station areas without noting references to walk-ability. Diversity within the node-place model is measured through a degree of functional mix, which sets of the amount of inhabitants to the amount of workers in the station area radius of 700 metres, while the Vlindermodel uses squares of 100x100 metres in order to give a good representation of the area. Both do not include visitors in their diversity indicator. The indicators imply that they are granted the same weights, meaning they are all assumed to be equal of importance in this research.

In the last step, the chances for the nodes were inventoried and coupled with one of the twelve characters that were developed by Vereniging Deltametropool (Provincie Noord-Holland & Vereniging Deltametropool, 2013).

Vlindermodel 2.0

NH and the Vereniging Deltametropool are also working on a further deepening on the Vlindermodel. It is also that NH wants to use and tweak the model further for their purposes.

"What we did was very complicated, excel with GIS-analysis, nobody could understand it. The province asked us if we could make this more simple, more accessible so that they could work with it as well, and develop it further" (I_3).

Because the Vlindermodel is very quantitative, there was also a need and a call for a more qualitative input; therefore some components were added (I_4). The area of influence that was first used in the Vlindermodel was 1200 metres. In addition, the Vlindermodel 2.0 uses a secondary area of influence with a radius equal to a 10-minute bike ride (about 3000-metres in an ideal situation), as about 40% of the people in the Netherlands use bicycles to travel to the station (I_3; I_4). Furthermore, instead of only mapping the amount of parking spaces and bicycle storage racks in reference to the transit rider-ship, the occupancy rates are used as it says more about how these things function (I_4). Additionally, the Vlindermodel 2.0 also maps quality and comfort in a more thorough way (I_4). However, besides the six existing indicators, no extra indicators are added, the six existing indicators are further deepened and expanded (I_3).*"The Vlindermodel is not going to change in shape, as it is also very recognisable, easy to visualise, it is an identity. Municipalities can identify with their model"* (I_3). In order to incorporate the comfort of the station into Vlindermodel 2.0 a research by Goudappel Coffeng was used: "For the comfort of the station we used a research by Goudappel Coffeng, which is about the services, is there a toilet, is there Wi-Fi, is it possible to wait sheltered, is there heating, that sort of things"(I_4). Additionally atmosphere, perception, attractiveness, and the quality of the routes are valued, but that is based on expert judgment done by the Vereniging Deltametropool: "At a couple of station areas we had a group-inspection, with a broad selection of people, and about twenty people, however still limited and debatable, but at least we have something"(I_4). And to make it less debatable, more data is needed, and mentioned is that data from the NS would be helpful as they have large sample groups to make things insightful. Concludingly, it remains very complex to capture everything that influences a station area in the Vlindermodel (I_4), and additionally, the more is captured in the model, the more complex it gets (I_3). The improvements that were made in the Vlindermodel 2.0 are shown below (Vereniging Deltametropool, n.d.-b):

The position in slow traffic network is set up as following:

$$\text{Score (OVF + SO + BGF) + } ((\text{Length of LW}/100) \times (\text{OFI}/2826)) \quad (8)$$

The measurements include:

- OVF = presence of OV-bicycle (score: 25)
- SO = presence railway crossing within 300-metre radius (score: 50)
- BGF = occupancy rate bicycle storage racks
- BGF < 50% (score: 50)
- BGF 50%-80% (score: 25)
- LW = local roads within 300-metre radius
- OFI = surface of bicycle isochronous

The position in public transport network is measured as following:

$$\text{Score (HSL + IC + SPR + MR + TS)} + \Sigma(F \times R \times 0{,}2 \times \text{Score}) \quad (9)$$

- HSL = presence high-speed rail (score: 125)
- IC = presence of intercity train or international bus (score: 100)
- SPR = presence of local train (score: 75)
- MR = presence of metro, R-net/light-rail/regional bus/HOV bus (score: 50)
- TS = presence of tram and/or city bus (score: 25)
- F = frequency per hour
- R = amount of directions served

The position in the road network is defined as following:

$$\text{Score (SA + S + RW1 + RW2 +BGA)} + \Sigma((R \times 0{,}5 \times \text{Score}) - (CF \times RC)) \quad (10)$$

- SA = presence motorway exit in an 1200 metre radius (score: 75)
- S = presence motorway in an 3200 metre radius (score: 50)
- RW1 = presence regional highway in an 1200 metre radius (score: 25)
- RW2 = presence regional highway in an 3200 metre radius (score: 10)
- BGA = occupancy rate parking spaces
- R = amount of directions
- CF = congestion factor (0,5)
- RC = direction of road with congestion (1 or 2)

- BGA <50% (score 50)
- BGA 50%-80% (score 25)

The place-index exists of the density of inhabitants, workers, and visitors, the ratio of inhabitants and workers and the percentage of types of services, and the intensity of use in the first 300-metre radius compared to the 1200-metre radius. (Proximity) The station area as a centre in its surroundings, comfort (based on Groenendijk, 2015) and quality is now split into two different measurements:

$$\text{Proximity} = (\text{Centre function of station area} + \text{Comfort of station area}) \times \text{Quality of station area} \quad (11)$$

$$\text{Centre function} = (((IW + WN + BZ)\ 300\ M) / ((IW + WN + BZ)\ 1200\ M)) \times 100 \quad (12)$$

- IW = inhabitants
- WN = workers
- BZ = visitors

$$\text{Comfort of station area} = (VW + BW + TV + GK + WF + SM + RE + TO) \times 0{,}25 \quad (13)$$

- VW = presence heated waiting (score 0,06)
- BW = presence sheltered waiting (score 0,06)
- TV = presence television screens (score 0,01)
- GK = presence free newspaper (score 0,01)
- WF = presence Wi-Fi (score 0,025)
- SM = presence supermarket (score 0,025)
- RE = presence restaurant (score 0,03)
- TO = presence toilets (score 0,03)

Quality of station area :

- 1 = very poor (score: -25%)
- 2 = poor (score: -12,5%)
- 3 = sufficient (score: 0)
- 4 = good (score: +12,5%)
- 5 = very good (score: +25%)

(Intensity) The density of inhabitants, workers, and visitors:

$$(IW + IWF + WN + BZ) / IG \quad (14)$$

- IW = inhabitants
- IWF = inhabitants within bicycle isochronous (3000 metres)
- WN = workers
- BZ = visitors
- IG = area of influence in hectares

(Mixture) The ratio of inhabitants and workers and the percentage of types of regional services:

$$(IW/WN)/2 + (VV/HV)/2 \quad (15)$$

- IW = inhabitants
- WN = workers
- BZ = visitors
- VV = different types of services
- HV = amount of services

In relation to the Vlindermodel 1.0 there are some notable changes we can identify: Within the node-index both the position in slow traffic network and the position in the road network

the parking facilities are expressed in occupancy rates. The position in road network also contains a congestion factor, which was not present in the first Vlindermodel. The proximity focuses on more than only the centre function, it also contains the comfort and quality of a station area. The intensity contains an extra dimension with regard inhabitants that live a bicycle distance from the station area. The mixture includes, in addition to the ratio of inhabitants and workers, a percentage of types of regional services. All the indicators and measurements included in the Vlindermodel 2.0 are focused on content. However, the soft 'experience' is better represented through the comfort of the station as well as the quality of the station area.

6.3.2 Vlindermodel (role)

While there was a lot going on with regard to Node-development, and while there was a lot of research passing by the province, not that much knowledge was at the province, therefore there was a need for coherent research (I_4). The Vlindermodel helped in observing how station areas are functioning in their current situation, and the goal, therefore, is to provide insights in the profile and qualities of a certain station area (I_3; I_4). However, the Vlindermodel is mostly a communication instrument towards municipalities; it is used to structure debate about how to develop a station area in an integrated way (I_4). Nonetheless, some also view it more as an analysis instrument, purely on content analysis, none of the process components are in the Vlindermodel (I_5).

> *"It works like a discussion tool, and it is not the truth. But it is a tool for debate towards the municipalities, do you recognise the challenges, and what do you have as ambitions?" (I_4).*

It is therefore not a normative blueprint and has more of an advising role in the process, whereas the province uses it to test certain things and to structure the debate (I_4). As spatial planning departments can be engaged in several things, the mobility department should also be integrated into that, in that sense you make sure things happen in the right way from both sides, to keep that balance right (I_4). Furthermore, it is not used as a hard monitoring instrument, but it is, however, possible to see if a municipality is working towards the right direction (I_4). "*If there is bicycle path added here, what happens to the station area, that is something that we would like to show"* (I_3).

6.4 Policy implementation phase

Within the policy implementation phase, evaluation takes places in the form of a monitor. The monitor is based on and linked to goal set in the policy formation phase. The monitor that is used in the NH is based on four strategic goals translated in four operational goals (Provincie Noord-Holland, 2016).

6.4.1 Monitor (construct)

In addition to what table 1 points out, the monitor mentions additional things they are planning to monitor in the future; these are however not taken into account in this research as they are not operationalised and fixed. In the monitor, goals are set at a programme level, and that is what is attempted to monitor. With NH they are still searching and researching on how to operationalise or counter certain things (I_4). Because the monitor is still incomplete, we can only partially analyse how it is done in comparison to the other cases.

> *"For some goals, we are still searching for a way to do it, but this is where we want to go, and these goals are connected to the principles in Maak Plaats! In that sense, the Vlindermodel is in it, indirectly"* (I_4).

The monitor identifies the first strategic goal as follows: The optimal usage and strengthening of intrinsic values of nodes, and increase the synergy between nodes on a corridor level, which is translated into making and executing agreements based on housing, business, leisure and services, while taking into account the identity profile. As if now the only thing that is monitored are the housing developments. The amount of housing developments within the area of influence of OVK compared to what is realised outside of those areas (Provincie Noord-Holland, 2016).The second strategic goal is identified as follows: Improving the station areas to comfortable areas and optimising the functioning link in door-to-door travelling. This is operationalised in three goals: Improving the first- and last mile: a quick and save route to and from the station. Improving the function of the station as a transfer-machine: a station area where different modes have a good connection, a logical organisation, and adaptation. And finally, improving the freedom of choice: the public transport as an equal alternative to the car. As mentioned before within NH there is still a search for how to monitor, and this is also mainly due to the lack of data (I_4). The data is often lacking, and it is complex to

get a hold of data, as it might be privacy sensitive or competitively sensitive from a market perspective (I_4). The province is for example not preoccupied with the search for a modal shift: *"We don't have that kind of models, we don't have that data, we would like to have better insights in that if we improve the bicycle network here, what influence does it have?"* (I_4).

6.4.2 Monitor (role)

Within the monitor, a positive aspect is that it, for example, includes percentages on the to develop amount of housing (I_4).

"Through that, you have something to fall back on. We monitor that on the provincial level, what has been built around those nodes? We can measure that in a concrete way" (I_4).

The goal with the monitor is to first make agreements, and the province is searching for how to do that, they are working on it (I_4). The idea is that the goals are operational on a programme-level, and therefore also measurable (I_4). The monitor, therefore, is meant to show progress in the goals: "If the provincial executive has to justify what we are doing here, we can show that we are doing this, and it contributes in this way, we can show something" (I_4). The steering power of the monitor is however limited, in the end, municipalities are responsible for what happens in their land-use development.

> *"We cannot force them, but we can do a little bit more than we used to, as the rules in the housing regulation now say that it must be in agreement with the provincial housing policy, and node-development is part of that"* (I_4).

In addition to the monitor, the Vlindermodel is still present.*"We can check if municipalities are working on the right things, so in that way, the Vlindermodel also has a role in the monitor"* (I_4). But the Vlindermodel is not strictly monitored on a day-to-day basis, that would be very complex and unnecessary as it would also not change that much (I_4). However, they do use it to see how the station areas evolve over a longer time. *"It would be better to observe these models over a longer period, for example, five years, in that way we can actually see changes"* (I_4).

6.5 Findings

Within the NH, the Vlindermodel is used to map station areas in the OVK network, this results that the station areas are being coupled with a certain character. The Vlindermodel offers insights in where potential for investment lies, however, based on specific research and facts. The Vlindermodel is not obligatory to follow, it merely gives municipalities advice on how to invest. It is therefore also not strictly monitored in the policy implementation phase, the goal is not to optimise the models, they are inherent to a larger policy goal, and this is monitored in the monitor. Moreover, the province does use the Vlindermodel in the policy implementation phase, this is done so they can see if municipalities are doing the right things according to the Vlindermodel, and this can be used in advising the municipalities.

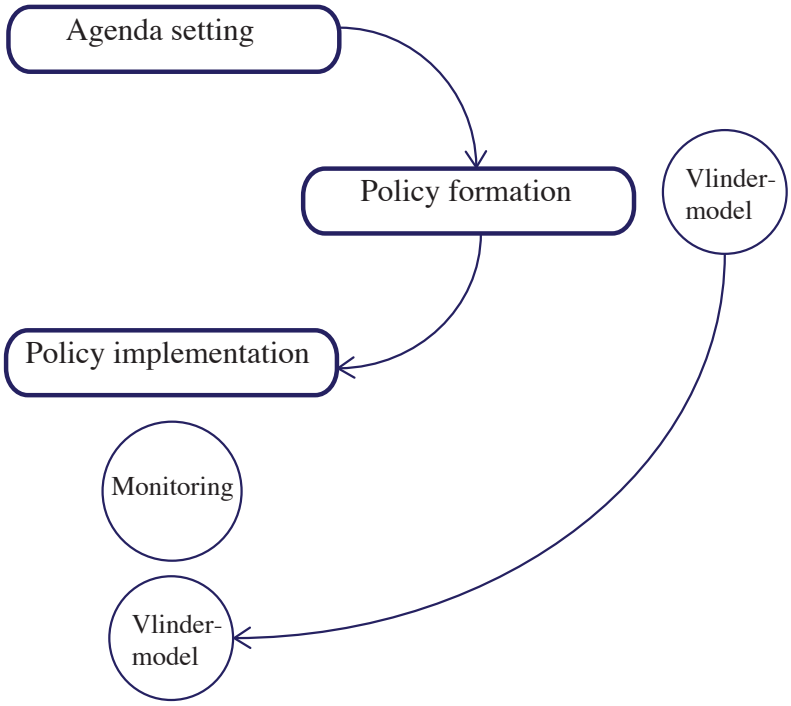


Figure 6.3. Use of the Vlindermodel in the OVK policy (Author, 2017)

7

7. Arnhem Nijmegen City Region

In this chapter, the collected data for the Arnhem Nijmegen City Region (AN) case is presented. The background will be given on AN and the OV/RO knooppunten programme that is executed in this region. Within this programme, principles of TOD are pursued, and with that programme, a station area evaluation model is used as part of policy evaluation. This evaluation tool is placed in the policy process along the policy cycle and analysed in how they are constructed and what their role is in the process.

7.1 Arnhem Nijmegen background

The Arnhem Nijmegen City Region is one of the highest urbanised areas in the Netherlands, outside of the Randstad (Mathijsse, 2013, in Tan et al., 2013). With the two big cities of Arnhem and Nijmegen being mutually dependent on each other, and many other municipalities being connected with each other and these cities, and about 750.000 inhabitants, a large polycentric network-city exists (Mathijsse, 2013, in Tan et al., 2013). The AN was a partnership between 20 municipalities, and since then regional plan 2005-2020 in 2006 node-development became more and more present (Mathijsse, 2013, in Tan et al., 2013). And for a long time, node-development has been high on the agenda of the within the Arnhem Nijmegen region (Stadsregio Arnhem Nijmegen, 2011). The role that the City Region had in this, involved in indicating places, chances, and the potency of places, while tempting municipalities and private parties to work together (Mathijsse, 2013, in Tan et al., 2013). The AN network can be seen below in figure 7.1 in which the S-axis functions as the backbone.

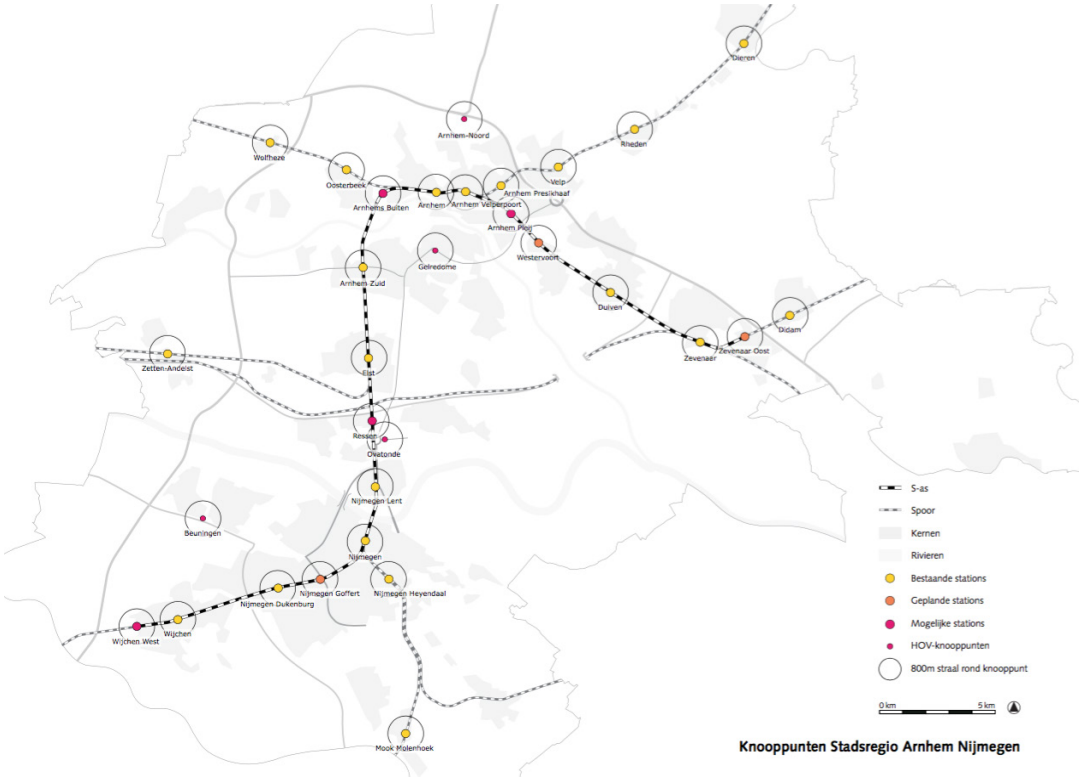


Figure 7.1. Arnhem Nijmegen City Region network (Stadsregio Arnhem Nijmegen, 2011)

7.2 Policy agenda phase

Within the agenda setting phase, we are identifying the problem definition or challenges that are the main motive behind the TOD or node-development policy that is being pursued in the OV/RO knooppunten programme. Mainly there are two issues mentioned that the City Region is dealing with, that is one the one hand the growing demand for mobility. “The demand for mobility, the accessibility of the region that is very important from an economic perspective” (I_6). On the other hand it is an urbanisation challenge, which played a big role in the City Region.

“And that urbanisation challenge, how are we going to shape that? Eventually the City Region decided that these spatial developments should be concentrated along this S-axis, so basically Wijchen, Nijmegen, Elst, Arnhem, Zevenaar, along these nodes. Dictated by the demand for mobility that was and in some cases still is there. If we look at the amount of congestion and the state of the train, they could really use an improvement back then” (I_6).

7.3 Policy formation phase

The demand for mobility or mobility challenge, following up on the agenda setting phase, was integrated with the spatial challenges for the coming years, The City Region linked those two. The thought behind that was that the moment the City Region has a good functioning transport network, they have a good answer to the accessibility challenge as a region (I_6).

> *"Through concentrating these developments around these station areas, there is the thought, logically, that public transport will become more attractive, and that it will bring other benefits to sustainability, environment and such"* (I_6).

It is however not believed that node-development by itself is going to solve congestion (I_6). It is more of accommodation for future growth, and it is important that the network will still be able to handle that (I_6). The main goals were aimed at spatial development around nodes, the intertwinement of public transport and car (multimodality), and a coherent and recognisable public transport (Stadsregio Arnhem Nijmegen, 2011). The idea lives that through bundling public transport and land-use development, congestion will however decrease, and it will improve the overall accessibility of the region (Stadsregio Arnhem Nijmegen, 2011).

7.3.1 Vliegermodel (construct)

To chart the station areas within the AN network and to determine the relationship between station areas, the Vliegermodel was used (Stadsregio Arnhem Nijmegen, 2011). The Vliegermodel is based on five themes that are presumed to be dominant in the development process of nodes (Stadsregio Arnhem Nijmegen, 2011). It was developed as a particularisation of the node-place model, and it was a particularising effort to compare station areas, in their current situation, and therefore showed were the municipalities could work on, according to the model (I_5). The Vliegermodel is build up out of five indicators and looks as following (Figure 7.2):

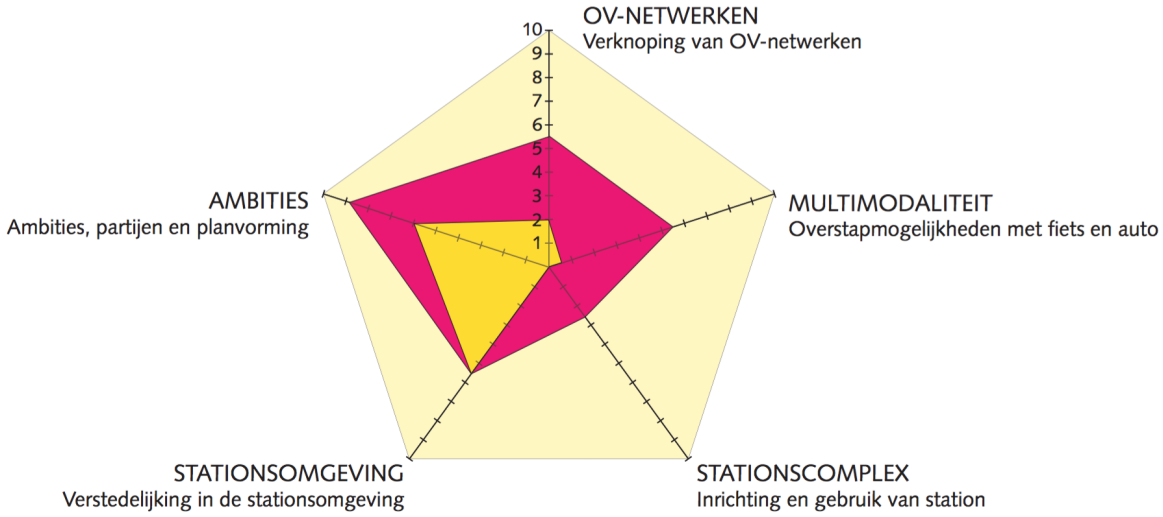


Figure 7.2. Operationalisation of the Vliegermodel (Stadsregio Arnhem Nijmegen, 2011)

The Vliegermodel is operationalised as is shown in Appendix 7. Within Appendix 7 five different indicators can be defined, within these five indicators, there is no clear distinction between the node and place value to be made. However, we can distinct five different indicators that are measured in their way.

The intertwinement of public transport networks is measured through the amount of trains that serve the station on an hour base; points can be earned through more connections per hour. However, no distinctions are made between different trains. Additionally, the amount of connection through quality public transport is measured (HOV), in Dutch 'Hoogwaardig Openbaar Vervoer' referring to forms of public transport that serve high demands (such as speed and comfort). Points in this measurement can be earned through the amount of connections it has, and more connections result in more points.

The multi-modal indicator, the ability of modal transfers is subdivided into the amount of parking spaces and the amount of bicycle racks a station area disposes of, the more spaces and racks in absolute numbers, the higher the points.

The station complex indicator is based on the measurement of transit rider-ship per day in

combination with the measurement of service level of the station complex. The measurement on transit rider-ship is measured through the amount of passengers that enter and exit the station per day; the more passengers enter and exit the station the more points are earned. In addition to the transit rider-ship, the service level of the station complex is measured. This is done through three levels of service on which stations can score points; the lowest level herein is the presence of a waiting room, as this is perceived as the least a station complex can have, after that comes the presence of a kiosk, and the top level is the presence of shops.

The urbanisation of the station area is subdivided into five measurements: the amount of houses in an 800-metre radius from the station, the amount of workers in an 800-metre radius from the station, the ratio of work space compared to housing, the density of housing per hectare, and the density of work spaces per hectare.

The more housing and work spaces, the more points are earned, however a balance between housing and work space is also valued, as the balance is between minus-one and one, meaning one or the other is not predominant, a point is earned, the points that are earned through housing and working spaces are subtracted (housing points minus workspace points). Additionally also the density of housing and workspaces per hectare are valued in points.

Lastly, the ambitions, parties, and plan making are valued. This is subdivided in the ambitions of the municipality, the complementarity of the land-use development plans, the land ownership, and financing. Ambitions of the municipality are expressed in a yes, a partially, or a no, each with corresponding points. The same goes for the other measurements as well, for the land-use development plan it is measured if the plans are corresponding with the developments that are strived for, land ownership is measured through the ownership of land by the municipality, and financing corresponds with the sufficiency of funds to (re)develop.

The Vliegermodel differs from the node-place model in the way that there is no clear distinction to be made between node and place indicators. Instead, five indicators are linked together which seem to be weighted equally and therefore the indicators imply that they are granted the same weights, meaning they are all assumed to be equal in importance in this research. The public transport network is based on the same indicator, while there is a distinction

between trains and other HOV-modes. Within the node-place model, the train accessibility indicator was subdivided in number of directions served, daily frequency, and the amount of stations within 45 minutes of travel. Within the Vliegermodel, however, the train indicator or intertwinement of networks is merely measured by the frequency of trains per hour. The accessibility by bus, tram, and underground as measured in the node-place model is translated into the amount of connections that HOV modes have, the frequency is therefore not taken into account. The car and bicycle are involved in the Vliegermodel only in the multi-modal chain, translated into absolute numbers on parking spaces and bicycle storage racks; nearby roads, motorway accesses or bicycle paths are not taken into account.

The station area facilities and usage is something that is new compared to the node-place model, in is based on the amount of services in the station and the numbers on transit rider-ship. The urbanisation in the station area indicator, however, seems comparable with what is measured in the place-index in the node-place model. While in the node-place model the absolute number of residents in the area, the number of workers per each of four economic clusters and the degree of functional mix are measured; the measurements in the Vliegermodel can also be subdivided in intensity and diversity measurements. Measurements are focused on the amount of houses and workspaces in an 800-metre radius, which is very alike with what happens in the intensity indicator in the node-place model, the difference is that the Vliegermodel measures both housing and workspaces, while the node-place model focuses on residents. Additionally the Vliegermodel also measures the amount of housing and workspaces per hectare. The diversity indicator in the node-place model is translated into the measurement on functional mix.

What also distinguishes the Vliegermodel from the node-place model is the ambitions indicator. Within the ambitions, parties, and plan making, the ambitions of the municipality are indicated and valued in points, the land-use development plan is valued in the way that it is in line with the future developments, land ownership in the way that the right parties are owning the land around station areas, and financing in the way that the funding is ready. These are all translated into points. All the measurements and indicators within the Vliegermodel besides the ambitions indicator are content indicators/measurements; the ambitions indicator can be seen more as a process indicator, as it says something rather about the process than the

content of the policy. The other measurements are all very quantitative of nature, while the ambitions indicator leaves more open to interpretation, as in the sense that ambition is partial, so while the other indicators/measurements are very quantitative/hard, these are more quantitative/soft of nature.

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7.3.2 Vliegermodel (role)

The Vliegermodel is a rough approximation that is claimed to be helpful to get an overview of the different nodes that the area possesses (I_6).

> *"I think that it is a rough approximation, which can be very helpful to get an overview, what are the nodes that we have in this area? And we can weigh these nodes against each other. Is it science? Probably not"* (I_6).

Through choosing five indicators, and involving a process indicator, and not making a clear distinction between node and place, the model aimed to move away from the node-place dichotomy (I_5). The five indicators are five different things (I_5).

> *"We tried to make clear that we are dealing with subjective evaluation; we have five different indicators in which we know they all play a part in node-development, but we do not know how they weigh up against each other. We added a process component as one of the indicators, and we did not use a quasi-form of science. We did not calculate this model, but instead, we filled it in with a group of people, together, so basically it is the best judgement of a group of people"* (I_5).

The Vliegermodel was then not pre-filled and based on hard data; instead, it was used in a session with a group of cooperating municipalities, and within that session, the Vliegermodel was filled in together for every station (I_5). Therefore it served mostly as a process instrument, a way of connecting municipalities. Within AN, the station area evaluation model did not work as a research instrument, but instead it is used as a communication instrument (I_5). The motivation for not using pre-filling the model and using hard data, is because it was not about the data, but more about the judgements of the people that are directly involved, aldermen can, for example, criticise a pre-filled model, they might not agree with the data, or how the data is translated into the model (I_5). Therefore it was used as a process instrument, to make municipalities work together, and realise one concept and interpretation of what we are doing.

"If the municipalities know where everyone is standing, and what the challenges are at which nodes, then we can agree on that. And that is a whole different goal, but that also has to do with my role as process manager to organise collaboration" (I_5).

The model therefore first worked as a tool for communicating, cooperating, but also to offer first insights (I_5; I_6). After that, the model was further used to set up context specific reports per station area (I_6). Within the policy implementation phase no clear monitor that was focused on purely the OV/RO knooppunten policy could be identified.

7.4 Findings

Within the AN, the Vliegermodel was used as a tool for making municipalities rethink their station areas, and viewing their station areas in relation to those of others. It was however not build on pre-filled hard data, but filled in together with the municipalities, and therefore it also served as a tool that made multiple municipalities work together. The model was not used in the implementation phase and was therefore also not monitored. And while no clear monitor could be distincted from the policy documents, it was mentioned in the interviews that several aspects were monitored.

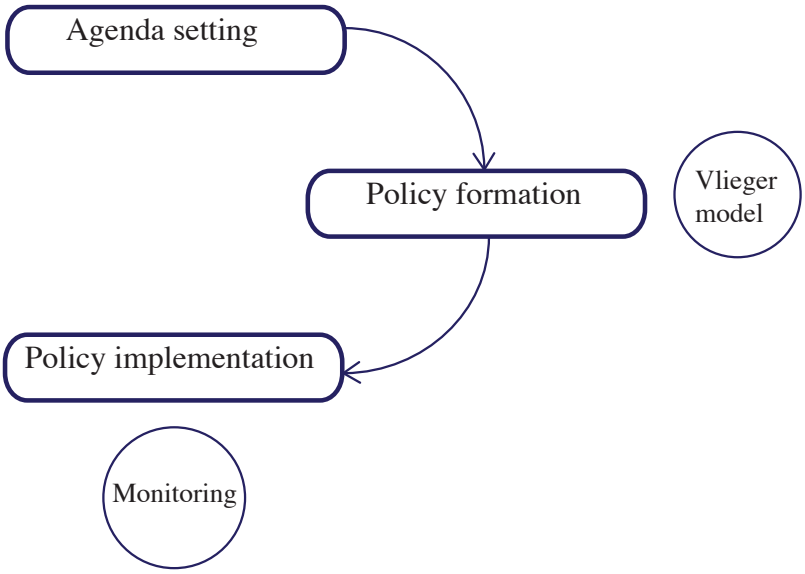

Figure 7.3. Use of the Vliegermodel in the OV/RO knooppunten policy (Author, 2017)

8

8. Comparing the cases

Placing the three examined Dutch cases next to each other after analysis provides some interesting insights. This chapter is set up following the layers mentioned in paragraph 3.5.3. The first layer exhibits the policy cycle analysis showing the challenges, goals, and used evaluation models in the different phases, and sets these out next to each other. The second layer exhibits the evaluation models and sets out their roles for comparison. The third layer analyses the evaluation models and compares their constructs.

Table 8.1. Comparison table layer 1

Case	RS	NH	AN
Policy cycle	- Agenda setting phase/ Policy formation phase/ Policy implementation phase	- Agenda setting phase/ Policy formation phase/ Policy implementation phase	- Agenda setting phase/Policy formation phase/ Policy implementation phase
Challenge/problem definition	- Necessity of an accessible region is fundamental to keep economic development going - High urbanisation challenge	- Sustainable land-use - High urbanisation challenge	- Accessibility of the region is of high importance in economic motive - High urbanisation challenge
Policy goals	- Improving the accessibility in the region	- Short travel times, nearby green areas and services, quick routes to stations, less emissions, and preservation of cultural landscapes	- Improving the accessibility in the region
Station area evaluation model	- Node-place diagram (policy formation phase)/ Vlindermodel (policy implementation phase)	- Vlindermodel (policy formation phase/policy implementation phase)	- Vliegermodel (policy formation phase)

Evaluation in the form of monitoring	Yes	Yes	Unknown (no distinct monitor found)

The first layer shows differences and similarities between the three cases and the accompanying policy processes. The first thing we can distinguish is that the three cases are all involved in the agenda setting phase, the policy formation phase and the implementation phase. None of the cases is involved in the policy review phase at the time of the research. The challenges or problem definitions that are given in RS and AN seem to be the accessibility of the region with an economic motive. Within NH the idea of using space and infrastructure more efficiently plays a bigger role. Within all the three cases a high urbanisation challenge seems to take place.

The policy goals aimed to reach all have to do with improving the public transport network in some way. The goals mentioned in NH, however, are goals that also have to with subjects outside of the transport network, in the form of preserving landscapes and green areas through concentrating developments around public transportation nodes.

The station area evaluation models in all the cases are first used within the policy formation phase. Within the NH case, the Vlindermodel is also used during the implementation phase to monitor changes in the station areas. In the RS case the Node-place diagram is not used after the policy formation phase, the Vlindermodel however, is used again to evaluate the station areas. In the AN case, the vliegermodel only had its place in the policy formation phase.

Within the policy implementation phase, monitoring takes places in all three cases. However, in the RS there is an specific form of monitoring that takes place every year, and within the NH this is also the idea. For the AN case no concrete or distinct evaluation in the form of a monitoring document could be found, nonetheless some things are being monitored, but it is not specifically mentioned in the policy documents.

Within the second layer we are focusing on the role of the evaluation models in the policy process. What is striking is while all three models are used as communication instruments towards municipalities in the region, while there are some big differences between them. The

Vlindermodel seems to be capturing the most data and strives to be exact. The Vlindermodel is built upon the Node-place diagram and is a deepened and improved version of the Node-place diagram. The Vliegermodel, however, is not a pre-filled based-on-hard-data model and is referred to as a rough approximation to get an overview of the station areas in the region. While the Node-place diagram and the Vlindermodel are filled in with exact GIS-data, the Vliegermodel is merely used as a way of structuring debate and making municipalities work together without the hard data. An important difference between the Node-place diagram and the Vlindermodel, and the Vliegermodel on the other hand, is the input of data.

Additionally, a noticeable difference is that the Vlindermodel in NH is used as an analysis model of the progress that station areas make through time, while not being a leading or obligatory instrument in the process. While in the case of RS the Node-place diagram is not used after the policy formation phase, and the Vlindermodel is only used to re-evaluate the stations once again. In AN the Vliegermodel was not used anymore after the policy formation phase.

Table 8.2. Comparison table layer 2

Case	**RS**	**NH**	**AN**
Station area evaluation model	Node-place diagram/ Vlindermodel	Vlindermodel/ Vlindermodel 2.0	Vliegermodel
Based on pre-filled hard data	Yes	Yes	No
Inspiration instrument	Yes	Unknown	Unknown
Communication instrument	Yes	Yes	Yes
Analysis instrument	No	Yes	No
Type	Ex-ante	Ex-ante/Ex-durante	Ex-ante

The third layer within this research focusses on the constructs of evaluation models. The three station area evaluation models used in the three cases are shown in Appendix 6. The measurements in the three models are translated to equations, if needed. This is done because it makes for a better overview and helps in making a comparison between elements that are not the same entity. Within in the comparison the most recent version of the vlindermodel is used.

A first distinction that we can make, is that a clear division between node and place is made within the Node-place diagram and the Vlindermodel, while the Vliegermodel is said to move away from the node-place dichotomy.

Based on the indicators that we have defined in the three models we can already point out differences and similarities within the models. The Node-place diagram consists of a public transportation indicator and a position in the road network indicator on the node side. The Vlindermodel uses the position in public transportation network, the position in road network, but adds the position in slow traffic network, which is focused on bicycles. The Vliegermodel has one indicator focused on public transportation, and none specifically on the road network or bicycle network. The Node-place diagram focusses on the place-index on population and worker density, and the degree of mix between them. The Vlindermodel adds the proximity indicator to that, which combines the stations function as a centre, the comfort of a station, and the quality of a station area. Considering the place-index in the Node-place diagram and the Vlindermodel, the station facilities and usage, and the urbanisation of the station area indicators in the Vliegermodel are very much corresponding with each other.

The Vliegermodel combines elements of the position in public transport network and road network in the ability of modal transfers indicator, as in the Vlindermodel 1.0, in the form of bicycle storing and car parking facilities. The Vlindermodel 2.0, splits bicycle storing and car parking facilities into the position in slow traffic network and the position in road network indicators, in the form of occupancy rates. Within the Node-place diagram the presence of different public transportation modes in the station areas is valued, this is combined with the amount of directions the modes serves. The position in the public transport network in the Vlindermodel builds upon this, but adds modes (local train, metro, regional bus, HOV-bus), the hourly frequency of modes, and lowers the value of high speed rail (from 200 to 125

compared to the Node-place diagram). The Vliegermodel distincts two modes in the intertwinement of public transportation network indicator; one the one hand the amount of trains hourly is measured, combined with the amount of HOV-connections the station has. There is no distinction made between different forms of trains, high-speed, intercity, local.

The position that a station area has in the road network is defined in the Node-place diagram by the presence of regional roads and motorways within the radius of 1200-metre and 3200-metre, combined with the amount of directions it serves. The Vlindermodel lowered the value of the presence of these roads, but added the occupancy rate of parking spaces into the equation, and additionally the idea of an congestion factor, which has a negative effect on the position in road network. Besides the measurement of parking spaces in the Vliegermodel, the position in the road network is not taken into account.

The Vlindermodel uses an indicator on the proximity of a station area. This is translated in measuring what is happening around the direct 300-metre radius around a station in relation to the 1200-metre radius around the station, measuring if the station works as a centre. Combined with the centre-function, the vlindermodel also measures the comfort of a station area and the quality of a station area. The comfort of the station area combines the points earned by the presence of services, each service adds points in that sense, and some are perceived to be more important than others. The Node-place diagram does not involve a proximity factor, and neither does the Vliegermodel. However, a certain service-level is measured in the Vliegermodel's station facilities and usage indicator, which makes only a distinction between three levels of service (waiting room=0, kiosk=0,5, and shops=1). Compared to the Vlindermodel, the facilities are not an addition to each other. The quality of the station area, which is not incorporated in the Node-place diagram and the Vliegermodel, is measured through expert judgement due to lack of data on the matter, but because it is perceived as an important aspect of station areas it was involved in the model.

The intensity of station areas is measured in all three evaluation models. Within the Node-place diagram a radius of 1200-metres is used, and the intensity of inhabitants and workers is measured. Within the Vlindermodel the same 1200-metre radius is used, and visitors are added to the equation. Additionally the Vlindermodel also incorporates a bicycle radius, or

the bicycle isochronous, meaning that in terms of bicycle distances, a station area has a larger area of influence. Inhabitants in that bicycle isochronous are also taken into the equation. The Vliegermodel on the other hand uses an area of influence of 800-metres in measuring the intensity of the station area, or urbanisation of the station area. Within the urbanisation of the station area indicator the Vliegermodel measures the absolute numbers of housing and workspaces, but also values the housing and workspaces per hectare in the radius of 800-metres. Additionally within the same indicator also a measurement for the mix between housing and workspaces is set. This is done by subtracting the points earned for the amount of workspaces per hectare in the 800-metre radius from the amount of housing per hectare within the 800-metre radius, the points left, make up for the mix of the area, and are valued with points. The mix of functions in the Node-place diagram is not based on housing an workspaces, but on inhabitants and workers. The formula calculates the ratio between inhabitants and workers per hectare in the 1200-metre radius. The Vlindermodel, however, uses the mix of functions formula as in the Node-place diagram, but adds the diversity in services, as representing the visitors, these are both valued equally.

What separates the Vliegermodel from the other two models, is that the Vliegermodel contains a process indicator, this process indicator incorporates four parts of the station area (re) development process, and puts them together. These involve the ambitions of a municipality, if the land-use development plan is in order, if the land ownership is in line with future developments, and the financing to realise future developments.

9

9. Conclusion

Within this research the aim is was to find how indicators and evaluation models of Transit-Oriented Development play a role in coordinating land-use transport integration within the context of the Netherlands. Within paragraph 9.1 the findings are presented. Paragraph 9.2 provides a discussion on the findings. Paragraph 9.3 reflects on the research and paragraph 9.4 gives an overview of the strengths and limitations of the done research.

9.1 Findings

Within the theoretical framework, a set of distinctions were made, such as the time-scale of an evaluation ex-ante/ex-durante/ex-post. The differences between content, process and effect in evaluations are set out. Variation in evaluation in the form of summative and formative was not possible to set out, as none of the processes reached the policy review phase yet.
The differences between qualitative/quantitative and soft/hard indicators and measurements are set out. To make a comparison possible between the three different cases a layered approach was used.

All three cases made use of a station area evaluation model in the process, and all were first used in the policy formation phase. The Vlindermodel was also used in the policy implementation phase in the NH case as an aspect of monitoring. All three models were, however, never leading or an obligatory tool that is necessary to follow. This also has to do with the governmental bodies that were studied in the research not being directive or more powerful over the municipalities. In the end, the municipalities themselves are responsible for what happens in their station areas. The role of these station area development tools, therefore, differed between the cases, but also in the time spirit of use. Within RS the Node-place diagram was there for inspiring municipalities to work on their station areas in an integrated way, and not seeing a station area purely as a functional station, but also inspiring to work together as municipalities in the same corridor. Within the NH case, the most expanded model was used, and it therefore also works as an analysis model, analysing every station area more thoroughly and exact than is done in the Node-place diagram and the Vliegermodel. It is used to show municipalities where they can work on their nodes, making the areas more in balance in their node and place function. However, as said before, never obligatory, but more as a communication tool, to show municipalities what they can do to improve their station areas and how

they can do it. Strikingly, the Vliegermodel, as used in AN, also serves the same purpose as a communication instrument, but is not a pre-filled based on hard data model. The Vliegermodel, however, does not serve an analysis purpose but is used to structure debate in sessions with the involved municipalities and make the municipalities work together. The idea there is also that it is more the municipalities responsibility to gather data on their station areas. The Vliegermodel and the Node-place diagram are therefore only used as ex-ante evaluations in the station area. The Vlindermodel is used as both an ex-ante evaluation instrument as a monitoring instrument.

The station area evaluation models analysed in this research are not leading in the process, nor are they directly linked to the goals that are set by the coordinating governmental bodies. This is not their purpose in the process, and they are not used to evaluate the whole policy process. The goals stated by the coordinating bodies are accompanied with a monitor, monitoring the process on the scale of the corridor. Therefore the station area evaluation models are used on a different scale in the process, and they are indirectly linked to the goals.

Besides the role that the station area evaluation models play in the process, there are also notable differences in the way that they are constructed. While three models are retrieved or based on the Node-place model, they differ in the way that they are set up and operationalised. While the first operationalisation of the Node-place model included the accessibility by bicycles, and even the walk-ability within the radius, the accessibility by bicycle was not to be found in the Node-place diagram and only partially in the Vliegermodel, in terms of storage racks. Walk-ability, however, is not to be found in any of the used models.

The mapping of public transportation is further deepened since the first operationalisation of the Node-place model. The Node-place diagram makes a distinction between different modes of public transportation, and the Vlindermodel makes an even more thorough distinction based on that. The Vliegermodel, however, makes no distinction in the presence of trains, and while it would be logical to assume the amount of directions a train serves says something about the quality and importance of a station, the Vliegermodel only focusses on the frequency per hour.

The position in the road network is involved in the Node-place diagram and the Vlindermodel, the Vliegermodel, however, does not involve the car, besides incorporating the amount of parking spaces.

The Vlindermodel and Node-place diagram are both purely content evaluation instruments, as they are both only involved with indicating and measuring the qualities of a station area. The Vliegermodel involves a process indicator in the form of ambitions, parties, and plan-making.

The measurements and indicators in all three models are however very quantitative and hard of nature. While it is said that a combination of research methods on a specific case usually gives the best results, all three station evaluation models are very quantitative of nature on paper. The Vlindermodel incorporates the idea of comfort which in first seems to be somewhat softer and qualitative aspect of a station area. Nonetheless, it is translated a quantitative formula that adds up different aspects of comfort in an equation. The quality of the station area, however, is incorporated in the Vlindermodel as an expert judgement, because no other data was available for analysis.

9.2 Discussion

Three levels can be distinguished on which we can say something about the evaluation models. We can criticise the station area evaluation models isolated from the process, in the sense of how they are built. On the other hand, we can say something about the station area evaluation models in the policy process, how does it relate to the problem definition and the goal aimed to reach.

A set of striking aspects of the way that station area evaluation models are operationalised and developed from the Node-place model are identified in this research. While Bertolini in his 1999 article already had a very refined operationalisation of his model as a station area evaluation tool, important aspects for evaluating station areas seem to be overlooked or left out in the more modern models. While we could argue that the accessibility or node-function of a station area is very much dependent on how accessible it is by both bicycle and in terms of walk-ability, which were both incorporated in the Node-place model, the Node-place diagram in 2006 left both of those out. The Vlindermodel, which was based later in 2013 on the Node-place model, re-added the bicycle aspect, translated in the position in the slow traffic

network. However, walk-ability as an accessibility indicator was not incorporated in any of the three station area evaluation models. Nonetheless, walk-ability can be perceived as an important aspect of the accessibility of station areas, and in some cases might even be the biggest or second-biggest mode of getting to and from station areas. It can, therefore, be argued that not incorporating the walk-ability aspect into a station area evaluation model results in a distorted reproduction of reality. The Vliegermodel does not incorporate walking, cycling, and car accessibility specifically, it merely includes the amount of storage racks and parking spaces, and therefore these modes are undervalued in the model.

Another issue that Bertolini raised in his 1999 article is that his then proposed model required further refinement in the form of the more qualitative aspects of the station area (re)development. As is observed in both the operationalisation of the Node-place model, but also in the more modern models, is that operationalisation of indicators in almost every aspect of the models are translated in a quantitative, hard measurement. While the Vlindermodel incorporated comfort in the place-index, the accessibility of a station area by public transportation, car, bicycle, and walking in reality also has a more qualitative soft aspect that can be included in the model. It could be argued that travellers not only value or perceive being in the station itself, they also value the trip from and towards the station, which might even be of more importance in their choice of using the train over the car in the first place.

As is often mentioned, a combination of research strategies, both quantitative and qualitative can give a better representation of reality than either one of them isolated. The comfort of the station area, therefore, could be strengthened through qualitative research, focus groups, interviews and expert judgements. This, however, also regards the other indicators in all three models.
We can also question whether how dynamic these models are, in the quickly changing and dynamic society, are these models able to keep up? To illustrate this further, we look into the construction of the comfort indicator of the most recent Vlindermodel; this is measured by adding up several aspects of the station area, invented in 2015, translated into the Vlindermodel in 2017. Amongst the measurement are aspects as Wi-Fi and free newspapers that can help earn points, however, we can question the relevance of these aspects in the quickly changing and digitalising society.

Another aspect that Bertolini mentioned in his 1999 article was that a thorough consideration of station area (re)development takes into account in-depth analysis of each specific situation, including process and context factors. Both the Node-place diagram and the Vlindermodel do not posses process indicators, while the Vliegermodel incorporates a process indicator in the form of ambitions, parties, and plan-making, which seems of importance in comparing station areas and the willingness of municipalities to cooperate and work on node-development.

However, we have to keep in mind that one station area evaluation model does not necessarily have the same function as the other one, how a station area evaluation model is constructed should be highly dependent on what one uses a station area evaluation model for, and not the other way around. There seems to be a fragmentation between what is proposed to do with station area evaluation models, as an analysis instrument may not always serve as well as a communication instrument. While the strength of the Vlindermodel is that it works well as an analysis instrument and is the furthest refined model out there, and still being further deepened and refined, it is also getting more and more complex, thus making it harder to understand what the model does for outsiders. Which brings is us to the question, does a station area evaluation model that serves as a communication tool need to be reinforced by hard data or is it a waste of resources and time?

9.3 Reflection

Within this study, certain strengths can be identified. The strength in this research mainly resides in the fact that station area evaluation models have not been analysed as thoroughly in an academic paper before. The research combined data on multiple cases and bundled it into one analysis, making it possible for outsiders to obtain insights in station area evaluation models in the Dutch context. It can, therefore, further debates on the nature of station area evaluation tools and how they are used, and should be used in practice. The research is in that sense relevant and timely, as node-development, TOD, or just station area (re)development are high on the agenda of many governmental bodies, and not just within the Netherlands. However, what is notable in the Dutch context of station area evaluation models, does not necessarily happen elsewhere, or is relevant elsewhere. Additionally, results in this study are not directly generalisable. Nevertheless, the methods used in this study are likely to be generalisable in the case of analysing station area evaluation models elsewhere. The study combines theory on policy analysis and links it to evaluation theory, to construct a framework that helps in analysing station area evaluation models and TOD policy processes. Another strength of this study is that it combines a policy document analysis mainly aimed at the constructs of the station area evaluation models with interviews to stand in for the role of the models and the context of the process in which the models find its place.

Within this research, however, the three most prominent cases are used to stand in for the Dutch context. Due to time-constraints, it was not possible to incorporate every single case of TOD, node-development or station area (re)development in the Netherlands. The results of the research are therefore only partially generalisable for the Dutch context, and no conclusions can be drawn from these results in the sense that it represents every case of TOD, node-development or station area (re)development in the Netherlands. Additionally, the analysis of the station area evaluation models is only viewed from a coordinating perspective, and no practical experts were interviewed from the municipal level of government, therefore the research scope is only showing the use of station area evaluation models from the coordinating governmental point of view. Also, private parties, transit agencies, project developers were not involved in the research, while their viewpoint on the role of the models could serve for a more thorough result.

The three cases and their policy processes that were analysed in this research were very divergent regarding progress. While the RS case is already far in their implementation phase, coming close to the 2020 goal they have set, the NH case is still working on structuring operational goals, and how to make them measurable. While within the AN case the coordinating governmental body was disembodied in 2015, and the coordinating of transport and infrastructure tasks in the region were transferred to the Province of Gelderland. And while certain station developments continue, the policy and use of the station area evaluation tool were not transferred to the Province of Gelderland. Having three cases in different phases, in which one is disembodied along the way made for a complex comparison.

The idea for the original study was to do a comparative research about the way station area evaluation is done within the Netherlands and a case in a different context. However, along with the research, it became clear that it would be illogical to analyse these models isolated from their policy processes. Analysing and comparing the station area evaluation models while not understanding their role and place in the process would grant incomplete and reasonless results. Nevertheless, comparing the Netherlands with another context connect to their role and process would be compromised by time constraints.

One of the limitations of this research is in the form of a language barrier. When elaborating the station area evaluation models, the research comes down to comparing indicators and measurements. However, it is also an interplay between different definitions and slight alterations in word choices, while translating these definitions it can be a challenge to find words that capture the same values.

9.4 Future research

Future research opportunities could focus on a set of different aspect that was touched upon this research. On the level of the station area evaluation models research could focus on how to incorporate the more qualitative aspects of indicators into the models, making the models like the Vlindermodel a better representation of what station areas are in empirical reality. In that sense, more focus could also be how to make station area evaluation models more dynamic and future resistant. On a different level, it would be interesting if future research focused on the differences between models serving as an inspiration, communication or an analysis instrument, in other words, the difference in the use of hard data in the Vlindermodel and the Vliegermodel, while both serving as a communication tool, offers the question, is that hard data really necessary to make up for a communication tool that helps municipalities work together and come to one definition about TOD.

Another interesting aspect that future research could look into is the differences between the models used in the Dutch context, and different models used in other context pursuing TOD. Which in term could lead to interesting insights on how to further develop station area evaluation models. Additionally, there are also other cases abroad that made use of the node-place model, and the operationalisation of this model is also done in different ways. Adding these cases to the already gathered information in this research will lead to a more thorough view on how the node-place model has evolved.

References

Abowitz, D. A., & Toole, T. M. (2009). Mixed method research: Fundamental issues of design, validity, and reliability in construction research. *Journal of Construction Engineering and Management,* 136(1), 108-116.

Atelier Zuidvleugel (2006). Ruimte en Lijn, *Ruimtelijke Verkenning Stedenbaan 2010-2020, Zuidvleugel van de Randstad*.

Austin, M., Belzer, D., Benedict, A., Esling, P., Haas, P., Miknaitis, G., Wampler, E., Wood, J., Young, L., & Zimbabwe, S. (2010). *Performance-Based Transit-Oriented Development Typology Guidebook*.

Belzer, D., & Autler, G. (2002a). Countering sprawl with transit-oriented development. I*ssues in Science and Technology*, 19(1), 51-58.

Belzer, D., & Autler, G. (2002b). Transit oriented development: Moving from rhetoric to reality. Washington, DC: Brookings Institution Center on Urban and Metropolitan Policy.

Bertolini, L. (1996). Nodes and places: complexities of railway station redevelopment. *European Planning Studies*, 4(3), 331-345.

Bertolini, L. (1999). Spatial development patterns and public transport: the application of an analytical model in the Netherlands. *Planning Practice and Research*, 14(2), 199-210.

Bertolini, L., & Spit, T. (1998). *Cities on rails: The redevelopment of railway stations and their surroundings*. Routledge.

Bertolini, L., Curtis, C., & Renne, J. (2012). Station area projects in Europe and beyond: Towards transit oriented development?. *Built Environment*, 38(1), 31-50.

Bertolini, L. (2013). Legitimatie en realisatie van het TOD-concept. *Stedenbouw en Ruimtelijke Ordening* , 3, 22-27.

Booth, P. (2011). Culture, Planning and Path dependence: some reflections on the problem of comparison. *Town Planning Review* , 82 (1), 13-28.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative research journal*, 9(2), 27-40.

Bressers, J.T.A. (1993). Beleidsevaluatie en beleidseffecten. *A. Hoogerwerf (Ed.), Overheidsbeleid*. Samsom H.D. Tjeenk Willink, Alphen aan den Rijn, 161-179.

Brons, M., & Rietveld, P. (2009). Improving the Quality of the Door-to-Door Rail Journey: A Customer-Oriented Approach. *Built Environment* , 35 (1), 122-135.

Bryman A. (2012). *Social research methods*. 4th edition. Oxford University Press: Oxford

Buitelaar, E., Sorel, N., & Opdam, S. (2009). *Ex-durante evaluatie Wro: evaluatieontwerp en nulmeting*. Planbureau voor de Leefomgeving.

Cameron, R. (2011). An analysis of quality criteria for qualitative research. Paper presented at 25th Annual Australian & New Zealand Academy of Management Conference (ANZAM 2011), Wellington, New Zealand.

Campbell, H. (2002). 'Evidence-Based Policy': The Continuing Search for Effective Policy Processes. *Planning Theory & Practice*, 3(1), 89-90.

Kagie-Schreuder, M. (2006). Bestuurlijke samenwerking groeit in 2004. Centraal Bureau voor de statistiek

Carlton, I. (2009). Histories of Transit-Oriented Development: Perspectives on the Development of the TOD concept. *Real Estate and Transit, Urban and Social Movements*, *Concept Protagonist*.

Cervero, R., & Kockelman, K. (1997). Travel demand and the 3Ds: Density, diversity, and design . *Transportation Research Part D: Transport and Environment* , 2 (3), 199-219.

Cervero, R. (1998). *The Transit Metropolis: A Global Inquiry*. Island Press.

Cervero, R. (2002). Built environments and mode choice: toward a normative framework. *Transportation Research Part D: Transport and Environment*, 7(4), 265-284.

Cervero, R., Arrington, G., Dunphy, R., & Smith-Heimer, J. (2004). Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects: Transit Cooperative Research Program, FTA

Chatman, D. G. (2013). Does TOD Need the T? *Journal of the American Planning Association* , 79 (1), 17-31.

Curtis, C., Renne, J. L., & Bertolini, L. (Eds.). (2009). *Transit oriented development: making it happen*. Ashgate Publishing, Ltd.

Curtis, C. (2012). Delivering the 'D' in transit-oriented development: Examining the town planning challenge. *The Journal of Transport and Land Use*, 5 (3), 83-99.

Ecoinformatics (n.d.). EcoInformatics. Retrieved June 28, 2017, from http://www.geostrategis.com/p_policy.htm

European Commission (2001): Ex ante evaluation. A practical guide for preparing proposals for expenditure programmes.

Faludi, A., & Waterhout, B. (2006). Introducing Evidence-Based Planning . disP - *The Planning Review* , 42, 4-11.

Geurs, K., & Klinkenberg, J. (2014). Ruimte, mobiliteit en bereikbaarheid succesvol combineren. *Rooilijn,* 47(3), 202-207.

Groenendijk, L. (2015). Incorporating the traveller's experience value in assessing the quality of transit nodes: A Rotterdam case study. Master thesis, Technische Universiteit Delft.

Handy, S., Cao, X., & Mokhtarian, P. (2005). Correlation or causality between the built environment and travel behavior? Evidence from Northern California. *Transportation Research Part D: Transport and Environment,* 10(6), 427-444.

Head, B. W. (2008). Three lenses of Evidence-Based policy. *Australian Journal of Public Administration*, 67(1), 1-11.

Howard, C. (2005). The policy cycle: a model of post-Machiavellian policy making?. *Australian Journal of Public Administration*, 64(3), 3-13.

Howlett, M., & Giest, S. (2012). The policy-making process. *International Encyclopedia of the Social & Behavioral Sciences*, 6, 288-292.

Janin Rivolin, U. (2012). Planning systems as institutional technologies: a proposed conceptualization and the implications for comparison. *Planning Practice and Research*, 27(1), 63-85.

Janssen-Jansen, L., & Smit, N. (2014). Beleidsgestuurd bewijs leidt tot TOD-tunnelvisie. *In Metropool Forum 2014*: Pakhuis De Zwijger Amsterdam: maandag 30 juni 2014. 16-17. Rotterdam: Vereniging Deltametropool.

Kamruzzaman, M., Wood, L., Hine, J., Currie, G., Giles-Corti, B., & Turrell, G. (2014). Patterns of social capital associated with transit oriented development. *Journal of Transport Geography,* 35, 144-155.

Kawabata, M., & Shen, Q. (2006). Job accessibility as an indicator of auto-oriented urban structure: a comparison of Boston and Los Angeles with Tokyo. *Environment and Planning B: Planning and Design*, 33(1), 115-130.

Kuiken, A. (2016, December 28). Verkeer in steden dreigt vast te lopen. *Trouw*. Retrieved January 02, 2017, from http://www.trouw.nl/tr/nl/39683/nbsp/article/detail/4440486/2016/12/28/Verkeer-in-steden-dreigt-vast-te-lopen.dhtml

Lijphart, A. (1975). The comparable-cases strategy in comparative research. *Comparative political studies*, 8(2), 158.

McLafferty, S. L. (2003). Conducting questionnaire surveys. *Key methods in geography*, 87-100.

Ministerie van Binnenlandse Zaken en Koninkrijksrelaties. (2013). Kabinet heft plusregio's op. Retrieved March 22, 2017, from https://www.rijksoverheid.nl/actueel/nieuws/2013/06/17/kabinet-heft-plusregio-s-op

Minto, R., & Mergaert, L. (2015). Ex Ante and Ex Post evaluations: two sides of the same coin?. *European Journal of Risk Regulation,* 2015(1), 47-56.

Mortelmans, D. (2001). Atlas-ti, een inleiding. Faculteit PSW: Universiteit Antwerpen.

Msila, V., & Setlhako, A. (2013). Evaluation of Programs: Reading Carol H. Weiss. *Universal Journal of Educational Research*, 1(4), 323-327.

Netwerk Zuidelijke Randstad. (2013). Monitor StedenbaanPlus 2013. Retrieved February 01, 2017, from https://www.ovpro.nl/wp-content/uploads/2013/10/monitor_stedenbaanplus_2013_web_0.pdf

Netwerk Zuidelijke Randstad. (2014). Monitor Stedenbaan 2014. Retrieved February 01, 2017, from http://www.zuidelijkerandstad.nl/sites/www.zuidvleugel.nl/files/documenten/monitor_2014_web_hr.pdf

Netwerk Zuidelijke Randstad. (2015). Monitor Stedenbaan 2015. Retrieved February 01, 2017, from http://www.zuidelijkerandstad.nl/sites/www.zuidvleugel.nl/files/document-en/monitor_2015_web.pdf

Netwerk Zuidelijke Randstad. (2016). Monitor Stedenbaan 2016. Retrieved February 01, 2017, from http://www.zuidelijkerandstad.nl/sites/www.zuidvleugel.nl/files/document-en/stedenbaan_monitor_2016_def_web_lr.pdf

O'leary, Z. (2004). *The essential guide to doing research*. London: SAGE Publications Ltd.

OV-Bureau Randstad. (2013). Knooppuntontwikkeling in de Randstad: Impressie van een traject van kennisuitwisseling, Den Haag: OV-Bureau Randstad,

Peek, G.-J., Bertolini, L., & De Jonge, H. (2006). Gaining insight in the development potential of station areas: A decade of node-place modelling in The Netherlands. *Planning Practice & Research* , 21 (4), 443-462.

Planbureau voor de Leefomgeving. (2014). *Kiezen en delen*. Planbureau voor de Leefomgeving, Den Haag.

Provincie Noord-Holland & Vereniging Deltametropool (2013). *Maak Plaats! Werken aan knooppuntontwikkeling in Noord-Holland*. Haarlem: Provincie Noord-Holland & Vereniging Deltametropool.

Provincie Noord-Holland (2016). Monitor OV-knooppunten. Retrieved February 01, 2017, from https://www.noord-holland.nl/Onderwerpen/Ruimtelijke_inrichting/OV_knooppunten/Documenten/Monitor_OV_knooppunten.org

Provincie Noord-Holland. (2017). OV-knooppunten. Retrieved August 07, 2017, from https://www.noord-holland.nl/Onderwerpen/Ruimtelijke_inrichting/OV_knooppunten

Pojani, D., & Stead, D. (2015). Transit-Oriented Design in the Netherlands. *Journal of Planning Education and Research*, 35(2), 131-144.

Renne, J., & Wells, J. (2005). Transit-Oriented Development: Developing a Strategy to Measure Success. *NCHRP Research Results Digest* , 294.

Renne, J. (2009). Measuring the success of transit oriented development. *Transportation Oriented Development: Making It Happen*. Surrey, England: Ashgate, 241-255.

Reusser, D. E., Loukopoulos, P., Stauffacher, M., & Scholz, W. R. (2008). Classifying railway stations for sustainable transitions - balancing node and place functions. *Journal of Transport Geography*, 16, 191-202.

Rijpers, Y. (2007) Stedenbaan. *De grenzeloze regio*. Sdu uitgevers, 146-153

Rose, R. (1991). Comparing forms of comparative analysis. *Political studies*, XXXIX, 446-462.

Salon, D. (2009). Neighborhoods, cars, and commuting in New York City: A discrete choice approach. *Transportation Research Part A: Policy and Practice*, 43(2), 180-196.

Sartori, G. (1991). Comparing and miscomparing. *Journal of theoretical politics*, 3(3), 243-257.

Saunders, M., Lewis, P., Thornhill A., Smitt, P. & Smeets, I. (2015). *Methoden en technieken van onderzoek*. 7th edition. Pearson Education.

Serlie, Z. (1998a), Stationslocaties in vergelijkend perspectief; verkenning van de toepassingsmogelijkheden van een modelmatige operationalisatie van het begrip stationslocatie. Master thesis, Universiteit Utrecht.

Serlie, Z. (1998b). Positionering van stationslocaties in de regio's Amsterdam en Utrecht. Universiteit Utrecht.

Simons, H. (2014). Case Study Research: In-Depth Understanding in Context. In P. Leavy (Red.), *The Oxford Handboook of Quantitative Research*. Oxford: Oxford Handbooks Online.

Singh, Y.J., Fard, P., Zuidgeest, M., Brussel, M., van Maarseveen, M., (2014). Measuring transit oriented development: a spatial multi criteria assessment approach for the City Region Arnhem and Nijmegen. *Journal of Transport Geography*. 35, 130–143.

Smit, N., Janssen-Jansen, L., & Tan, W. (2014). Tunnelvisies en cirkelredeneringen in kennisuitwisseling knooppuntenbeleid. Stichting Colloquium Vervoersplanologisch Speurwerk.

Spaans, M., & Louw, E. (2009). Crossing borders with planners and developers and the limits of lesson-drawing. In City Futures' 09, 1-21.(2009). Universidad Rey Juan Carlos, Madrid.

Stadsregio Nijmegen & Provincie Gelderland (2006). *Regionaal Plan 2005-2020*.

Stadsregio Arnhem Nijmegen (2008). Openbaar vervoer in een nieuw perspectief–Masterplan Openbaar vervoer 2008-2020. Retrieved February 08, 2017, from http://www.destadsregio.nl/publicaties/publicaties-mobiliteit/masterplan-ov/masterplan-ov

Stadsregio Arnhem Nijmegen. (2011). Knooppunten! Bereikbaarheid en ruimtelijke ontwikkeling op knooppunten van openbaar vervoer. Retrieved February 08, 2017, from http://www.destadsregio.nl/publicaties/publicaties-ruimte/ov-ro-knooppunten/overzichtsdocument-ov-ro-knooppunten

Stadsregio Arnhem Nijmegen. (2014). OV/RO Knooppunten. Retrieved August 08, 2017, from http://www.destadsregio.nl/projecten/ov-ro-knooppunten

Tan, W. (2013). *Pursuing Transit-Oriented Development: Implementation through institutional change, learning and innovation*.

Tan, W., Koster, H., & Hoogerbrugge, M. (2013). *Knooppuntontwikkeling in Nederland:(hoe) moeten we Transit-Oriented Development implementeren?*.

Tan, W. G., Janssen-Jansen, L. B., & Bertolini, L. (2014). The role of incentives in implementing successful transit-oriented development strategies. *Urban policy and research,* 32(1), 33-51.

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative inquiry,* 16(10), 837-851.

Vereniging Deltametropool (n.d.-a). Het Vlindermodel 1.0. Handleiding voor de berekeningen.

Vereniging Deltametropool (n.d.-b) Het Vlindermodel 2.0. Handleiding voor de berekeningen.

Walby, K., & Luscombe, A. (2016). Criteria for quality in qualitative research and use of freedom of information requests in the social sciences. *Qualitative Research,* 1468794116679726.

Weiss, C. H. (1998). Have we learned anything new about the use of evaluation?. *The American Journal of Evaluation,* 19(1), 21-33.

Winnips, C., & Price, G. (2013). Optimale combinatie groen, blauw en rood; TOD in Amsterdam en Vancouver. *Stedenbouw en Ruimtelijke Ordening* , 3, 28-31.

World Health Organization. (2002). Health in sustainable development planning: The role of indicators.

World Health Organization. (2015). Health in all policies: training manual. World Health Organization.

Yin, R. K. (1994). *Case study research: design and methods*. Thousands Oaks. International Educational and Professional Publisher.

Yin, R. K. (2009). *Case study research: Design and Methods*. SAGE publications. Thousand oaks.

Zhang, X.-Q. (2016). The trends, promises and challenges of urbanisation in the world. *Habitat International*, 54, 241-252.

Zweedijk, A. (1997), Knoop of plaats? Naar een operationalisatie van het begrip stationslocatie. Master thesis, Universiteit Utrecht.

Appendices

Appendix 1

Interview guide

Name interviewee: Date of the interview:

Case:

Introduction

1. Interviewer thanks interviewee.

2. Interviewer introduces himself.

3. Interviewer introduces the subject, the goal of the research, the goal and the structure of the interview. The structure of the interview follows the policy cycle and is used to identify where station area evaluation models are used.

4. Interviewer asks for permission to record the interview.

5. Interviewer asks if the goal and structure of the interview are clear, and if the interviewee has any questions in advance.

6. Interviewee asks the interviewer if he/she could introduce him/herself.

The policy cycle

Agenda setting

Q1. What is the foundation behind the TOD policy that is pursued? Problem defintion/ Challenges

Policy formation

Q2. Could you tell about the exploration of the TOD policy?

Q3. Why was the TOD policy chosen?

Q4. Who are involved in the policy and why?

Q5. What is the goal in the policy?

Q6. What is the role of (Station area evaluation model) in the formation of the policy?

Q7. What is the (Station area evaluation model)?

Q8. Why are these indicators chosen?

Q9. Who choses these indicators?

Q10. What is the role of typologies?

Q11. What is the role of the (Station area evaluation model) in relation to the other phases?

Q12. What is the scale-level that is used in the policy?

Policy implementation

Q13. What is the goal in the monitor?

Q14. What indicators are used in the monitor?

Q15. How does the monitor relate to the (Station area evaluation model)?

Policy review

Q16. What is the policy review phase going to exist of?

Q17. Is there going to be an ex-post evaluation in the policy review phase?

Conclusion

Q18. Are there any remarks that the interviewee wants to make?

Q19. Ask the interviewee if there are any important documents or literature that should be incorporated in the research.

Q20. Inform the interviewee about the procedure of analysis, that the analysis will be send back and the interviewee can change/modify his/hers statements.

Q21. Ask the interviewee if he/she wants to receive the research.

Q22. Thank the interviewee for his/her time.

Appendix 2

Atlats.ti outputs are available upon request. For receiving the outputs, contact:

jbekink@hotmail.com

Appendix 3

Appendix 3A. List of pre-defined codes

Code	Description
AN	Arnhem Nijmegen City Region
ASP	Agenda setting phase in the policy cycle
CM	Construct of the monitor
CI	Construct of the indicators
FNPD	Foundation of the node-place diagram
FNPM	Foundation of the node-place model
FVDM	Foundation of the Vlindermodel
FVGM	Foundation of the Vliegermodel
GNDD	Goal of the node-place diagram
GNDM	Goal of the node-place model
GVDM	Goal of the Vlindermodel
GVGM	Goal of the Vliegermodel
NH	Province of Noord-Holland
ONPM	Operationalisation of the node-place model
PFP	Policy formation phase in the policy cycle
PG	Policy goals mentioned by the civil servant
PIP	Policy implementation phase in the policy cycle
PPP	Public-private partnership
PRP	Policy review phase in the policy cycle
PPUP	Public-public partnership between municipalities
RM	Role of the monitor
RI	Role of the indicators in the evaluation model
RS	Randstad Southwing

Appendix 3B. List of new-defined codes

Code	Description
AI	Analysis instrument
BD	Broadening of the disciplines
CF	Contextual factors
CI	Communication instrument
DG	Derivative goals
EXT	Externalities that influenced the case in a way
FRA	Fragmentation of goals
ISP	Inspiration instrument
MAK	Makeableness of TOD
VF	Vision for the future

Appendix 4

Research criteria table (based on Tracy, 2010)

Research criteria	Explanation	How is it incorporated in the research?	Can be found in chapter
Worthy topic	The research is relevant, timely, significant or evocative.	As TOD is a highly popular policy strategy in the context of the Netherlands, and the evaluation models that are analysed in the research are compared, a timely and significant research has been set up.	1.3, 1.4
Rich rigor	The research exists from a variety of theoretical constructs, data sources, contexts and samples. The research exercises appropriate time, effort, care, and thoroughness.	The theoretical framework is based on a variety of different sources, combining theory on TOD and policy evaluation. To ensure rich rigor, three cases are chosen and a combination of both a document analysis and semi-structured interviews is used.	2, 3.3
Sincerity	The research is characterised by self-reflexity, vulnerability, honesty, transparency and data auditing. The research shows openness about methods, challenges, biases and goals.	To demonstrate self-reflexity and vulnerability, the limitations and reflection are written as thorough as possible. Honesty, transparency, and data auditing are demonstrated through transcribing interviews, these are available on request to make the research and data gathering insightful for those interested. Additionally, the methods and goals are shared in the beginning of each interview.	3.6, 10
Credibility	The research involves thick description, triangulation or crystallisation, multivocality, and member reflections.	To incorporate credibility in the research data is shown as pure as possible and with enough background that readers can draw their own conclusions. Triangulation and crystallisation is used through combining policy document analysis with semi-structured interviews. Member reflections are included in the sense that interview analysis is sent back to the interviewees, and therefore they are offered the opportunity to reflect on what they said in the interview. A control session was also held in order to ensure the quality of the policy document data.	3.3, 3.5
Resonance	The research involves reverberation and affects an audience. This can be achieved through presenting a text in an evocative an aesthetic way. Also it can be achieved through transferability and naturalistic generalisations.	While the research is involved with the Dutch context of TOD in particular, methods that are used to research TOD evaluation can be generalisable. In the sense that the policy cycle in combination with policy evaluation offers a method for research outside of the Dutch context. Also, knowledge is generated on the use of evaluation models, which can help Dutch governments to make well-considered choices on their evaluation models.	9, 10

Significant contribution	The research aims to contribute to a better understanding of life, bring clarity in confusion, and make visible what is hidden. It is strived for through extending, building, and criticising existing knowledge. Additionally, it can be achieved through developing curiosity among readers and helping in inspiring new discoveries. But it can also be achieved through using other methodological approaches than previously has been done.	This research extends knowledge on how indicators and evaluation models are used in the Dutch context of TOD. To do so, it links existing theory about policy evaluation to TOD practice in the Netherlands, and in addition interesting and relevant suggestions for future research are made.	2, 4, 5, 6, 7, 12
Ethical	The research incorporates the participant's awareness of the goals, nature, and potential consequences of the research. The research reflects on the circumstances, in the sense that the means justify the ends. Additionally, the research recognises and values dignity, respect, and connectedness between the researcher and researched. And finally, the research is involved with how to continue beyond data collection and results sharing, in the form of presenting data in such a way that no unintended effects will take place.	Within the research ethical considerations are made in respect to the interviewees, the interviewer states the goal of the research in the introduction of each interview. Additionally the interviewees are offered the opportunity to reflect on the parts that the interview wants to use for analysis, they can change, improve, or remove certain parts of the analysis. It is strived for to evoke a minimum of unintended effects through research, this is done through respecting alterations from the interviewees, and keeping the interviews anonymous, and presenting data as purely as possible.	3.6
Meaningful coherent	The research achieves the stated purpose, accomplishes what is adopted or supported, uses methods that fit well with the theories, stated goals, and is interconnected with the research focus points, methods and findings.	The research is focused around a set of sub-questions, which are inherent to the main research question. The study uses methods that ensure to gather the information needed to answer the research questions, and an interconnection between theory, goals, methods, and findings is strived for.	3.3, 10, 11

Appendix 5

Operationalisation of the Node-place diagram (Atelier Zuidvleugel, 2006)

	Indicator	Sub-indicator	Measurement
Node	POVN (Position in public transport network)	Connection-value (Measurement based on the amount of modes a station is connected to)	HSL = presence high-speed rail (score: 200)
			Intercity = presence of intercity train (score: 100)
			Stedenbaan = connected to Stedenbaan network (score: 75)
			Light rail = presence light rail (score: 50)
			Regional bus = presence regional bus (score: 50)
			Local bus/tram = presence local bus/tram (score: 25)
		Access-value	Measurement based on the amount of directions per mode
	PWN (Position in road network)	Connection-value (Measurement based on the presence of regional ways and motorways)	Provincial roads within a 3200 metre radius (score: 25)
			Provincial roads within a 1200 metre radius (score: 50)
			Motorways within a 3200 metre radius (score: 50)
			Motorways within a 1200 metre radius (score: 100)
		Access-value	Measurement based on the amount of directions that one can travel in
Place	IWD (Population density & worker density)	Population density	Measurement based on the amount of inhabitants per hectare within an 1200 metres radius
		Worker density	Measurement based on the amount of workers within an 1200 metres radius
	MNG (Degree of mix)	Mix of activities	Measurement based on the mix within the influence of the station area, based on postal code

Appendix 6

Operationalisation of the Vlindermodel (Vereniging Deltametropool, n.d-a; Provincie Noord-Holland & Vereniging Deltametropool, 2013).

	Indicator	**Measurement**	
Node	Position in slow traffic network	(OVF + SO + (PF/IU) x 100) + (Number of LW x 1.5)	OVF = presence of OV-bicycle (score: 25)
			SO = presence railway crossing within 300 metre radius (score: 50)
			PF = number of bicycle storage racks
			IU = transit ridership in amounts PF/IU x 100 > 30 (score: 50) PF/IU x 100 > 15 (score: 25)
			LW = amount of local roads within an 300 metre radius
	Position in public transport network	Score (HSL + IC + SPR + MR + ST + TS) + Σ (F x R x 0,2 x Score)	HSL = presence high-speed rail (score: 125)
			IC = presence of intercity train (score: 100)
			SPR = presence of local train (score: 75)
			MR = presence of metro or R-net (score: 50)
			ST = presence of regional bus (score: 75)
			TS = presence of tram and/or city bus (score: 25)
			F = frequency
			R = amount of directions served
	Position in road network	Score (SA + S + RW1 + RW2 + (PA/IU) x 100) + Σ (R x 0,5 x Score) *(PA/UI) x100 > 5%= score 50* *(PA/UI) x100 > 2.5%= score 25*	SA = presence motorway exit in an 1200 metre radius (score: 75)
			S = presence motorway in an 3200 metre radius (score: 50)
			RW1 = presence regional highway in an 1200 metre radius (score: 25)
			RW2 = presence regional highway in an 3200 metre radius (score: 10)
			PA= amount of parking spaces
			IU = transit ridership in amounts
			R= amount of directions
Place	(Proximity) Intensity of use in the first 300 metre radius	(((IW + WN + BZ) 300 M) / ((IW + WN + BZ) 1200 M)) x 100	IW = inhabitants
			WN = workers
			BZ = visitors
	(Intensity) Density of inhabitants, workers, and visitors	(IW + WN + BZ) / IG	IW = inhabitants
			WN = workers
			BZ = visitors
			IG = area of influence in hectare
	(Mixture) Ratio of inhabitants and workers per	1/N Σ (Minimum (IW, WN) / Maximum (IW, WN)) x 100	N = amount of squares 100 x 100 metres

Appendix 7

Operationalisation of the Vliegermodel (Stadsregio Arnhem Nijmegen, 2011)

Indicator	Measurement	
Public transport networks: The intertwinement of public transport networks	Measurement based on the amount of trains per hour	<0 trains = 0 points 2 trains = 4 points 4 trains = 5 points 6 trains = 6 points
	Measurement based on the amount of quality public transport (HOV) connections	<0 connections = 0 points 1 connection = 2 points 2 connections = 3 points 3 or more connections = 4 points
Multimodal: The ability of modal transfers	Measurement based on the amount of parking spaces	<0 = 0 points 0 to 100 = 2 points 100 to 200 = 3 points 200 to 300 = 4 points 300 to 400 = 5 points 400 or more = 6 points
	Measurement based on the amount of bicycle racks	<0 = 0 points 0 to 200 = 1 point 200 to 400 = 1.5 point 400 to 600 = 2 points 600 to 800 = 2.5 points 800 or more = 3 points
Station-complex: The station facilities and usage	Measurement based on the amount of transit ridership per day	<0 = 0 points 0 to 500 = 0.5 point 500 tot 1000 = 1 point 1000 to 1500 = 2 points 1500 to 2000 = 3 points 2000 to 2500 = 4 points 2500 to 3000 = 5 points 3000 to 4000 = 6 points 4000 to 5000 = 7 points 5000 or more = 8 points
	Measurement based on the service level of the station complex	Waiting room = 0 points Kiosk = 0.5 point Shops = 1 point
Station-area: The urbanisation in the station area	Measurement based on the amount of houses in an 800 metre radius	<0 = 0 points 0 tot 1000 = 1 point 1000 tot 2000 = 2 points 2000 tot 3000 = 2.5 points 3000 tot 4000 = 3 points 4000 or more = 4 points
	Measurement based on the amount of workspaces in an 800 metre radius	<0 = 0 point 0 tot 1000 = 0.5 point 1000 tot 2000 = 1 point 2000 tot 3000 = 2 points 3000 tot 6000 = 2.5 points 6000 tot 9000 = 3 points 9000 or more = 4 points
	Measurement based on the functional mix (difference in work space and housing)	-1 to -2 = 0 points <0 = 1 point 0 to 1 = 1 point 1 to 2 = 0 points
	Measurement based on housing per hectare	<0 = 0 points 0 to 10 = 0.5 point 10 to 40 = 1 point 40 or more = 2 points

Appendix 8

Comparison table (Vereniging Deltametropool, n.d-b, Atelier Zuidvleugel, 2006; Stadsregio Arnhem Nijmegen, 2011)

Indicator	Measurement
1. Intertwinement of public transport networks	Score ((FT) + (HOV))
2. The ability of modal transfers	Score (PA + PF)
3. The station facilities and usage	Score (TR+ SL)
4. The urbanisation of the station area	Score (H 800 M + WP 800 M + H/Ha 800 M + WP/Ha 800 M) + (FM: Score H/Ha 800M - Score WP/Ha 800 M)
5. The ambitions parties and plan making	Score (AG + LU + LO+ FI)

Indicator	Measurement
1. Position in slow traffic network	Score (OVF + SO + BGF) + ((Length of LW/100) x (OFI/2826))
2. Position in public transport network	Score (HSL + IC + SPR + LR + TS) + Σ (R x F x 0,2 x Score)
3. Position in road network	Score (SA + S + RW1 + RW2 +BGA) + Σ ((R x 0,5 x Score) – (CF x RC))
4. Proximity (Centre function of station area + Comfort of station area) x Quality of station area	Centre function = (((IW + WN + BZ) 300 M) / ((IW + WN + BZ) 1200 M)) x 100
	Comfort of station area = (VW +BW + TV + GK + WF + SM + RE + TO) x 0,25
	Score Quality of station area
5. Intensity	(IW +IWF + WN + BZ) / IG
6. Mixture	((IW/WN) per 100x100)/2 + (VV/HV)/2)

Indicator	Measurement
1. Position in public transport network	Score (HSL + IC +ST+ LR +RB + LBT) + Σ (R x Score)
2. Position in road network	Score (PR 3200 M + PR 1200 M + MO 3200 M + MO 1200 M) + Σ (R)
3. Population density & worker density	((IW/Ha)/1200 M)) +((WO/ Ha)/ 1200 M))
4, Degree of mix	(IW/WN) per 100x100

Node-place diagram:
HSL = Presence high-speed rail (score: 200)
IC = Presence intercity train (score: 100)
ST = Connected to Stedenbaan network (score: 75)
LR = Presence light rail (score: 50)
RB = Presence regional bus (score: 50)
LBT = Presence local bus/tram (score: 25)
R = Directions served
PR = Provincial roads
MO = Motorways
IW = Inhabitants
WO = Workers

Vlindermodel:
OVF = OV-bicycle (score: 25)
SO = Presence railway crossing within 300-metre radius (score: 50)
BGF = Occupancy rate bicycle racks
BGF < 50% (score: 50)
BGF 50%-80% (score: 25)
LW = Length of local ways
OFI = Surface of bicycle isochronous in 3000-metre radius
HSL = Presence high-speed rail (score: 125)
IC = Presence intercity train or international bus (score: 100)
SPR = Presence local train (score: 75)
LR = Presence light rail/metro/regional bus/HOV bus (score: 25)
TS = Presence tram/local bus (score: 25 points)
SA= Presence motorway exit in a 1200-metre radius (score: 75)
S = Presence motorway in a 3200-metre radius (score: 50)
RW1= Presence regional highway in a 1200-metre radius (score: 25)
RW2= Presence regional highway in a 3200-metre radius (score: 10)
BGA= Occupancy rate parking spaces
BGA < 50% (score: 50)
BGA 50%-80% (score: 25)
R = Amount of directions
CF= Congestion factor (presence congestion) = 0,5
RC= Amount of directions congested roads (1 or 2)
IW = Inhabitants
WN = Workers
BZ = Visitors
VW = Presence heated waiting (score: 0,06)
BW = Presence sheltered waiting (score: 0,06)
TV = Presence television screens (score: 0,01)
GK = Presence free newspaper (score 0,01)
WF = Presence Wi-Fi (score: 0,025)
SM = Presence supermarket (score: 0,025)
RE = Presence restaurant (score: 0,03)
TO = Presence toilet (score: 0,03)
IWF = Inhabitants within bicycle isochronous (3000-metres)

IG = Area of influence in hectares
VV = Different types of services
HV = Amount of services

Vliegermodel:
FT = Amount of trains per hour
HOV = Amount of HOV connections
PA = Amount of parking spaces
PF = Amount of bicycle racks
TR = Amount of transit rider-ship per day
SL = Service level of the station complex
H = Housing
WP = Work spaces
AG = Ambitions municipality
LU = Land-use development plan
LO = Land ownership
FI = Financing

FT=
<0 trains = 0 points
2 trains = 4 points
4 trains = 5 points
6 trains = 6 points

HOV=
<0 connections = 0 points
1 connection = 2 points
2 connections = 3 points
3 or more connections = 4 points

PA=
<0 = 0 points
0 to 100 = 2 points
100 to 200 = 3 points
200 to 300 = 4 points
300 to 400 = 5 points
400 or more = 6 points

PF=
<0 = 0 points
0 to 200 = 1 point
200 to 400 = 1.5 point
400 to 600 = 2 points
600 to 800 = 2.5 points
800 or more = 3 points

TR=
<0 = 0 points

0 to 500 = 0.5 point
500 tot 1000 = 1 point
1000 to 1500 = 2 points
1500 to 2000 = 3 points
2000 to 2500 = 4 points
2500 to 3000 = 5 points
3000 to 4000 = 6 points
4000 to 5000 = 7 points
5000 or more = 8 points

SL=
Waiting room = 0 points
Kiosk = 0.5 point
Shops = 1 point
H 800 M=
<0 = 0 points
0 tot 1000 = 1 point
1000 tot 2000 = 2 points
2000 tot 3000 = 2.5 points
3000 tot 4000 = 3 points
4000 or more = 4 points

WP 800 M=
<0 = 0 point
0 tot 1000 = 0.5 point
1000 tot 2000 = 1 point
2000 tot 3000 = 2 points
3000 tot 6000 = 2.5 points
6000 tot 9000 = 3 points
9000 or more = 4 points

H/Ha 800M=
<0 = 0 points
0 to 10 = 0.5 point
10 to 40 = 1 point
40 or more = 2 points

WP/Ha 800M=
<0 = 0 points
0 to 10 = 0.5 point
10 to 40 = 1 point
40 or more = 2 points

FM=
-1 to -2 = 0 points
<0 = 1 point
0 to 1 = 1 point
1 to 2 = 0 points

AG =
No = 0 points
Partially = 2 points
Yes = 3 points

LU =
No = 0 points
Partially = 1 points
Yes = 2 points

LO =
No = 0 points
Partially = 1 points
Yes = 2 points

FI =
No = 0 points
Partially = 1 points
Yes = 2 points