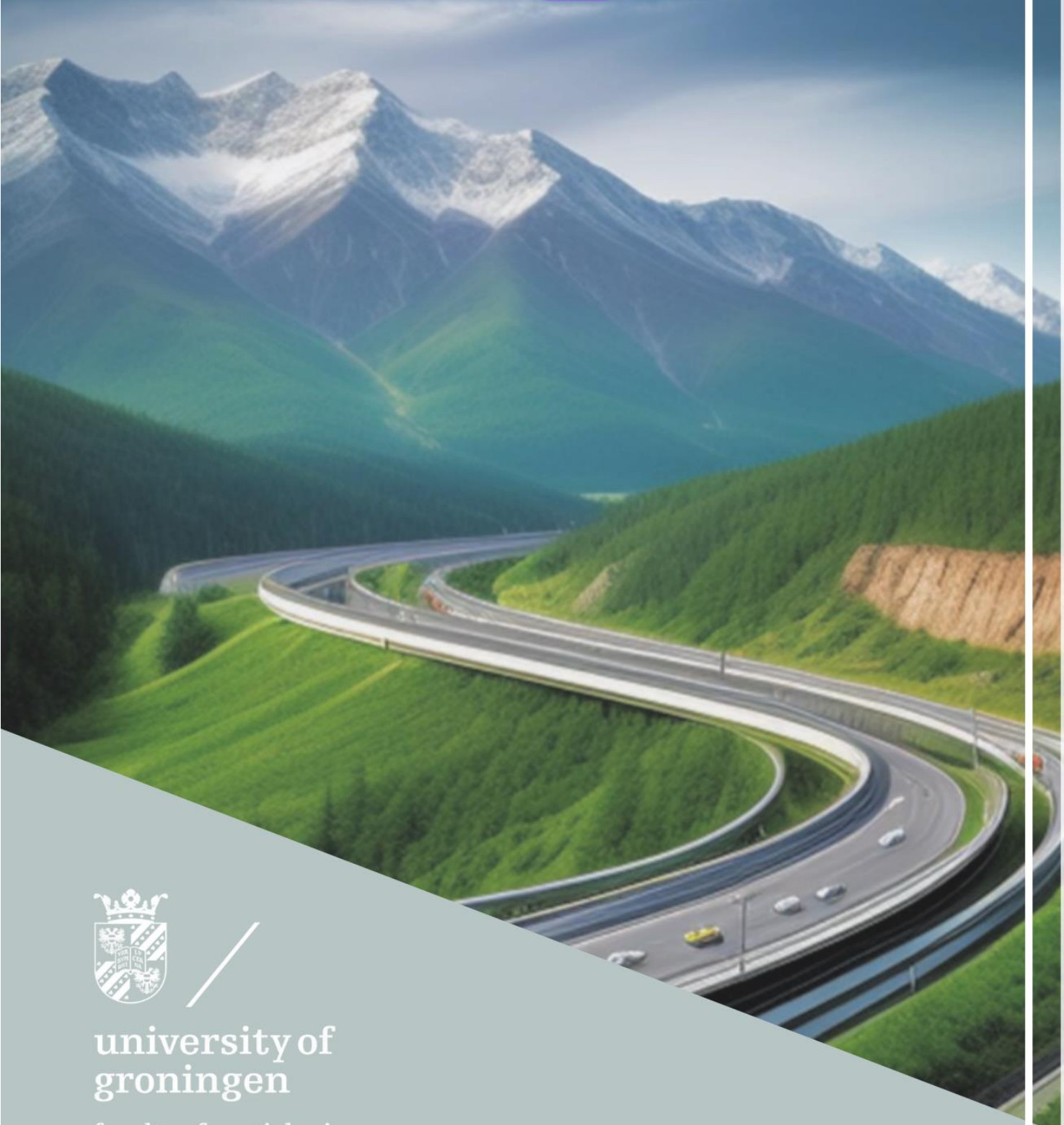

MASTER THESIS CONCEPT

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TOWARDS AREA-ORIENTED APPROACHES IN TRANSPORT INFRASTRUCTURE PLANNING

A cross-case analysis of European best practices

MSc Environment & Infrastructure Planning

Colophon

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Abstract

The societal and environmental developments of the last decades have a large impact on the transportation networks and their providers. National Road Authorities (NRAs) experience pressure due to the tension between functional interrelatedness and institutional interdependencies, and therefore feel a need for a different approach to planning. To help NRAs transition from a line-oriented or project-oriented planning approach towards an area-oriented approach, several research programs have been executed, e.g. SPINdesign, FLUXNET and Vital Nodes. Through a broad inventory of cases and an in-depth analysis of best practices, the barriers, success factors and conditions of upscaling area-oriented pilots to successful planning practice are studied, in addition to the role of NRAs in this process. The results demonstrate that NRAs lack capacities (e.g. financial resources or knowledge), that they often do not sufficiently prioritise area-oriented approaches (despite their acknowledged importance), and that they tend to lose valuable documentation on projects (negligence). The successes of area-oriented planning lie in collaboration based on joint ownership. Creating a sense of joint ownership is therefore an essential condition for the upscaling process. Furthermore, the results show that the mandate of NRAs is often limited, leading to NRAs not being able to position themselves as area partner in projects. Therefore, it is recommended that (1) NRAs broaden their mandate to position themselves as area partners, (2) to engage in long term, structural and integral partnerships and collaborations, and (3) that they create institutional memory to ensure their continuous learning processes.

Key words Area-oriented planning, collaborative planning, transport infrastructure planning, Land Use Transport Interaction, multi-level transition theory.

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List of Abbreviations

Abbreviation	**Meaning**
CEDR	Conference of European Directors of Roads
EU	European Union
LUTI	Land Use Transport Interaction
NPM	New Public Management
NRA	National Road Authority
PVM	Public Value Management
TEN-T	Trans European Transport Network
WG CP	Working Group Collaborative Planning

Preface

Dear reader,

Exactly five years ago I set foot at the University of Groningen to study the Bachelor Spatial Planning & Design. This was soon followed by the Bachelor Philosophy of Economic and Social Sciences and finally the Master Environmental & Infrastructure Planning. During these years I learned to critically think, reason and reflect. Competences I consider the most valuable in an increasingly complex spatial domain. Within the spatial domain specifically transport and mobility sparked my interest, while in the field of philosophy I was intrigued by relativism and the question why things are done differently in different places. Combining these interests has resulted in this master thesis.

After five years of studying how to *make places better together*, this thesis marks the end of my studies. For this I would first like to thank all interviewees for their valuable insights and enthusiasm to contribute to this study. Next, I want to thank the members of the CEDR working group Collaborative Planning for the dynamic discussions and their support. Third, I want to thank my colleagues at Rijkswaterstaat (Water, Verkeer en Leefomgeving, cluster Ruimte, Economie, MER/MIRT) and specifically my internship supervisor Sjaak van der Werf for his contributions and guidance. Last, I want to thank my supervisor prof. dr. Jos Arts and second assessor prof. ir. Wim Leendertse for their constructive feedback and helpful insights.

Cheyenne Raskeyn

Groningen, 24 August 2023

1. Introduction

1.1 Need for integrated planning approaches

The global challenges we face today are challenges that cannot be solved within a single policy field and that cannot be solved in a single plan on a global scale (Allmendinger, 2017). Challenges such as climate change or the energy transition have large impacts on both society and environment. Their origin lies in a variety of spatial functions, such as transportation or industry (Leendertse et al., 2020). Compensation, mitigation and prevention measures therefore need to be implemented within multiple policy areas at multiple interacting scales varying from the international to the local level. This multiplicity in policy areas and scales asks for interaction, adjustment and collaboration between different (governmental) organisations, businesses and stakeholders (Arts et al., 2016; Leendertse & Arts, 2020). As many governmental organisations are traditionally organised in a sectoral and hierarchical manner, this results in pressure on public administrators, such as National Road Authorities (NRAs).

The societal and environmental challenges described above, in combination with global challenges and pressure on NRAs, results in the need for a different planning approach. This pressure on NRAs can partially be attributed to these global challenges, but also to implementation issues, e.g. cost and time overruns or limited stakeholder satisfaction. Such implementation issues are, in part, the result of a tension between functional interrelatedness and institutional interdependencies (Arts, 2007; Arts et al. 2016; Heeres et al., 2016). The interplay between these two elements is central to integrated planning (Heeres et al., 2017).

The development of road infrastructure and other land uses are *functionally interrelated*: they can be both conflicting and complementary. Conflicts between the functional relations between infrastructure and other land uses may result in negative impacts (externalities), such as noise nuisance and air pollution (Banister et al., 2011). However, if an integrated planning approach (or an approach with at least interaction and adjustment between departments and organisations) is used, infrastructure planning has a higher potential to positively affect other land uses. This functional relation may provide an opportunity for infrastructure investments to generate positive spillovers or synergies as increased accessibility may improve spatial quality on different scales (Heeres et al., 2017). Heeres et al (2017) distinguished three degrees of integration that can be distinguished: functional isolation, sector-internal integration and external integration. The first is the conventional approach that deals with infrastructure issues as if they are an isolated issue. Negative effects on other land uses are handled through mitigation and compensation, following a reactive approach. Within sector-internal integration, the functional scope is expanded with other transport modalities. This entails a network approach to widen the solution space and incorporate other transport modes within the transport sector. Lastly, external integration goes beyond the transport silo alone, and considers other interrelated land uses within the area. Using this approach, the broader context of an area is considered and solutions to overarching issues (e.g., liveability and sustainability) can be reached (Heeres et al., 2017).

Besides this interrelation between functions, land-use and infrastructure planning are *institutionally interdependent*. At the infrastructure-land use interface there is a variety of interests held by different governmental jurisdictions (multi-sector and multi-level governance) across multiple spatial sectors. The interests of each government may also differ because of their specific procedures, budgets and referential frames. The public sector has traditionally been characterised by a hierarchical and sector-oriented division of tasks. This has resulted in fragmented government action. In the last three decades of the 20th century governmental reform led to further fragmentation through the rise of New Public Management. Public policy roles and responsibilities became decentralized and sectors became segmented (Peters, 2018), leading to

policy domains becoming autonomous "single purpose" organisational units (Cejudo & Michel, 2017; Pollit & Bouckaert, 2011) with their own segmented conception of policy issues, adequate solutions, ideologies and interests (van Geet et al., 2021). Fragmentation became institutionalised through legislation and administrative/organisational reform. Thereby shaping the politics and policies of a country, as well as the distribution of power, accountability and budgets (van Geet er al., 2021).

This type of organisation within the public sector is beneficial when it comes to for instance specialisation or governmental efficiency. However, there are several disadvantages as well. The success of a policy is often dependent on the effects of other policies from other domains (Peters, 2018) and the causes and solutions for large-scale contemporary issues (e.g. climate change) are embedded within multiple policy domains (Cejudo & Michel, 2017; Jordan & Lenschow, 2010). This also applies to transportation issues and development in the sense that transport and land use planning interact with and are interdependent on each other.

To overcome the issues of segmentation and decentralisation within governmental organisations, government action needs to be integrated by building inter-sectoral and multilevel relationships between interdependent policy actors (Keast, Brown, & Mandell, 2007; van Geet et al, 2021), i.e. enhanced coordination is required (Heeres et al., 2017). This is not to be done by involving a larger number of stakeholders, but rather by addressing the interdependencies and change the nature and intensity of interaction in coalitions (Woltjer, 2000). There are three coalition types (forms of integration) that can be distinguished (Heeres et al., 2017): no cooperation, coordinated action and co-production. The first entails the conventional closed governance style that is defined by central coordination and hierarchical control. The second and third coalition types are characterized by an open governance style, where the interaction between the involved stakeholders plays a central role in decision-making. Coordinated action focuses on enhancing the inter-sectoral coordination of interests and therewith improving the efficiency and legitimacy of sectoral policies. Thirdly, co-production concerns open dialogue to discuss opinions, conflicts, values and power relations in order to pursue synergies and enhance legitimacy (Heeres et al., 2017; Leendertse & Arts, 2020).

In dealing with functional interrelatedness and institutional interdependencies by use of coalition forming, the ultimate goal is to pursue synergetic effects (co-production/co-development) or at least coordination to prevent negative effects (Heeres et al., 2017). In the former to explore infrastructural issues within a broader context and generate synergies to reach broader goals such as liveability and sustainability, and in the latter to engage actors in open governance processes for networked decision-making (Heeres et al., 2017). Therefore, there is a need to transition from isolated to contextual exploration of infrastructure issues and to transition from closed to open governance systems. One potential approach is to enhance integrated and collaborative planning, and use an area-oriented approach to infrastructure development projects. Although the importance of transitioning towards area-oriented planning approaches is growing, initiating and guiding such a transition is complicated and highly challenging for NRAs, especially considering their institutionally fragmented contexts.

1.2 European research into area-oriented planning

One of the key organisations connecting European road authorities is the Conference of European Directors of Roads (CEDR). Their mission is to support and help navigate National Road Authorities to anticipate to future trends and challenges (CEDR, 2022). CEDR aims to provide a vital network as challenges of National Road Authorities are becoming increasingly complex and are multidimensional by nature. Overcoming these complex challenges requires a holistic and vital network that can deliver innovative, efficient and long-term solutions for all parties involved

(CEDR, 2022). This is done by sharing best practices between National Road Authorities through various programs. Within the field of area-oriented infrastructure development – regarding spatial and (road) infrastructure development – these programs are for instance Collaborative Planning (i.e. SPINdesign), FLUXNET and the EU Horizon 2020 program Vital Nodes.

These programs focus on different parts of infrastructure planning, but overlap in their approach to achieve their respective goals and overcome their challenges. The focus of the Collaborative Planning program is three-fold: it focuses on trends in mobility and spatial development to explore approaches for future-proof road networks (SPINtrends), it studies the interface between long distance and last-mile delivery (SPINdesign), and it evaluates the added value from spatial development within infrastructure planning (SPADE) (CEDR, 2021). The FLUXNET program has a different focus than the Collaborative Planning program. FLUXNET is namely focused on the optimization of multimodal use of infrastructure networks, while addressing land use influences simultaneously. Lastly, the Vital Nodes programs key objective is to bring together networks of different geographical scales.

Although the program objectives of these three programs seem to differ, they are all directed at area-oriented planning. For instance, the Collaborative Planning program was established through the wish of NRAs to jointly study methods to achieve integrated projects when it comes to infrastructure development. The FLUXNET program uses integrated planning to meet logistical demands under stricter environmental regulations and growing cities. Lastly, the Vital Nodes program proposes an integrated approach to connect networks of different scales while facing spatial and environmental challenges at urban nodes.

To conclude, quite some research has been done recently, however, it remains difficult how to implement and use area-oriented approaches in regular planning practice. Currently regular planning practice is sector-oriented. This study is therefore concerned with the transition to a more prominent position for area-oriented planning in regular planning practice, and therewith the institutionalisation of area-oriented planning as the new default approach in infrastructure planning. In the abovementioned programs a variety of cases has been researched, but there is limited research into how these cases have developed after the pilot-phase and how they relate to each other. Therefore, this study focusses on the cases from the SPINdesign, FLUXNET and Vital Nodes programs. Area-oriented approaches within these cases are studied as a transition process and analysed in relation to the institutional interdependencies and functional interrelatedness.

1.3 Research questions

The aim of this research is to study and compare the planning of infrastructure and spatial development of infrastructure through pilot projects with an area-oriented approach in European countries in order to determine the institutional role National Road Authorities can take to guide the upscaling of these pilot projects. To this end, the study focuses specifically on the transition from area-oriented pilot projects into area-oriented projects in regular planning practice and the role of respective National Road Authorities in this transition. This results in the following main research question:

> *How does the role of National Road Authorities affect the upscaling of area-oriented transport infrastructure planning pilot projects into regular planning practice?*

In order to develop a substantial understanding of the role of National Road Authorities in this transition, the following secondary research questions are formulated:

1. *Which relevant theories conceptualise the upscaling of area-oriented infrastructure development pilot projects into regular planning practice?*

2. *How have the selected projects develop since the pilot phase considering the project scope, goals and objectives, and deliverables?*
3. *What is the role of National Road Authorities within the selected area-oriented infrastructure development projects?*
4. *What are barriers, success factors and conditions in the upscaling of area-oriented infrastructure development pilot projects into regular planning practice?*
5. *How can National Road Authorities ensure suitable conditions and overcome barriers in the planning of area-oriented infrastructure projects?*

Through elaborating these questions, the study provides insight in the development of the pilot projects, the conditions and barriers in upscaling these pilot projects and the role of National Road Authorities in this transition. From this, more general recommendations and conclusions for National Road Authorities are drawn.

1.4 Thesis outline

The remainder of the thesis is structured as follows. In the second chapter the key concepts related to land use and transport integration and area-oriented approaches are explained. The third chapter elaborates on the methodology, which includes the case selection, data collection through semi-structured interviews and secondary data collection, and the qualitative data analysis using the qualitative data analysis tool ATLAS.ti. After which the development of the selected pilot projects and the role of National Road Authorities are discussed in chapter 4. Followed by the institutional conditions and barriers, including guidelines for National Road Authorities in chapter 5. In the sixth chapter the critical reflection on the research results and limitations are presented. The seventh and final chapter answers the main research question and provides recommendations for future research.

2. Theoretical Framework

This chapter discusses theories relevant to collaborative planning of integrated spatial and infrastructure development. These theories relate to functional interrelatedness on the one hand and to institutional interdependencies on the other. The former is discussed using the Land Use Transport Integration concept (Section 2.1) which illustrates the functional interrelatedness and the importance of integration between multiple modes, spatial functions and scales. Section 2.2 describes the different levels of integration between land use and transport functions in the transition from line-oriented towards area-oriented planning. In Section 2.3 a different transition is discussed that elaborates upon institutional interdependencies resulting from multiple governments/parties at different scales collaborating on land-use and infrastructure solutions. This is the overall transition from New Public Management to Public Value Management where the transition from line-oriented to area-oriented falls within. As transitions of a socio-technical system – e.g. transition towards area-oriented or transition towards Public Value Management – do not happen overnight and are complex by nature, they need to be properly guided. To do so, an understanding of Geels and Schot's transition theory (2007) is necessary (Section 2.4). Lastly, the phenomenon of pilot syndrome is discussed as a theory explaining the success factors and barriers of upscaling pilot projects in Section 2.5. The relations between the theories are captured in the conceptual model in Section 2.6.

2.1 Land Use Transport Integration

The relationship between land use and Transport Infrastructure Planning is reciprocal as demonstrated in Figure 1 (Wegener & Fürst, 1999; Bertolini, 2012). The patterns and functions of land uses determine the locations for activities that people engage in. It determines where people live, work, get their groceries, sport, etc. To engage in such activities, people have to travel between the different locations through the use of the transport system. Developments in the transport system adapt according to the location of activities and the amount of people that engage in these activities. Therefore, transport developments influence the accessibility and connection of locations. An improved accessibility of a location then in turn increases their attractiveness for land use developments (Bertolini, 2012).

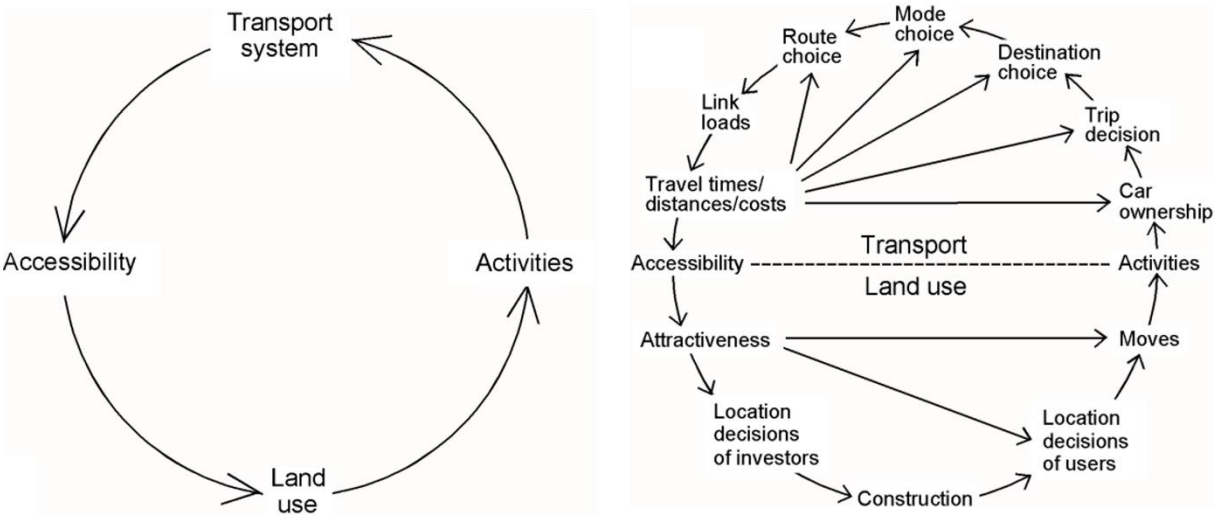

Figure 1 *Transport Land Use Feedback cycle (Wegener & Fürst, 1999)*

This theoretical model is however too abstract as in practice developments are influenced by more factors (Hanson and Giuliano, 2004) and the role of individual agents may be overlooked (Bertolini, 2012). For this reason, Bertolini (2012) argues that the cycle should be considered

open and the influence by other (external) factors must be taken into account (Figure 1). Examples of external influences are technological innovations, infrastructure investments and mobility policy on the transport side, and regional demand, land availability, area attractiveness, etc. on the land use side.

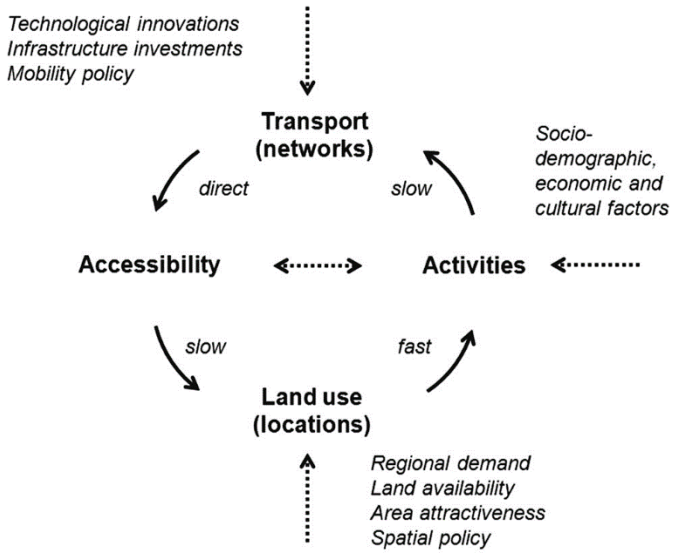

Figure 2 *Transport Land Use Feedback cycle (Bertolini, 2012)*

From an environmental and sustainability perspective, Land Use Transport Integration (LUTI) is an attractive strategy as reducing transportation needs and emissions is possible through land use measures, e.g. increasing urban density and mixing land uses to create less car-dependence (van Geet et al., 2021). Within infrastructure development projects, LUTI refers to the approach where land use development are integrated with infrastructure development projects. Together the land use and infrastructure project becomes an integrated area-development project (Heeres et al., 2016). Figure 2 illustrates the functional interrelatedness between transport and land use, as well as the contextual influences exerting pressure on the transport and land use system, e.g. technological innovations, socio-demographic factors, regional demand, etc.

Transport infrastructure planning was traditionally characterised by a technocratic rationality with a primary focus on the enhancement of the transport system (Heeres, Tillema & Arts, 2012). The focal point of transport policies has often been one particular infrastructure mode, such as road infrastructure or water infrastructure (Banister, 2005). This technical rationality faced critique as complexities such as contextual factors and diverting interests of related actors are not taken into account, often resulting in suboptimal planning interventions (de Roo, 2017; Allmendinger, 2017). Therefore, using an integrative approach results in higher quality and better overall outcomes for the entire area, rather than solely for the transport system (Heeres, 2017). The focus of projects should no longer be line-oriented, but become area-oriented.

2.2 From line-oriented to area-oriented infrastructure planning

In general, road infrastructure planning and spatial planning have been separated sectors in the Netherlands (Heeres et al., 2012). Consequently, this has resulted in a sectoral planning practice that is most often line-oriented in nature (Heeres et al., 2012). Road planners have wrongfully neglected the interaction between road infrastructure and other spatial functions (functional interrelatedness), as illustrated in paragraph 2.1, therewith limiting the scope of road infrastructure planning (Heeres et al., 2012). Because of the interaction between land use and transportation, as demonstrated by various authors (e.g. Wegener & Fürst, 1999; Bertolini, 2012), it is suggested that the development and maintenance of road infrastructure requires

consideration of the area around the project, and therefore also an integrated or area-oriented planning process (Arts, 2007; Struiksma et al., 2008; Heeres et al., 2012).

In the Netherlands a transition from line-oriented towards area-oriented road infrastructure planning approaches is visible over time. During the post-war period (1945-1970), Western countries were focused on the reconstruction of the country and on economic prosperity (Heeres et al., 2012). Travel behaviour became more car-centric and also private car ownership significantly increased (Banister, 2005). The increased demand for road infrastructure resulted in enormous systematic investments in the development and maintenance of a sufficient road network (Heeres et al., 2012). The commonly used approach was based on predictions using forecasting and modelling. This *predict and provide* approach resulted in a sectoral, siloed and mostly line-oriented approach to infrastructure planning on a local scale (Bertolini, 2019). To accommodate continuous growth and to maintain an adequate national road network, large-scale infrastructure development and maintenance projects remain necessary. However, from the 1970s onwards, public environmental awareness was raised and the drawbacks of continuous growth became apparent. During this period, the negative effects of car usage were exemplified e.g. health issues, environmental pollution, safety, etc. This growing public awareness led to opposition to infrastructural projects and institutional fragmentation. Combined with the economic impacts of the oil crisis, this resulted in delays within projects' planning (Heeres et al., 2012; Hajer and Zonneveld, 2000).

Internal and external integration

To handle these issues, the planning system needed to shift its perspective towards an approach that no longer puts forecasting and modelling central in road infrastructure development: towards intra and intersectoral integration (LUTI). Following the three types of external integration in road infrastructure planning as introduced by Struiksma and Tillema (2009), Heeres et al. (2012) established a model that depicts the trends and phases over time towards area-oriented infrastructure planning (Figure 3).

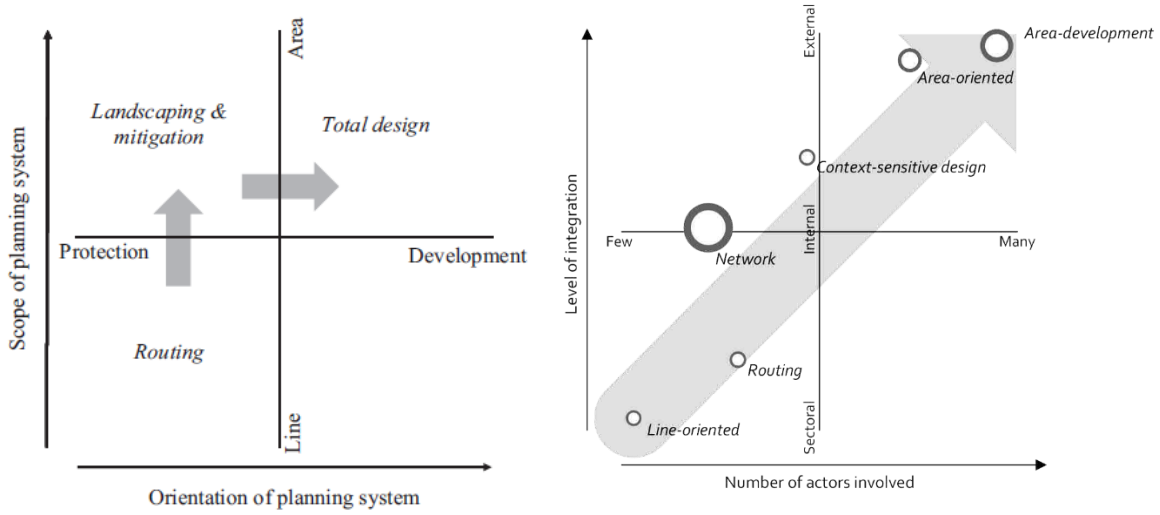

Figure 3 *Trends towards area-oriented infrastructure planning (Heeres et al., 2012)*

The first trend in the transition to area-oriented infrastructure planning is *routing*. The environmental effects of road infrastructure, needed to be minimized. The initial approach to do so was by using an engineering perspective for the routing of road infrastructure (Heeres et al, 2012). In this trend the relationship between road infrastructure and other land uses is

recognized, but infrastructure policy mostly remains separated from other spatial policy domains (Struiksma and Tillema, 2009).

As routing policy was not effective enough in minimizing the negative environmental effects, a new approach was introduced: *landscaping and mitigating*. Within this approach the context around infrastructure development was taken into account in the planning process. As roads form a physical barrier between areas, a tension between road infrastructure development and spatial/environmental quality is experienced (network-oriented) (Heeres et al., 2012). Minimizing the negative effects required a broader spatial scope in road infrastructure planning. At places where the negative effects were most present, mitigation and compensation measures – such as noise barriers and silent asphalt – were required because of noise and nature regulations. More recently, prevention measures have been used in addition to mitigation and compensation. Unfortunately, the financial burden of these measures is often high, and landscaping and mitigation measures are not always adequate to avoid landscape fragmentation (Heeres et al., 2012).

Area-oriented planning

Under the landscaping and mitigation approach, the relationship between road infrastructure and its surroundings remains to some extent disconnected. On the one hand, the planning of road infrastructure remained sectoral and line-oriented, while on the other hand, spatial planning has not sufficiently considered the mobility consequences of spatial plans, such as housing development. Heeres et al. (2012) suggested a more efficient alternative to the line-oriented approach would be an approach focused on the synergetic (re)development of areas by means of *total design*. This entails that road infrastructure ought to be adapted to the surrounding area and the other way around. The perspective of planning should thus be inside out (from infrastructure to the area) and outside in (from the area towards infrastructure) (Arts, 2007). This expansion of the planning scope leads to a growing number of parties involved in the planning process as there are more interests at stake, increasing the complexity. With the expansion of the planning scope, government action needs to be integrated by building both inter-sectoral and multilevel relationships between interdependent policy actors (Keast, Brown, & Mandell, 2007; van Geet et al, 2021). This requires the addressation of the institutional interdependencies (Woltjer, 2000) and enhanced governmental coordination between national and local levels (Heeres et al., 2017). Thus connecting local area-oriented planning to national policy and vision.

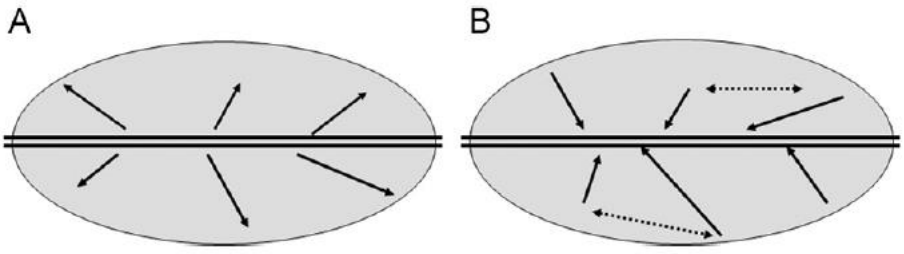

Figure 4 *Inside-out and outside-in (Heeres et al., 2012)*

2.3 From New Public Management to Public Value Management

As governments are institutionally interdependent on other parties and therefore cannot initiate a transition on their own, a shift in management style from government to governance was needed in earlier transitions. Such a paradigmatic shift occurred at the end of the 20th century when governments moved away from Traditional Public Administration to the more market-oriented New Public Management (Stoker, 2006). This shift entailed the end of the dominant position of the national government. The importance of other parties became apparent, resulting in both

privatisation and decentralisation. However, the negative effects of the existing New Public Management paradigm indicate another paradigm shift is needed towards a management approach that places more emphasis on social values and intersectoral collaboration rather than market forces and efficiency: Public Value Management (O'Flynn, 2007). This transition from NPM to PVM relates to the transition towards area-oriented planning as a larger background movement, in which similar aspects, such as joint collaboration, are central.

The *New Public Management* paradigm was a reaction to the existing Traditional Public Administration paradigm as a result of perceived weaknesses. Traditional Public Administration is characterised by Weberian bureaucracy and received criticism for its "monopolistic forms of service provision" (Stoker, 2006, p.45). "New Public Management arose out of a concern with government failures, a belief in the efficacy and efficiency of markets, a belief in economic rationality, and a push away from large, centralized government agencies toward devolution and privatization" (Bryson, 2014, p.448). The wish for a more market-oriented approach led to the exploration of New Public Management as an alternative.

New Public Management distinguishes itself from Traditional Public Administration by using markets and competition between actors to deliver government services as efficient and effective possible. The recipients of the services are no longer seen as citizens, but rather as clients (Bryson, 2014). The state now has to learn from market efficiency and this results in the rise of managerialism. The key objective of New Public Management is to manage inputs and outputs to ensure economic feasibility and responsiveness to clients. The role of the manager is no longer to ensure the rules and procedures are adequately followed, but rather define performance targets and ensure they are met (Stoker, 2006). For governmental organisations such as NRAs, this entailed a different type of governance within the organisation. The Dutch NRA for instance became an executive agency of the Ministry of Infrastructure and Water Management with specific tasks, assignments and responsibilities (mandate). This way more distance from national policy was created and policy and execution were divided into separate organisations (Lenferink, 2013).

This market-oriented public management approach also faces severe challenges. The focus on managing rather than governing is criticised as its suitability is questioned in increasingly diverse and complex societies dealing with highly complex issues (Bryson, 2014), such as interaction between land use and transport infrastructure (LUTI). New Public Management has led to fragmentation and the lack of central coordination (Rhodes, 1996). These issues ask for reconsidering the existing system and rethinking what should be central to public management.

This rethinking of the status quo has resulted in a new approach: *Public Value Management*. Central to this type of public management are citizens, citizenship and democracy (Bryson, 2014). Citizens are not seen as clients, but now fulfil a more engaging role in deliberative problem solving. Public value emerges from engagement through inclusive dialogue complemented with deliberation (Bryson, 2014). Therefore, this approach fits with more intensive forms of participation between multiple parties and sectors, in which differing needs and interests need to be adjusted to one another. The continuous process of involving each stakeholder's needs and wishes is important for successful plan and decision-making. For NRAs this entails joint collaboration with other parties to engage in co-creation or co-production (third coalition type as explained in Heeres et al., 2012). Public Value Management encompasses self-organisation by a diverse group of actors with achieving public value as its main goal. It tackles the issues the public is most concerned with. Public managers actively steer networks of deliberation instead of defining targets and ensuring they are met, which is one of the characteristics defining New Public Management (Stoker, 2006).

As a relatively large number and a variety of stakeholders is involved in public management within this approach, there are notable consequences in terms of time management. Public Value Management may result in endless dialogue without undertaking any or limited action. It is the task of the public manager to adequately steer the dialogue to ensure temporal limitations are not exceeded (Stoker, 2006).

Table 1 *Comparison of New Public Management and Public Value Management*

	New Public Management	Public Value Management
Key objectives	- Goals are politically provided; - Managers manage inputs and outputs to ensure economy and responsiveness to consumers.	- Create public value so that what the public most cares about is addressed effectively.
Mechanisms for achieving policy objectives	Create mechanisms and incentive structures to achieve policy objectives especially through use of markets.	Selection from alternative delivery mechanisms based on pragmatic criteria; this entails helping build cross-sector collaborations and engaging citizens to achieve agreed upon objectives.
Role of public manager	- Help define and ensure agreed upon performance objectives are met; - Responsive to elected officials and customers; - Wide discretion allowed.	- Play an active role in creating and guiding networks of deliberation and help maintain and enhance the overall effectiveness, accountability, and capacity of the system; - Responsive to elected officials, citizens and stakeholders; - Discretion is needed but is constrained by law, democratic and constitutional values, and a broad approach to accountability.
Approach to accountability	Market driven approach: aggregated self-interests result in outcomes desired by citizens that are seen as clients.	Multifaceted approach: public servants must attend to law, community values, political norms, professional standards and citizen interests.
Definition of public interest/value	Public interests are determined by elected officials or by aggregating individual preferences supported by evidence of consumer choice.	The common good is determined by broadly inclusive dialogue and deliberation informed by evidence and democratic and constitutional values.
Role of citizen	Customer/Client	Citizens are seen as problem-solvers and co-creators actively engaged in creating what is valued by the public and is good for the public

Source: adapted from Bryson (2014) based on Denhardt and Denhardt (2011, 28–29); Stoker (2006, 44); Kelly, Mulgan, and Muers (2002); Boyte (2011).

2.4 Multi-level perspective on transition theory

In Section 2.1 the importance of the interaction between transport and land use is illustrated. The interrelatedness between these functions asks for a transition from line-oriented to area-oriented planning approaches and a change in the current socio-technical system (Sections 2.2 and 2.3). A socio-technical system can be defined as shared cognitive routines and patterned development along socio-technical trajectories in a community consisting of social and technical users (engineers, scientists, policy makers, special-interest groups, etc.) (Geels and Schot, 2007). Here the social aspect relates to the institutional dimension and the technical aspect relates to the physical-spatial functional dimension. Transitions of socio-technical systems are rather complex and difficult to initiate as they appear when dominant societal structures are put under pressure

of both external change and endogenous innovation (Loorbach, 2010). This is referred to as the multi-level perspective on transitions.

Within the multi-level perspective on transitions a distinction between three analytical levels can be made: technological niches at the micro level, sociotechnical regimes at the meso level and sociotechnical landscapes at the macro level (Geels and Schot, 2007) (Figure 5). This distinction between analytical levels is made to describe the change processes in sociotechnical systems (Brugge et al., 2005).

The landscape or macro level is characterised by rigidity: it is subject to low-paced trends and large-scale changes (Geels, 2002; Brugge et al., 2005). For instance, changes in demographics, politics, macro-economics, culture, climate change, etc. (Geels and Schot, 2007). The macro level forms the external context for interactions between actors, and it cannot be directly influenced by regime and niche actors (Geels & Schot, 2007). Therefore, changing the landscape is more difficult compared to changing a regime. Changes in the landscape require a longer period of time (Geels, 2002). However, this low pace can be sped up in situations of external shocks, where there is a high urgency to change, e.g. in situations of war, financial crisis, natural disasters, etc. (Geels, 2019).

As landscapes are characterised by rigidity, regimes are characterised by stability. This entails that change processes happen gradually and are aimed at the optimisation of the regime in place. The regime or meso level constitutes of institutions, laws, regulations and norms (Stigter, 2019) that are assembled and maintained with the purpose of performing economic and social activities (Berkhout et al., 2003). There are two types of institutions: formal institutions and informal institutions. Formal institutions consist of rules, regulations and procedures that are publicly accepted as official, while informal institutions are socially shared values, rules and norms that are not official, but influence socio-political behaviour (Helmke and Levitsky, 2004).

Lastly, the niche or micro level is concerns individuals, groups, organisations and innovations (Brugge et al., 2005). The niche level is where the roots of innovations and new technologies lie. Change processes are not rigid or gradual, but rather radical. These novelties challenge the status quo and are divergent from the current regime. These niche innovations are developed by small networks of actors (Geels and Schot, 2007). They can be seen as deviations from the status quo (Brugge et al., 2005). Important here is that niche innovations are not self-contained, but that they are connected to one another to strengthen their position and bundle their pressure in a certain direction. Separate standalone niche innovations or pilots are unlikely to generate a transition on their own (Geels, 2019).

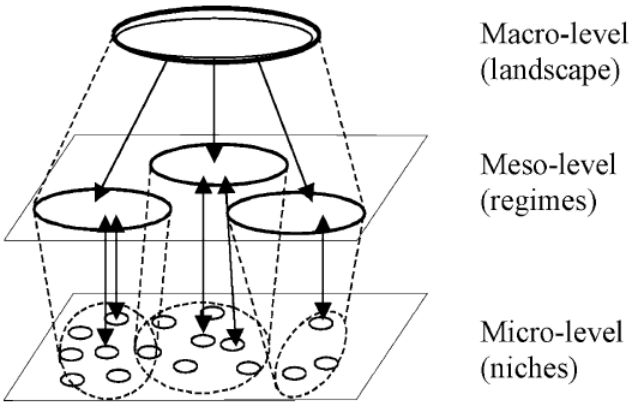

Figure 5 *Multi-level concept (Brugge et al., 2005 based on Geels & Kemp, 2000)*

Figure 5 illustrates how niches are embedded in regimes and how regimes are in turn embedded in the landscape. Geels (2002) refers to this as the *nested character* of the multi-level perspective. Change processes start at the regime level when innovations originating from the niche level are being upscaled. As a consequence, the niche innovation's influence increases, it develops momentum and the regime changes (Stigter, 2019). The described change process illustrates that the success of a niche innovation does not only depend on processes within the niche, but also by developments in the regime and landscape. A regime needs to be adequately adaptive, open and stable to accept radical innovations. Next to this, there needs to be pressure on the landscape to exploit change opportunities (Raven et al., 2010). Therefore, a transition is the result of interaction between all three analytical levels (Figure 6), where the regime is open for niche innovations and the landscape exerts pressure (Brugge et al., 2005; Geels & Schot, 2007; Geels, 2018).

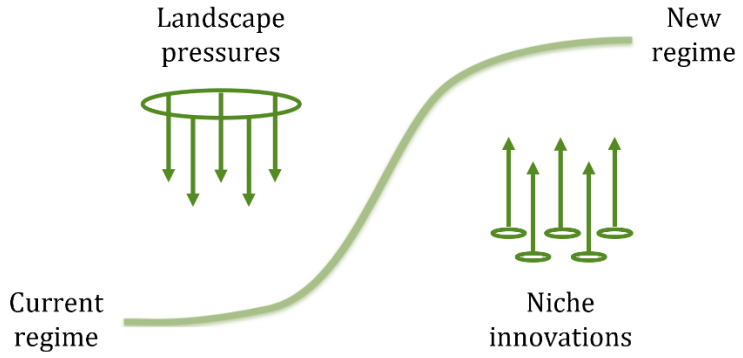

Figure 6 *Influence of landscape pressures and niche innovations on socio-technical regime transitions*

Geels and Schot (2007) use two critical factors in determining transition pathways: the timing of interactions and the nature of interactions between landscape, regime and niche. The timing of interactions refers to the difference in outcome when timing is different. Especially the timing of landscape pressures is of high importance: if landscape pressures on regime when niche innovations are not adequately developed yet, the transition path would differ from a situation in which the niche innovation was adequately developed (Elzen & Hofman, 2007). The nature of interactions refers to the type of relationship from the regime with the niche and landscape. The relationship can either be reinforcing or disruptive through pressure and competition (Elzen & Hofman, 2007).

Based on the multi-level perspective and combinations of these two critical factors, Geels and Schot (2007) define four potential transition pathways:

1. Transformation pathway: in the situation where there is moderate landscape pressure and niche innovations are not adequately developed, regime actors should modify the direction of development paths and innovation activities.
2. Technological substitution pathway: in the case of high landscape pressure, and sufficiently developed niche innovation, the innovation will break through and take over the current regime.
3. Reconfiguration pathway: in the adaptation of symbiotic niche innovation in the regime, the innovations trigger further modification of the basic structure of the regime.
4. De-alignment and re-alignment pathway: in the situation of large sudden change in the landscape and underdeveloped niche innovation, space is created for multiple niche innovations co-existing and competing against one another (Geels and Schot, 2007).

The characteristics of each pathway are summarized in Table 2 by Elzen and Hofman (2007) based on Geels and Schot (2007).

Table 2 *Taxonomy of transition pathways and the main actors*

Transition pathway	Main actors	Type of interaction	Characterisation
Transformation	Regime actors and outside groups (social movements)	Regime outsiders voice criticism. Incumbent regime actors adjust goals, guiding principles and search heuristics.	Outside pressure, institutional power struggles, negotiations and adjustment.
Technological substitution	Incumbent firms versus new firms	Newcomers develop novelties which compete with technologies from regime actors.	Market competition.
Reconfiguration	Regime actors and suppliers	Regime actors adopt component-innovations developed by new suppliers. Competition between old and new suppliers.	Cumulative component changes and new combinations.
De-alignment and re-alignment	New niche actors	Incumbents lose faith and legitimacy. Emergence of many new actors who compete for resources, attention and legitimacy.	Erosion, collapse, co-existence of multiple novelties, prolonged uncertainty and competition restabilisation.

Source: Elzen and Hofman (2007) based on Geels and Schot (2007)

2.5 Pilot syndrome

In the transition from one regime to another, the landscape exerts pressure on the existing regime and niche innovations are upscaled to reach a new socio-technical regime. In practice, niche innovations are often tested or evaluated using pilots in which knowledge is gained through learning-by-doing e.g. by governmental organisations. Within pilots a small-scale project is set up to learn lessons about practice, usually at a rapid pace. New theories and approaches are tested, often with success. However, the upscaling of such projects and the integrating of the new technologies or innovations into regular planning practice (insitutionalisation) often happens at a slower pace or even fails (Groenendijk, 2018). Groenendijk (2018) distinguishes between five characteristics of pilot projects as the main reasons for failure or slow integration of knowledge in planning practice:

1. Firstly, pilot projects are often characterised by having more room for innovation and dynamic development. Pilots are less prone to hierarchy, rules, regulations and routines. However, when upscaling a pilot that was executed with a lot of freedom into a planning system where there is less room due to a hierarchical organisation structure with its rules and routines, it can create a difficulty as the distance to the regular production environment is severely different.
2. Secondly, pilot projects are often given additional resources so that there is room to do a little extra and step up their development. The barrier resulting from these additional resources is that when implementing pilot into regular practice, there is a chance that the implementation falls out of the regular budget or outside of the available capacities.

3. Next to this, pilot projects are often carried out by enthusiastic participants that generally enjoy working on something new and innovative. In the process of upscaling the project into becoming a regular practice, it might be that other people (that are less enthusiastic) might not feel responsible for using the results of the pilot into their work routines.
4. Furthermore, pilot projects often have their own distinct method or way of working. This allows for easy triple helix collaboration between knowledge institutes, governmental organisations and businesses. Although these collaborations tend to be fruitful, they are not used regular collaborations within organisations. This again may result in severe difficulties in the upscaling of pilot projects.
5. Lastly, the character of pilot projects is explorative by nature. Pilots are innovative and aimed specifically at experimenting and learning. However, because of this explorative character of pilots, it does not necessarily effectively or efficiently contribute to the goals and objectives of organisations.

Thus, the process of upscaling pilots touches upon a tension between exploration and exploitation. Where exploration is focused on innovating through learning-by-doing, exploitation is concerned with the regular execution of goals and objectives (Groenendijk, 2018). The success of upscaling pilot projects lies in finding the right balance and creating connections between exploration and exploitation. Finding the right balance is therefore essential to institutionalise the innovations of pilots into regular planning practice, and thus transition into the new planning regime.

2.6 Conceptual model

Figure 7 below schematically indicates the relations between the transitions, concepts and theories discussed in this chapter. In order to reach a successful area-oriented approach a social technical regime change is needed. This change in regime consists of two related transitions. The first is concerned with the functional interrelatedness of land use and transport, where there is a shift from line-oriented to area-oriented planning. The second concerns the institutional interdependencies with a larger background shift from New Public Management to Public Value Management. Both transitions are affected by pressure from the landscape (DESTEP) and the niche innovations. The success of the institutionalisation of niche innovations in turn is influenced by the barriers of the pilot syndrome. A successful socio-technical regime shift results in successful area-oriented planning approaches. Success in this study is defined as the institutionalisation of area-oriented planning approaches within the field of transport infrastructure development through a joint collaborative process between a coalition of stakeholders, including the role of NRAs as a partner.

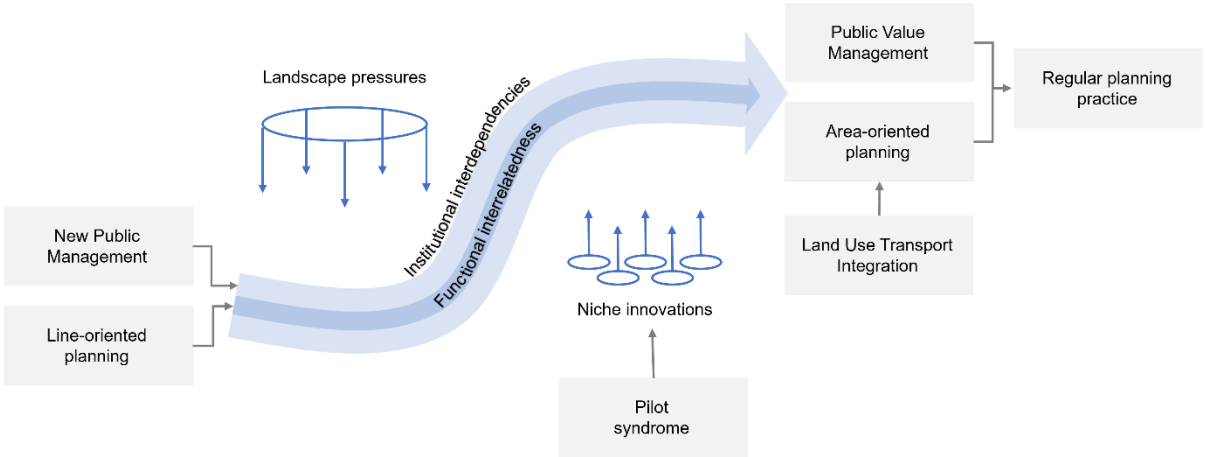

Figure 7 *Conceptual model*

3. Methodology

To answer the primary research question, "*How does the role of National Road Authorities affect the transition of area-oriented infrastructure development pilot projects into regular planning practice?",* a mixed-methods cross-case analysis is conducted using literature research, document analysis (research reports, case documentation, policy reports, etc.), generic and case-specific interviews and a round-table discussion. This qualitative method is specifically suitable to study this research question as both the formal and informal context of cases is discussed. Using this approach the spatial and institutional plans of seventeen pilot projects were reviewed and analysed. The role of NRAs was analysed to provide insights in how their role affects the outcomes of the projects and how they can provide suitable conditions for area-oriented projects to become institutionalised in regular planning practice. This chapter first elaborates on cross-case analysis and the selection of cases from the Collaborative Planning (i.e. SPINdesign), FLUXNET and Vital Nodes programs. Hereafter the used data collection and analysis techniques are discussed. This includes a literature review, a document analysis and semi-structured interviews. Lastly, the ethical considerations concerning this study are discussed.

3.1 Literature review

The first step of this study was to conduct a literature review to establish a theoretical foundation on the area-oriented infrastructure development and answer the first sub-question. The search terms used were 'land-use transport interaction', 'functional interrelatedness, 'institutional interdependencies', 'area-oriented development', 'line-oriented development', 'new public management', 'public value management' and 'transition theory'. These search terms were used both individually and combined with other mentioned search terms in the search engines Google Scholar, Scopus and Smartcat. The first search terms were selected based on Heeres et al. (2012), after which the snowballing technique was used to find additional articles based on recommendations from the search engines and based on references found in selected articles. The iterative process of adding on and adapting the theoretical foundation and conceptual model throughout the first stages of the research process served as an aid in refining the research aims and questions, the theoretical stance and the methodology (Taylor, 2016).

The literature review resulted in a description of the key concepts related to area-oriented infrastructure development and a conceptual framework that together form the theoretical foundation for the study. In this conceptual model the relations between the concepts and theories are made explicit. The results from the literature review were used to define indicators for the document analysis and the semi-structured interviews.

3.2 Cross-case analysis

The research method used is cross-case analysis. This research method is used as a comparative method to identify differences and similarities between the unit of analysis in case studies (Khan & van Wynsberghe, 2008). This can for example be activities or processes, but also projects. Cross-case analysis is described as "*a mechanism for mining existing case studies so that knowledge from cases can be put into service for broader purposes"* (Khan & van Wynsberghe, 2008, p. 3). This entails that there should be case studies available to compare, and that knowledge can be derived from the comparison to serve a broader purpose. Therefore, the method is suitable for this study, as there is sufficient case study material available through Rijkswaterstaat and the aim is to compare the development and transition of a multitude of area-oriented infrastructure development pilot projects. The broader purpose is to provide NRAs with an institutional foundation on how to upscale these pilot projects to successful projects.

This study has a three-tiered approach:

1. Firstly, each program (SPINdesign, FLUXNET and Vital Nodes) is studied using a document analysis.
2. Secondly, an inventory of the seventeen pilot projects is made using a document analysis and preliminary interviews.
3. Lastly, semi-structured interviews are conducted for an in-depth analysis of 4 selected cases from the inventory made in tier 2.

Initially, a first round of semi-structured interviews was planned for the broad case analysis. However, the results from the document analysis and the preliminary interviews showed that the Collaborative Planning working group members had limited access to documents and contacts information of potential interview candidates. Therefore, the scope of the research has been altered to an in-depth analysis of four cases after the document analysis and preliminary interviews.

3.3 Three-tiered research approach

Tier 1: Overall analysis research programs

The first step of the three-tiered approach consists of an overall analysis of the three research programs SPINdesign, FLUXNET and Vital Nodes. This overall analysis aimed to partially answer the second sub-question, concerning the development of the cases. Before diving into these cases it was essential to understand the objectives of each of the research programs. This was done through a document analysis of a variety of documents. This data was acquired through the websites of the respective programs, the internal CEDR archive, and members of the CEDR working group Collaborative Planning. The collected documents mainly consist of the research call documents, final reports, meeting minutes and presentation slides. The selection of documents can be found in the overview in Appendix 1. These documents were coded and analysed with qualitative coding software ATLAS.ti, according to the coding scheme in Appendix 5.

Tier 2: Inventory of cases

After the overall analysis of the research programs, a document analysis in combination with preliminary interviews was executed to study the development of seventeen selected pilot projects and the role and responsibilities of the respective National Road Authorities. For the case inventory all available cases from the programs SPINdesign, FLUXNET and Vital Nodes were selected, as these three programs have been executed the most recently with the involvement of CEDR. These pilots serve as best practices from their respective program and were used to form guidelines and toolboxes for other area-oriented infrastructure projects. The selected cases, their respective program and NRA are displayed in the Table 3.

Table 3 *Primary case selection*

#	Case	Country	Program	NRA
1	Tilburg	Netherlands	SPINdesign	Rijkswaterstaat
2	Linz	Austria	SPINdesign	ASFiNAG
3	Oslo	Norway	SPINdesign	Statens Vegvesen
4	Örebro	Sweden	SPINdesign	Trafikverket
5	Cologne	Germany	FLUXNET	Federal Ministry of Transport and Digital Infrastructure
6	Norrköping	Sweden	FLUXNET	Trafikverket
7	Rotterdam	Netherlands	FLUXNET	Rijkswaterstaat

8	Milano	Italy	FLUXNET	ANAS SpA
9	Mannheim	Germany	Vital Nodes	Federal Ministry of Transport and Digital Infrastructure
10	Strasbourg	France	Vital Nodes	
11	Turku	Finland	Vital Nodes	Väylävirasto
12	Genova	Italy	Vital Nodes	ANAS SpA
13	Hamburg	Germany	Vital Nodes	
14	Budapest	Hungary	Vital Nodes	Hungarian Public Road Non-Profit Company
15	Gothenburg	Sweden	Vital Nodes	Trafikverket
16	Rotterdam	Netherlands	Vital Nodes	Rijkswaterstaat
17	Vienna	Austria	Vital Nodes	ASFiNAG

The document analysis was initially supposed to be used to answer the second and third sub-question: to gain a better understanding of the selected cases, their development after the pilot phase and the role of NRAs. However, as the availability of documents was limited, not all necessary information could be collected. Attempts to collect the necessary documents through preliminary interviews showed the same result. Therefore, the scope of the second tier was altered and the document analysis and preliminary interviews have resulted in an overview of the seventeen cases according to the (end)reports of each program. The selected documents were collected through the websites of the respective programs in addition to the internal databases of the respective NRAs and participants from the preliminary interviews. The documents consist of policy documents, workshop reports, final reports and meeting agenda's and minutes. The documents were coded using the qualitative coding software ATLAS.ti, according to the coding scheme in Appendix 5. The document analysis resulted in an overview of the cases, in which the development of the case during the pilot phase is discussed. An overview of the selected documents is presented in Appendix 2.

Tier 3: In-depth analysis selected cases

Lastly, semi-structured interviews were conducted with interviewees that have been involved in one of the pilots. These were used to answer the second, third, fourth and fifth sub-question. After the case inventory (tier 2), four cases were selected for further in-depth research, based on the availability of the necessary documents and contacts. Semi-structured interviews were used to evaluate the roles and responsibilities, but also the possibilities, the mandate, the relationships and the dependencies of the NRAs during the upscaling of the pilot projects. The semi-structured nature of the interviews was chosen over fully structured interviews to remain flexible and organic in conversation and allow interviewees to describe their planning context. The selected cases are shown in the table below.

Table 4 *Secondary case selection*

#	Case	Country	Program	NRA
1	Rotterdam/ Tilburg	Netherlands	SPINdesign, FLUXNET, Vital Nodes	Rijkswaterstaat
2	Linz	Austria	SPINdesign	ASFiNAG
3	Oslo	Norway	SPINdesign	Statens Vegvesen
6	Norrköping	Sweden	FLUXNET	Trafikverket

Through semi-structured interviews on the selected cases information has been gathered that is not to be found within the formal and informal documentation used in the document analysis. With the interviews both additional as well as deepening information is gathered. The interviews were used to establish an understanding of the development of three selected area-oriented

transport development pilot projects, as well as the conditions and barriers in the upscaling and to establish an institutional foundation for National Road Authorities in how to ensure adequate conditions for the upscaling of pilot projects. A total of sixteen interviews were conducted: each interview relating to one of the selected pilot projects. The interviewees were selected following the criteria that they were involved within one of the pilot cases, e.g. consultant or NRA official. These professionals with long standing experience in the field of infrastructure planning were selected using the network of members from the CEDR working group Collaborative Planning, and the recommended interviewees suggested by earlier respondents. This method of selecting interview candidates is referred to as snowballing (Longhurst, 2016). The interview guide for the semi-structured interviews can be found in Appendix 3 and the list of interviewees can be found in Appendix 4.

Almost all interviews were held remote using a digital platform as the researchers location was of considerable distance from the participant's. Only interviews concerning cases in the Netherlands were conducted in a physical setting. Each of the interviews was transcribed and coded using coding software ATLAS.ti and according to the coding schemes in Appendix 5. The coding scheme for the interviews consists of multiple code groups consisting of deductive codes derived from the literature review.

Lastly, the preliminary results of this study were presented and discussed with the CEDR working group Collaborative Planning in a physical meeting in Oslo (1-2 June). During this session the aim of the study, the in-depth analysis of the four selected cases and the preliminary results were presented. After this, the members of the working group were asked to respond to the presentation and to provide complementary or new insights in the results. The discussions from this meeting have been used to finetune the results and discussion section of this thesis.

3.4 Ethical considerations

As the study includes a cross-case analysis and semi-structured interviews, critical reflection on the ethical matters is necessary. First, in the case of cross-case analysis and case study research the researcher might be subject to a confirmation bias as the method allows for subjective interpretation of qualitative data (Flyvbjerg, 2006). This entails that the researcher might have the tendency to confirm their preconceived hypothesis or expectations. However, Flyvbjerg (2006) argues that case study research is no more subject to confirmation bias compared to other research methods, and he demonstrates that the case study methodology is characterised by falsification rather than verification. The researcher has to ensure to use a variety of sources for the collection of information to minimize distortions in interpretation of the qualitative data (Clifford et al., 2016).

Regarding the interviews that were conducted in this study, the participants and their provided information was processed and used anonymously, as suggested by Punch (2014). All personal details, such as name and contact details, were anonymized in any documentation, with an exception for the participants' job title and the respective NRA. As the participants were situated in different European countries, the researcher chose remote interviewing with use of digital software. All interviews were recorded in verbal agreement with the participants. Conducting interviews online may create a distance between the researcher and the participant, which may lead to participants feeling less comfortable compared to physical interviews. However, participants were treated in a respectful manner to ensure a comfortable environment for them to share their expertise (Punch, 2014).

Lastly, the researcher is affiliated with the party of interest Rijkswaterstaat as the study was conducted during a research internship at the Rijkswaterstaat department of Water, Traffic and

Living Environment, in the cluster Environment. The research subject and the research design have been discussed with Rijkswaterstaat in order to assure the study fits within their research interests. To prevent bias from Rijkswaterstaat's influence on the study, a mixed methods approach is used (triangulation) and the preliminary results were discussed within the CEDR working group Collaborative Planning before finalising the study. Rijkswaterstaat has provided the researcher with internal documentation on the researched case studies. To ensure transparency (Punch, 2014) these documents were coded in accordance with the coding scheme in Appendix 5.

4. Research Programs into Area-Oriented Infrastructure Planning

In this chapter the latest research programs focusing on area-oriented or collaborative planning are discussed. These are the Collaborative Planning program from CEDR (including the SPINtrends, SPINdesign and SPADE projects), the FLUXNET program and the Horizon 2020 Vital Nodes program. The seventeen cases used in this study were all part of one of these programs, and therefore these programs placed the cases within a certain context.

4.1 Collaborative Planning (2018-2021)

Within the network of CEDR, National Road Authorities have expressed their need and interests for new innovative approaches. These should address the multi-dimensional nature of challenges within the infrastructure network, multi-modality, area development, time management, value capturing and governance. The National Road Authorities wish to jointly study how to achieve integrated projects when it comes to area-oriented infrastructure development (CEDR, 2017). To study these challenges, three mutually related issues have been formulated. Each resulting in a collaborative planning project: SPINTRENDS to identify future mobility trends, SPINDESIGN to create and implement a combination of measures, and SPADE to evaluate the value of measures.

The *SPINtrends* research project studied the trends in mobility and spatial development to explore effecting approaches to ensure future-proof road networks (CEDR, 2021). The project consisted of two phases. The first phase aimed to provide a well-substantiated basis to develop both a vision and a roadmap. This was done by identifying the trends, the conditions and barriers and the internal and external factors. This was followed by the development of measures suitable to deal with the identified trends. During the second phase the vision was developed. In this document the results of the first phase were combined and analysed to form a collaborative planning vision (CEDR, 2017). The vision functioned as basis for the development of the roadmap that provides National Road Authorities with a guideline to reach the objectives defined in the vision. This guideline consists of actions and transitions that are necessary for future work in the field of mobility and spatial development.

SPINdesign was a research project that studied the interface between long distance and last mile delivery transport (CEDR, 2021). The research comprised a good practice study from which a toolbox and a vision on collaborative planning and design were developed. The SPINDESIGN toolbox offers tools for National Road Authorities in optimizing their networks concerning their multimodal performance. These tools serve as an aid for National Road Authorities in install an integrated, multi-scalar collaborative approach (CEDR, 2017). This entails that the toolbox has a broad scope that goes beyond singular modalities, incorporates multiple spatial scales (corridor, regional and local) and that the key actors and stakeholders from multiple sectors are involved. This toolbox for tailor-made designing and planning is shown in the figure below. Lastly the developed vision consists of strategies and measures for National Road Authorities to improve the connection between long-distance transport and last-mile transport at the Daily Urban System level (CEDR, 2017).

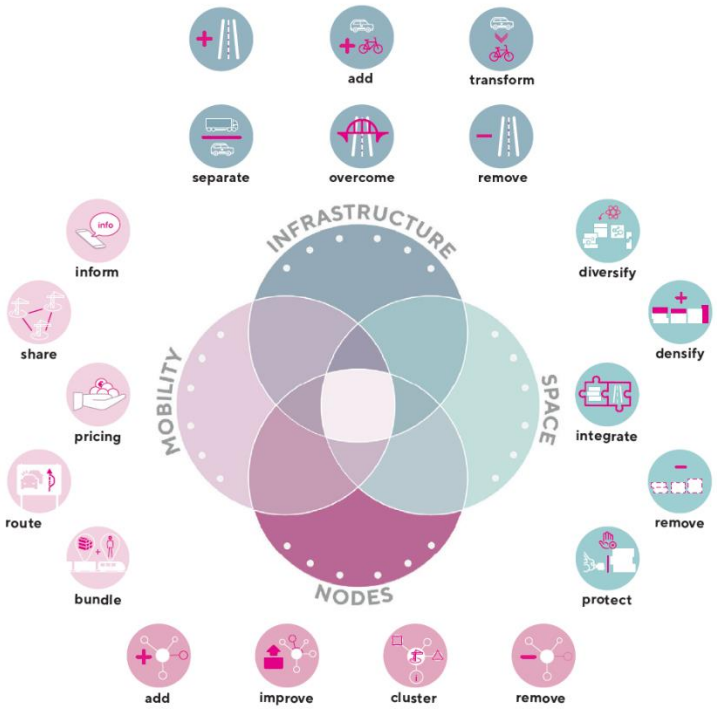

Figure 8 *SPINdesign toolbox for tailor-made design and planning (CEDR, 2017)*

The *SPADE* research project was aimed at evaluating the added value from spatial development within infrastructure planning (CEDR, 2021). The evaluation and assessment method comprises a process and a tool. The former consists of five steps to define the involved actors and their background, their diverting interests and the planning procedures necessary to collaborate. The latter comprises an assessment tool developed for Rijkswaterstaat combined with a multicriteria analysis and a cost-benefit analysis (CEDR, 2017). This evaluation tool guides National Road Authorities through the process. The project deliverable is a straightforward evaluation method for National Road Authorities through which (combinations of) measures can be assessed (CEDR, 2017). The SPADE assessment tool complements usual planning procedures and supports collaboration between actors in all stages of the planning process. The tool simplifies joint assessment of mobility measures and the exchange of information between actors (Hindriks & Kiel, 2021).

4.2 FLUXNET (2015-2018)

As the transport demand (both freight and person transport) is increasing, cities are growing, the logistic delivery demand is increasing, while stricter environmental rules are required, there is a growing need for a shift towards integrated planning for land use and infrastructure development (FLUXNET, 2018). To gain better understanding, the FLUXNET research project studied tools for planning professionals and National Road Authorities to optimize the multi-modal use of infrastructure networks. A FLUXNET spatial-infrastructural model was developed to aid planning discussion between authorities and actors from the transport and logistics sector. The model (Figure 9) visualizes the relationships between different scales (corridor, region, city), infrastructure (e.g. roads, waterways, pipelines), terminals (e.g. airports, inland ports, distribution centres, freight villages) and modes (e.g. networks, vehicles, operations) (FLUXNET, 2018).

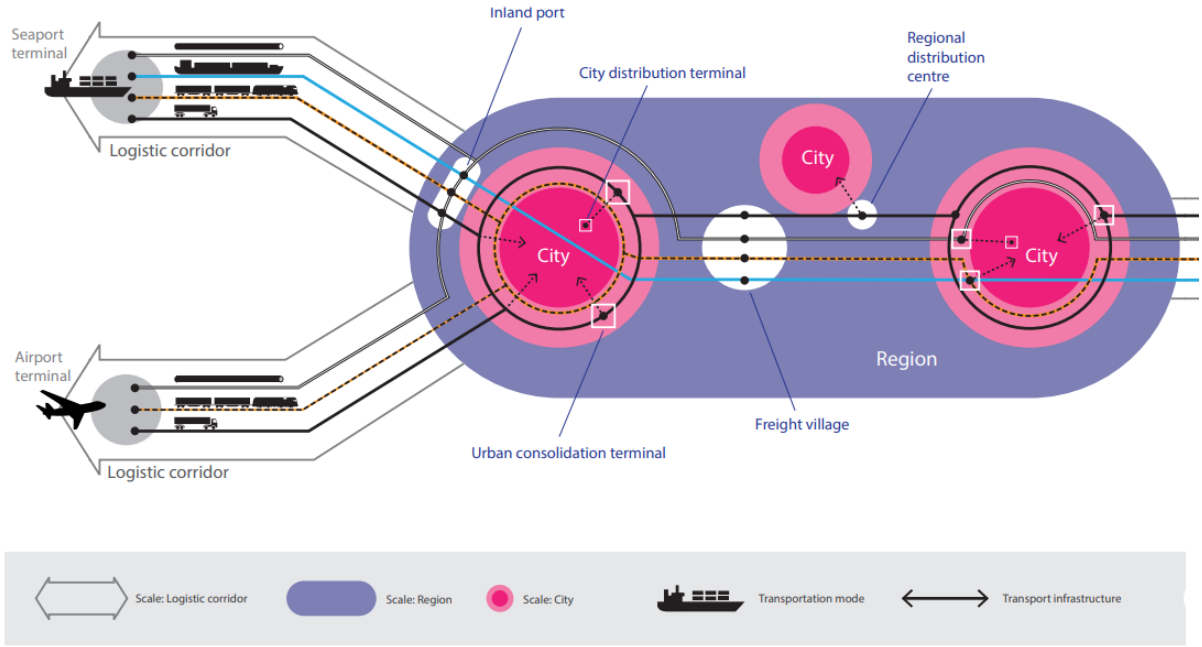

Figure 9 *FLUXNET scheme of the spatial infrastructural system for Logistic Orientated Development (CEDR, 2018)*

Consequently, the model was used to identify the effects of best practices on modalities. From the analysis an extensive list of principles was compiled that can be used by practitioners to optimize the spatial-infrastructural system's multi-modal functioning concerning transport and logistics (FLUXNET, 2018). Finally, it is recommended when selecting principles to follow the prioritization of the trias logistica:

1. Minimize the need for transport.
2. Optimize the use of existing sustainable infrastructural systems.
3. Add new sustainable infrastructural systems (FLUXNET, 2018, p.27).

For each region it is context-dependent which principle belong to which level, and must therefore be decided on by the actors that apply the toolbox (FLUXNET, 2018).

4.3 EU Horizon 2020: Vital Nodes (2017-2019)

As the population of most European cities is expected to continue growing in the coming decades (European Commission, 2019), there is a need to anticipate to an increase in freight and logistics traffic as well. The EU Horizon 2020 project Vital Nodes aims to bring together networks of different scales (European, national and regional) to enable efficient and sustainable freight delivery across urban areas (TEN-T urban nodes). At urban nodes challenges, resulting from increasing freight traffic demand, such as congestion, low air quality, noise nuisance and road safety risks are addressed. The objective of the project is to enhance European interconnection while developing sustainable urban mobility simultaneously (Vital Nodes, 2019).

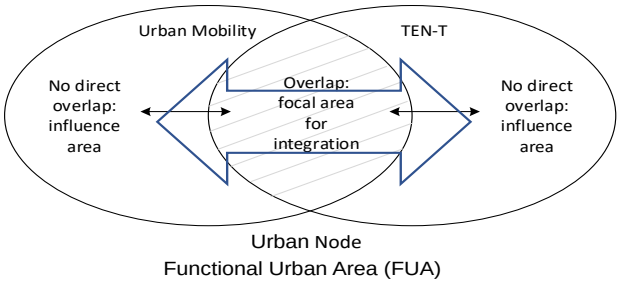

Figure 10 *Focal area for integration between urban mobility and TEN-T network*

Integrating freight logistics of urban nodes into existing network corridors is a complex process because of its multidimensional character (Poppeliers, 2018). Network issues of the transportation and mobility system need to be considered in relation to spatial issues derived from urban vitality. For instance socio-economic development, liveability and the spatial and environmental quality (Vital Nodes, n.d.).

The Vital Nodes approach builds upon the proven Networking for Urban Vitality (NUVit), a successful approach for addressing these challenges through spatial and infrastructure integration (Vital Nodes, 2019). It takes the full A-S-I approach into account:

- Avoid transport needs by integrated planning, e.g. Transit Oriented Development;
- Shift transport modes from car to other modes of transport;
- Improving transport means making it more sustainable via electric mobility, other fuels (SUPT, 2011).

In the Vital Nodes approach six dimensions related to mobility, land-use and infrastructure planning are integrated to exploit synergy effects. The dimensions are spatial, network, time, value, institutional and implementation. Together these dimensions take into account broad spatial opportunities and networks of different scales (Vital Nodes, 2018). In order to integrate TEN-T and urban mobility policy, the Vital Nodes toolbox was developed. It consists of analytical methods and requires that stakeholders have data, capacity and tools, including models, to be able to formulate SMART objectives and their role and function for the TEN-T network (Vital Nodes, 2019).

The Vital Nodes project is part of the EU Horizon 2020 research and innovation program. This program aims to remove barriers within innovative projects in the European Union (European Commission, 2020).

4.4 From programs to transitions

These three programs share a common interest: they all aim for better embedded infrastructure developments through area-oriented approaches. The specific cases and the repeated search for area-oriented approaches in these programs, demonstrate the importance and urgency of the transition. However, these programs also illustrate that not every NRA is as far along in the transition compared to other NRAs. The programs discussed can be seen as a tool for NRAs to help them transition through learning-by-doing. These programs provide NRAs with financial resources, room for innovation and dynamic development, and expert guidance. The involved NRAs are the first to try out and help develop tools for area-oriented planning. They are given the opportunity to become frontrunners in the transition and serve as an example for other NRAs.

5. Inventory of Cases

All seventeen cases from the three area-oriented research programs are selected and studied through a document analysis complemented by exploratory meetings with representatives of each case. In the exploratory meetings general information on individual cases was shared by experts. This chapter contains a broad overview of the cases as discussed in workshop reports, meeting and workshop minutes and additional material suggested by representatives. The results of this document analysis are summarised in Table 4 below Figure 11 displaying the geographical location of the cases.

Figure 11 *Location of the SPINdesign, FLUXNET and Vital Nodes cases*

The overview in the table above provides an inventory of all cases part of the SPINdesign, FLUXNET and Vital Nodes research programs. The seventeen cases are spread across Europe and represent large-scale or important urban nodes and transportation hubs (Figure 11). These cases are important due to their location along major transport corridors, such as Rotterdam at the end point of the Rhine-Alpine corridor or Vienna at the intersection of the Baltic Adriatic, Orient-East-Mediterranean and Rhine-Danube corridors (Figure 12).

Most cases face similar infrastructural challenges and therefore often have similar key objectives. For instance, almost all cases are prone to capacity issues, such as congestion and bottlenecks. In addition, many cases are required to increase capacities due to increasing passenger and logistical

demand, while simultaneously dealing with land use issues, such as a lack of space in combination with steep population growth, stricter environmental rules and regulations and the need for sustainable urban development. Therefore, the responsible actors of each case have been exploring integrated strategies to tackle these complex urban challenges. Proposed infrastructural and spatial measures are often aimed at connecting multiple modes from different scales to enhance multi-modal connections and efficiency for both freight and passenger transport, the promotion of alternative and more sustainable modes of transportation to induce a modal shift, and developing new connections or adjusting existing connections to increase network capacities while taking into account environmental considerations.

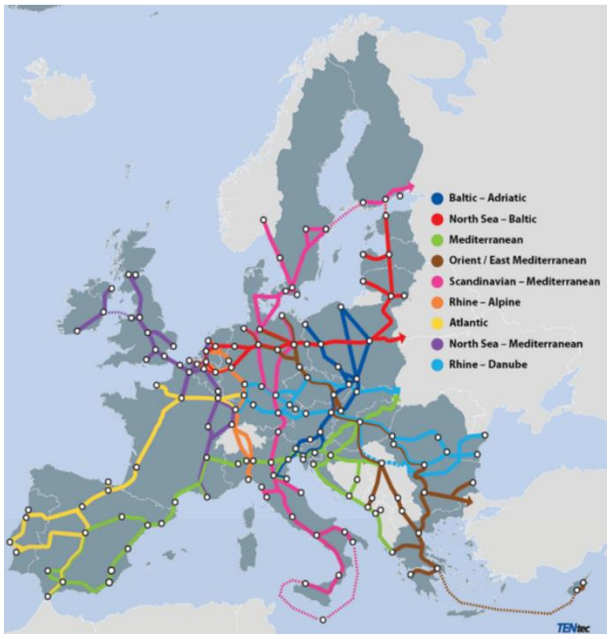

Figure 12 *TEN-T core network corridors (Eurostat, 2017)*

Table 5 *General case descriptions*

Case	Program	NRA	Description	Measures
Tilburg-Waalwijk	SPINdesign	Rijkswaterstaat	The interface between Tilburg and Waalwijk is part of the international freight corridor connecting the port of Rotterdam with the harbour of Antwerp and the industrial cluster Northrhein Westfalia. The spatial issue at hand results from pressure on the N260 and N261 created by logistical, business park, housing and leisure developments. The functioning of the mobility system is threatened due to competition for road capacity, while traditional expansion of road capacity limited. To deal with these issues the goal was set to make the N261 corridor the carrier of an integrated strategy encompassing logistics, mobility and spatial development through a series of SPINdesign measures.	- Logistics: specializing and clustering of terminals Waalwijk Haven, Vossenberg/Kraaiven and Loven to increase efficiency in use of infrastructure and assets. - Leisure: increase transfer points to theme park Efteling. - Commuters: increase infrastructure for other modalities (slow modes) + use of transit-oriented development around theme park Efteling.
Linz	SPINdesign	ASFiNAG	At the interface Linz two major European corridors intersect: the west-east corridor (A25 West – A1 East) connecting Munich, Vienna, Bratislava and Budapest, and the north-south corridor (A7 North – A1 South) connecting Prague to northern Italy. The city and region of Linz are challenged with strong population growth (+30.000 in city by 2030/+50.000 in region by 2030), high demand for commercial space along the A1, increasing travel demand on several scales and competition for infrastructure by different sectors. To solve the infrastructural challenges a regional integrated strategy is drawn that encompasses road infrastructure, rail infrastructure and spatial development.	- City Highway (A7): downgrading the use of the A7 by lowering speed limit, reserving lanes for public transport and slow modes, create a tunnel to give room to densification. - City Edge Highway (A1): integral development of multimodal infrastructure in urban development area by new access road parallel to A1, new rail line, implementing mainly regional functions (housing, education, shops), develop HUBs at rail stops and potentially a cable car between Ebelsberg and the center of Linz.
Oslo	SPINdesign	Statens Vegvesen	The most important north-south corridor in the Norwegian national road network is the E6. The corridor no longer meets current-day design requirements and results in issues from noise and air pollution. As a solution the construction of a tunnel is proposed, leaving more space above-ground for more sustainable modes of transport such as public transport and cycling infrastructure and for urban development.	- Increase in travel movements should all be in public transport, walking or cycling: construction of tunnel for car usage, more attractive routes/infrastructure for other modes above ground. - Construction of major logistical area at Alna: improve accessibility of other modes than car. - Construction of mobility hub at Ryen: new entry point of Oslo.

Örebro	SPINdesign	Trafikverket	In the Örebro region the public transport network is reaching its maximum capacity resulting in congestion on important public transport lines for both freight and personal transport. The region competes with Linköping and Norrköping on the Stockholm-Gothenburg connection with regards to freight and logistical activities.	- Development of a new bus rapid transit (BRT) line in combination with park+ride facilities to significantly decrease travel time and congestion. - Increased synergy between city development and logistics. - Development of a new connection between the university and other knowledge centres to improve the robustness of the logistical area. - Adjusting the appearance of the motorway that currently acts as a barrier.
Cologne	FLUXNET	Federal Ministry of Transport and Digital Infrastructure	The economic region of Cologne is one of the most important ones in the European Union. The region is undergoing strong economic growth resulting in pressure on both housing and the mobility network. Combined with an ongoing growth in person and freight transport, the pressure is expected to become highly problematic. Using the FLUXNET toolbox a variety of potential measures is offered.	- Optimize terminals: transform highway-oriented terminals into multimodal terminals (connection to rail system). - Add a terminal: e.g. distribution centres along the Rhine or urban consolidation terminals at the edge of Cologne and Bonn. - Optimize infrastructure: deepening of the Rhine, use rail network for cargo transport at night, separate cargo and freight transport within existing infrastructure. - Add infrastructure: new rail track for freight transport outside urban conglomerations. - Optimize a mode: synchromodal transport. - Add a mode: e.g. high speed cargo train.
Norrköping	FLUXNET	Trafikverket	With the proximity of Stockholm and its current growth, the town of Norrköping (150 kms south of Stockholm) is rapidly transforming. Plans for a new high speed railway, a new station, the transformation of the inner-city harbour into residential area and the isolation of harbour activities at the harbour island. These developments are combined with the ambition to establish a sustainable and healthy transport system in which pedestrians, cyclists and public transport are central. To facilitate the developments in Norrköping and a sustainable and healthy transport system a new urban ring structure is proposed, in which a new connection to the highway corridor is proposed.	- High-speed railway to improve connectivity of the labour markets. - Urban densification to construct more housing (e.g. at inner-city harbour). - Transit oriented development. - High standard of urban quality to compete with other labour markets by for instance isolating heavy industry at the harbour island to realize high environmental quality in urban areas.

Rotterdam	FLUXNET	Rijkswaterstaat	As Rotterdam is within close proximity to the North Sea, it is often referred to as the gateway to Europe. Rotterdam has a well-connected network to the Randstad area and the hinterland by road, rail and waterways. With one of the most modern and automated harbour terminals in the world, Rotterdam struggles with the isolation of the harbour from the city. While on the other hand the growing logistical mega hub and urban development are interlinked. To enforce the relationship between the harbour and the city four measures were proposed.	- Enforce relation by establishing new hot spots: major investments in highway network (expansion A15, linkage to A4, new tunnel A22, etc.). - Ensure consistency between local scale planning and the city's mobility vision/other policies. - Brainpark location as potential new distribution logistics hub. - Find solutions for social challenge in type of workers (low-skilled to high-skilled).
Milano	FLUXNET	ANAS SpA	The Lombardy wider region is referred to as one of the four motors of Europe due to its heavily industrialised areas in multiple fields that contributes to about 25% of the national GDP. Two spatial challenges in the region are the strengthening of capacities along the Rhine-Alpine corridor and the improvement of hinterland connections between industrial and logistic areas, and ports. For the first challenge especially the freight flows can have a high impact on the transport and logistics system.	- Improvement of connection between seaport of Genua and the regions along the corridor in Germany and improvement of inland terminals. - Investments to improve the rail network of Lombardy as expected growth in modal share for rail due to improvement of Gotthard Base Tunnel and improvement of Swiss rail network. - Construction of multimodal corridor terminals with proximity to urban centres using smart urban design solutions to handle the conflict between highly urbanized areas and infrastructure development. - Improvement of road connections to ensure good multimodal performance.
Mannheim	Vital Nodes	Federal Ministry of Transport and Digital Infrastructure	The Mannheim region is situated at the centre of the European transportation network. With major motorway connections (A5/A67 north-south and A6 east-west), a large railway network for international passenger and freight trains, and its location along the Rhine and the Neckar connected by the Mannheim/Ludwighafen harbour, Mannheim is an important European node.	- Renovation of the two Rhine bridges at Mannheim and Ludwigshafen. - Major maintenance of bridges in general. - Limited possibilities to cross the Rhine makes the Rhine a large physical barrier. - Noise nuisance caused by train tracks laying in close proximity or within residential areas. - Connection to the Chinese Silk Road with Mannheim as a final destination instead of a pass-through station. - Brownfield redevelopment of former US Army areas.

Strasbourg	Vital Nodes	Direction départementale des territoires du Bas-Rhin (decentralised)	The urban node Strasbourg is situated in close proximity to the German, Luxembourg and Swiss border, and is a European Union political hub. The city is located in the Alsace region where four TEN-T corridors intersect (Rhine-Alpine, Atlantic, North-Sea Mediterranean and Rhine-Danube) and has good access to roads, railways and inland waterways.	- Connecting the corridors, especially container transport along the Rhine. Strasbourg is currently excluded from the Silk Route that is expected to end in Duisburg. - Bottlenecks at Rhine bridges due to the expanding logistic pressure of e-commerce. - Lack of good connection for pedestrians and cyclists at the port of Strasbourg and the general quality of life due to industry. - Economic and social unbalance in the Grand Est region. - Stimulating awareness and involvement of inhabitants. - Cross-border collaboration and harmonization.
Turku	Vital Nodes	Väylävirasto	The urban node Turku is located at the northern part of the Scandinavian-Mediterranean corridor, connecting to Stockholm (West), Tallinn (South) and St. Petersburg (East). Turku is part of the Northern Growth Zone and functions as the network coordinator with half of the Finnish population and jobs situated in this zone.	- High travel time for railway connection between Turku and Helsinki (new high speed train connection) - Changes in supply chain management. - Shallow channels at port area of Turku (pilotage fee). - Optimization of (inter)national transport flows e.g. agreement with Russia on regulations.
Genova	Vital Nodes	ANAS SpA	The most southern point of the Rhine-Alpine network corridor is located at Genova. The corridor forms a connection between Southern Europe and the North Sea with along the route Switzerland, France, Germany, Belgium and the Netherlands. The Genova network consists of the modalities road, rail, air and waterways. The key challenges for the urban node are a lack of space as Genova is situated on a small stretch of land between mountains and the sea and need for a modal shift from road to rail.	- New motorway bypass (Gronda). - Cableway from Genova airport to new Erzelli railway station (GATE project). - Upgrade of the Genova railway junction. - New railway connection along the Rhine-Alpine corridor. - Updated Urban Plan for Sustainable Mobility. - Increased capacity at port of Genova and port of Savona. - Modal shift incentive stimulation (freight logistics from road to rail) (Ferrobonus). - Regional collaboration with north-west regions Piedmont, Lombardy and Liguria.

Hamburg	Vital Nodes	Federal Ministry of Transport and Digital Infrastructure	The Metropolitan Region of Hamburg is home to the third largest port of Europe and Europe's largest railway port for maritime transport. Three core network corridors come together in Hamburg: the Scandinavian-Mediterranean, the Orient-Eastern Mediterranean and the North Sea Baltic corridors. The Metropolitan Region of Hamburg faces challenges such as the vulnerability of the network as the port of Hamburg is perceived as an inner-city hub and there is competition between (inter)national freight and local passenger transport. Other challenges are environmental impact combined with low air quality and noise nuisance, and limited space due to physical barriers.	- Involvement of inhabitants at the functional urban level. - Investments in a tunnel network for roads to deal with limited space and noise nuisance and air pollution. - Stimulating cycling by creating a safer environment for cyclists.
Budapest	Vital Nodes	Hungarian Public Road Non-Profit Company	The city of Budapest is located along three TEN-T corridors: the Mediterranean, the Orient-Eastern Mediterranean and the Rhine-Danube corridors. Furthermore the city has an important railway hub for both passengers and freight. However, Budapest experiences some issues, such as limited accessibility towards the west due to heavy congestion (M1 motorway), the unfinished ring road (M0) leading to additional traffic through western city districts, the limited development of navigation on the Danube inland waterway and limited adaptability to policy changes and innovations.	- Limiting freight transport during peak hours by use of travel demand management. - Logistics-oriented development. - Development of a cargo centre at the edge of the city. - Development of micro and midi hubs.
Gothenburg	Vital Nodes	Trafikverket	On the Scandinavian-Mediterranean TEN-T corridor the urban node of Gothenburg is situated with freight and passenger transport (road, rail, air, water). The port of Gothenburg is seen as the gateway of Scandinavia, the city has six intermodal freight terminals and one rail terminal. The crossing of multiple national highways (E45, E29, E6, highway 60) in the city centre cause a bottleneck in the network. Next to this, the Gothenburg airport is located 20 kilometres outwards of the city without a rail connection. Furthermore Gothenburg faces challenges due to the conflict between a growth (population, housing, workplaces) and coexistence (with nature), physical barriers that create an unconnected feeling in the city	- Expansion of ElectriCity project (electric bus network for public transport with multiple functions at nodes such as parcel shop and cafés). - Opening of new shipping routes. - Deepen entrance to the port of Gothenburg. - High speed rail link between Gothenburg and Stockholm. - Overcome barrier between two parts of the cities by building a bridge. - Completion of the ring road. - RiverCity: redevelop the former inner city port and densify the inner city. - River as barrier: lowering of the renewed Hisingsbron bridge.

			(river) and competition between the rail and road network.	
Rotterdam	Vital Nodes	Rijkswaterstaat	Urban node Rotterdam is one of the end points of the Rhine-Alpine corridor connecting the North Sea port with the North of Italy. Rotterdam is seeking to find the right balance between city, labour, logistics and transport as the relationship between the city and the port is limited interconnected. Next to this, some tension is experienced between small residential areas in relation to the port. Furthermore, congestion may occur at motorways A15 and A16 due to suboptimal supply chain handling. Another challenge is the need to realise 50.000 dwellings in the existing urban area.	- The mixing of functions to intertwine the port and the city. - Transformation of/revitalising the port area (near Rozenburg, Pernis and Heiplaat). - Collaboration in the supply chain and on the corridor level for more optimal fast handling (make better use of existing infrastructure by densifying, investment in other modalities to improve connections between urban nodes). - Potentially congestion charge that will be reinvested into the city (example from Sweden). - Potential housing development in the rail corridor The Hague – Delft – Rotterdam – Dordrecht (transit oriented development/logistics oriented development).
Vienna	Vital Nodes	ASFiNAG	The urban node Vienna is situated along the intersection of three TEN-T core network corridors: the Baltic Adriatic, Orient-East-Mediterranean and the Rhine-Danube corridors. The city needs to accommodate for the rapid population growth of 40.000 inhabitants per year, resulting in an expected population of 2 million by 2030. The key challenges of urban node Vienna are the lack of logistics oriented development (link between long distance and last mile logistics), the lack of coordinated spatial planning at the functional level (resulting in ad hoc urban sprawl) and the robustness and vulnerability of the network (capacity constraints).	- The organisation of logistics and distribution centres and the creation of multi company hubs. - The development of a common strategy with Bratislava (on east-west connections). - The construction of alternative routes, modes and timing.

6. In-Depth Analysis of Cases

The seventeen cases analysed in Section 5 all aimed to use integrated strategies to deal with complex spatial and infrastructural challenges. Unfortunately, information concerning the development and the current status of the projects is scattered and difficult to acquire. As specifying the successes and the failures of the cases in relation to the area-oriented or integrated strategies is central to this study, four cases were selected for a further in-depth analysis on the basis of the availability of data. The selected cases are Rotterdam/Tilburg (The Netherlands), Linz (Austria), Oslo (Norway) and Norrköping (Sweden). The results in this chapter are based on the preliminary meetings, document analysis, expert interviews and a collective group discussion of the CEDR working group Collaborative Planning. Each section describes the development of the cases after the pilot-phase, the barriers, success factors and conditions for the project and the mandate and role of each NRA. In section 5.5 the four cases are compared and linked to the theoretical foundation of this research in order to determine where the NRAs are positioned in their transition towards area-oriented planning.

6.1 Rotterdam/Tilburg-Waalwijk, Netherlands

Background

The city of Rotterdam is characterised by its harbour, also known as the gateway to Europe (Linden and Linssen, 2018). The freight imported in the harbour needs to be distributed to its hinterland reaching over Western Europe. As roads are often used for the growing freight distribution, as well as passenger transport, the road capacity needs to be expanded. As part of the SPINdesign programme, measures such as the creation of transfer points and transit-oriented developments were proposed. The FLUXNET programme also aimed beyond infrastructural improvements. Major investments in the highway network are needed for other routes as well to increase capacities (A4, A15, A22). Lastly, the tension between the harbour and the city needs to be addressed. This tension between the two sides of the city have been an issue for a longer period, and were also part of the Rotterdam case in the Vital Nodes program, where the suggested measures were to mix functions to intertwine the port and the city, and to revitalise the port area (Linden and Linssen, 2018).

Since the pilot programmes were executed, improving the road infrastructure network in the Rotterdam region was linked to the Topcorridor programme (R12). This programme is aimed at connecting the Netherlands with the Ruhr-Gebiet industrial area (in Northrhine-Westfalia, Germany), as it forms and important link between European economic zones and is vital for the Dutch economy. As part of this programme the road infrastructure between Tilburg and Waalwijk is being renewed (R12). This corridor is an important link between the harbour of Rotterdam and the harbour of Antwerp, as well as for the industrial area of Northrhine-Westfalia in Germany Linden and Linssen, 2018; R10). The expansion of road capacity on this corridor is limited due to environmental concerns for a nearby national park/Natura2000 area (Loonse and Drunense Duinen) (Arcadis, 2011). Therefore, a range of non-infrastructural measures is taken, using an integrated strategy (R10). The Topcorridor programme aims for integral and borderless corridor development and partners with several regional governments to ensure well-connected links and nodes (Topcorridors, n.d.).

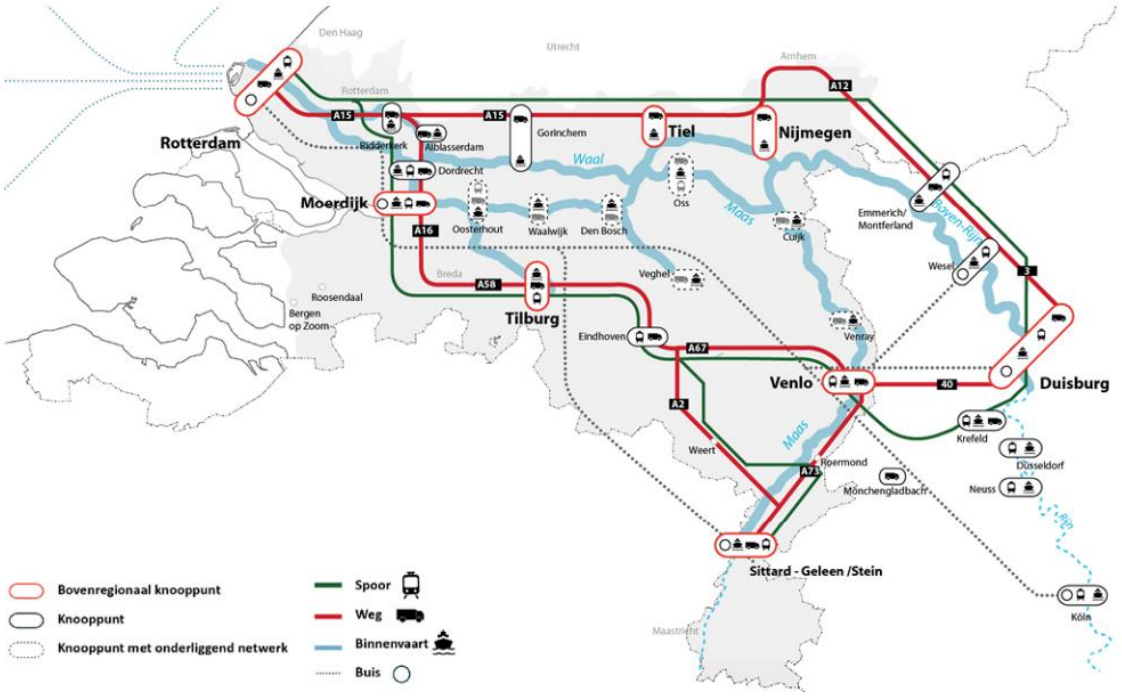

Figure 13 *The infrastructure and node network connecting the harbour of Rotterdam with its hinterland through the TEN-T Rhine-Alpine corridor (Topcorridors, 2019)*

Barriers

One of the barriers for Rijkswaterstaat in the case of Rotterdam is the organisational structure that limits having a broader scope to infrastructural planning (R4; R8; R9; R12). Rijkswaterstaat functions as a partner in this project as they are involved in many infrastructure networks in this region (highways, waterways, bridges, tunnels, and flood safety infra). However, Rijkswaterstaat is traditionally organised in a sectoral manner with a project-oriented planning approach (Leendertse & Arts, 2020; R4; R9). This organisational structure results in hampers in relationships with stakeholders. Rijkswaterstaat builds on project-oriented relationships with lower levels of collaboration (e.g., information and consultation) rather than structural contact with partners with higher levels of collaboration (e.g., co-creation) (R9). This organisational structure often results in top-down decision-making by one actor rather than collaborative decision-making as Rijkswaterstaat is often performance- and technically oriented.

Secondly, using area-oriented approaches is often a task for employees to do next to their main tasks. Within the time employees are given, their main tasks end up being prioritised over their side tasks. Employees whose main task is ensuring area-oriented approaches in projects is limited (R8; R9).

Success factors

One of the success factors is the overarching programme Topcorridors, which provided a platform for different stakeholders to collaborate. This program allows the governmental organisations to collaborate beyond the borders of their ow province or country. For example, in 2019 the Dutch Ministry of Infrastructure and Water Management signed a collaboration with the Ministry for Traffic in Nordrhein-Westfalen to jointly work on connecting economic zones and enhancing the TEN-T corridors in the region. With this collaboration the involved parties pursue a joined agenda for the development of corridors where cross-border collaboration and area-oriented development are central themes (Topcorridors, n.d.). Additionally, the cross-border relations allow for the cross-border exchange of knowledge between ministries and provinces

(Topcorridors, n.d.). The incentive to motivate each stakeholder to collaborate in this joint planning process is the possibility of obtaining state funding and assistance in the project. All actors bring expert knowledge and financial resources to the table, and gain valuable connections and develop robust cross-border and integral corridors (R12).

Role of Rijkswaterstaat

Rijkswaterstaat is the executive agency of the Dutch Ministry of Infrastructure and Water Management. They are responsible for the design, construction, management and maintenance of the main infrastructure network and facilities in the Netherlands. This includes multiple modalities: both the national road network and the national waterways (Rijkswaterstaat, n.d.). For this specific case this entails that all designing, maintaining, management and maintenance for the corridors (N261) and the waterways from the port of Rotterdam are the responsibility of Rijkswaterstaat. Within this project the role of Rijkswaterstaat is that of a partner. Rijkswaterstaat is an important actor in the Topcorridor programme that is being led by the Ministry of Infrastructure and Water Management. Rijkswaterstaat is the administrator of the road and waterway networks and facilities in the Rotterdam region (R12). Rijkswaterstaat aims to take on the role of an "area partner" ("gebiedspartner"), which can be linked to an area-oriented planning approach (R9). However, Rijkswaterstaat still has a long way to go as both partners and representatives of the organisation expressed that the role of Rijkswaterstaat as an area partner is still somewhat lacking due to their project-oriented and technical approach (R8; R9). Partners specify that Rijkswaterstaat has obtained an extensive knowledge base, but is sometimes unable to use it when needed (e.g. due to limited capacity). This project-oriented approach can be linked to the sectoral organisational structure of Rijkswaterstaat (R9; R10). This traditional structure does not allow for robust and stable connections between different parts of the organisation, resulting in suboptimal planning interventions where only limited capacity of the organisations knowledge and experience is used (R9). Next to this, the company culture of Rijkswaterstaat does not have an explorative character (R9), resulting in limited or slow institutionalisation of new innovations and approaches. Speeding up the transition towards area-oriented planning may therefore need a change in structure and culture.

6.2 Linz, Austria

Background

Two major European corridors intersect at Linz: west-east corridor and north-south corridor (see Figure 14). With an expected population growth and a high demand for commercial space, the travel demand is increasingly creating pressure on the junction of the corridors (SPINdesign, 2020a). During the SPINdesign process of Linz it was envisaged that the infrastructural issues would be solved using a regional integrated strategy encompassing road infrastructure, rail infrastructure and spatial development (SPINdesign, 2020a; R7). Therefore, the Austrian public road administration ASFiNAG joined the municipality of Linz, the Austrian federal railways, the provincial administration and other stakeholders in the early planning and analysis phases. During this stage ASFiNAG fulfilled the role of a partner and contributed to the preparation of analysis and concept development (R7). As the main objective was to release the congested highways (A7 and A1), it was decided to focus on creating a modal shift by developing a multimodal junction with a new rail connection and an extension of the tram network (R7). Within this transport project, land use development projects were also taken into consideration, for instance the new location of the new soccer stadium. As none of the project objectives involved measures concerning the road network, ASFiNAG is no longer involved in the project. The project is currently led by the Province of Upper Austria and the federal railways (R7). Although the project is expected to heavily influence the road network, ASFiNAG is not up-to-date or aware of

any activities concerning the project (R7). The only way in which the road authority is involved is through the co-financing of a P+R facility located at the multimodal hub. This P+R facility is aimed at car users parking outside of the city and travelling further using public transport (tram or train). The Federal Ministry regulates the extent to which ASFiNAG is allowed to financially participate in the construction of commuter parking facilities.

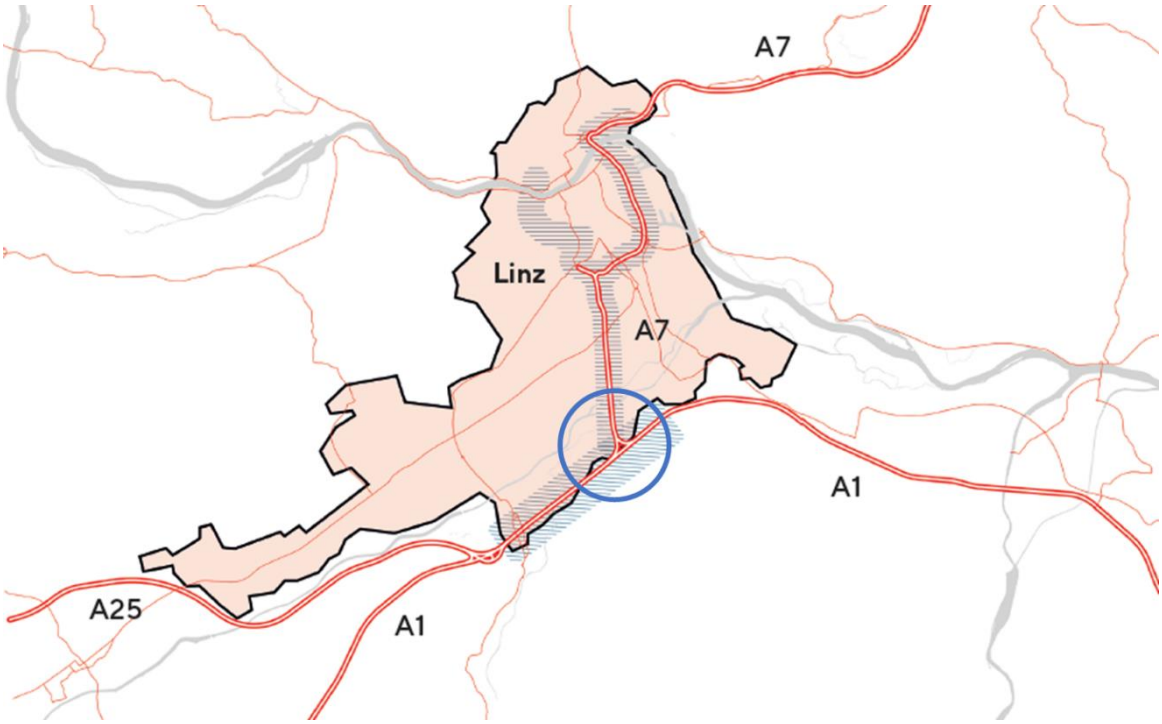

Figure 14 *Map of the intersection of the A1 and A7 at Linz (ASFiNAG, 2018)*

Barriers

The foremost barrier of ASFiNAG in the project is their limited involvement in in the project. In the early planning stages ASFiNAG considered themselves a partner: "*ASFiNAG has seen itself as a partner in the project, as the potential for relieving the motorway network seems to be given. For this reason, ASFINAG was involved in the brainstorming process and contributed to the preparation of potential analyses and concepts*" (R7). Currently, their role for the planning of the multimodal junction has been reduced to being a co-financer for only a small part of the project, namely the P+R facility (R7). Even though the role of ASFiNAG was reduced to co-financer, they still could have been involved as a stakeholder in the planning process of the project, especially considering the influence of the project on their infrastructure network. However, as the project did not include infrastructural measures for the road network any longer, ASFiNAG disappeared from the planning scene. The remaining project objectives did not fall within the mandate of ASFiNAG and therefore the Austrian NRA was no longer actively involved in the planning process (R7). Without being up-to-date on the current planning or activities, it is difficult to adapt future infrastructure planning strategies to the development of the multimodal hub (R7).

A second barrier is the limited scope within the mandate of ASFiNAG when it comes to multimodal projects. In the ASFiNAG Authorisation Act the mandate of ASFiNAG is limited to solely motorways and expressways (R7). Therefore, as long as no road infrastructural measures are required, collaboration within the transportation sector with other modes of transport is difficult, let alone collaboration outside of the transportation sector e.g. urban planning and land use development. ASFiNAG as an organisation is structured in a way that limits itself from collaboration with other transport providers. The mission of the NRA is to develop and maintain reliable motorways and

expressways: "ASFiNAG funds all expenses – from new roads to functioning winter services to clean service areas – solely with its own resources. Toll revenues are directly reinvested into the infrastructure – ensuring even higher safety" (R7). The NRA's mission, mandate and funding are highly focused on road infrastructure. Therefore ASFiNAG misses meaningful and lasting collaborations with other (governmental) organisations. Using area-oriented approaches proves to be difficult: ASFiNAG remains stuck in its silo.

Success factors

In the starting phases of the multimodal junction project, ASFiNAG has demonstrated its ability to collaborate with other transportation providers and local governments (R7). Maintaining such relationships and staying involved is a prerequisite for successful area-oriented planning. Engaging in area-oriented planning requires broadening the scope and mandate of ASFiNAG.

Secondly, despite their limited mandate, ASFiNAG has not entirely withdrawn from the project. They are still involved in developing a P+R facility (R7). ASFiNAG's contribution may be of a smaller scale, but it is still an improvement of the local infrastructure.

Role of ASFiNAG

ASFiNAG is a state-owned company that is responsible for the planning, funding, building, maintaining and operating of the motor- and expressways in Austria (ASFiNAG, n.d.). Next to that, ASFiNAG collects toll along their roads, which is directly reinvested into the infrastructure network. Through these toll revenues, ASFiNAG collects all its finances and thus does not receive any subsidies from the state budget. Therefore, ASFiNAG funds all expenses of the road network solely with their own resources (R7). These financial arrangements ensure that all financial resources collected are directly reinvested in the road network. The Austrian NRA does not rely on other parties and thus is financially independent. As the mandate of ASFiNAG dictates that the organisation is mainly responsible for the road network, there is limited organisational incentive to use the financial resources (initially allocated for road development and maintenance) for anything other than the road network. Considering the mandate and the financial independency of the organisation, ASFiNAG does not have much stimulus to shift to area-oriented planning.

The role of ASFiNAG in the Linz project is somewhat passive and reserved. Although involved in the early stages of the planning process, ASFiNAG was not able to broaden their scope and stay involved when no road infrastructure measures were required to combat congestion (R7). As the main objective of the project is to relieve pressure from the road infrastructure network, it is viable for ASFiNAG to stay involved in this project. However, since the project no longer requires road infrastructural measures (other than a P+R facility), ASFiNAG has withdrawn from the planning scene. ASFiNAG missed out on the opportunity to build valuable collaborations with key players of other transportation modes and land use developers, and therefore the organisation missed out on experimenting with and learning from area-oriented planning. Within such a project, ASFiNAG's role does not have to be that of a leader or coordinator, but can be that of a stakeholder or area partner.

6.3 Oslo, Norway

Background

A strong increase in traffic during the past 15 years has led to increased pressure on the transport system around Oslo. The E6 Oslo East is considered outdated and exceeds noise and air pollution limits (SPINdesign, 2020b). As the E6 is the most important north-south corridor of the Norwegian national road network, a plan to create a tunnel from Abildso to Alna was proposed, complemented by enhancing public transport, slow mode infrastructure and urban development

around important public transport nodes (SPINdesign, 2020b). After the SPINdesign pilot, however, the planning of the tunnel was indefinitely stopped in 2020 as the result of political disagreement concerning the scope of the project. Therefore, the municipality of Oslo wishes not to proceed with the plan in its current form (R5; R11). The Norwegian government has expressed its ambition to further lower the financing of road construction due to environmental considerations (R11). In the beginning of 2024, the Norwegian governments plans to present a Draft of the revised National Transport Plan 2025-2036. This National Transport Plan prioritises the focus areas of transport policy for a period of twelve years. The plan is revised every four years (R11). For the most recent revision, the Norwegian NRA Vegvesen has proposed a prioritisation of projects as input, in which the E6 Oslo East was not included (Norwegian Ministry of Transport, 2023; R11). For this reason, it is highly unlikely that the E6 Oslo East project will be executed in the coming years. Vegvesen awaits the next national elections that will be held in 2024. If the then newly elected government is willing to finance road construction, the project will be picked up again and might become a part of the revised National Transport Plan (R11).

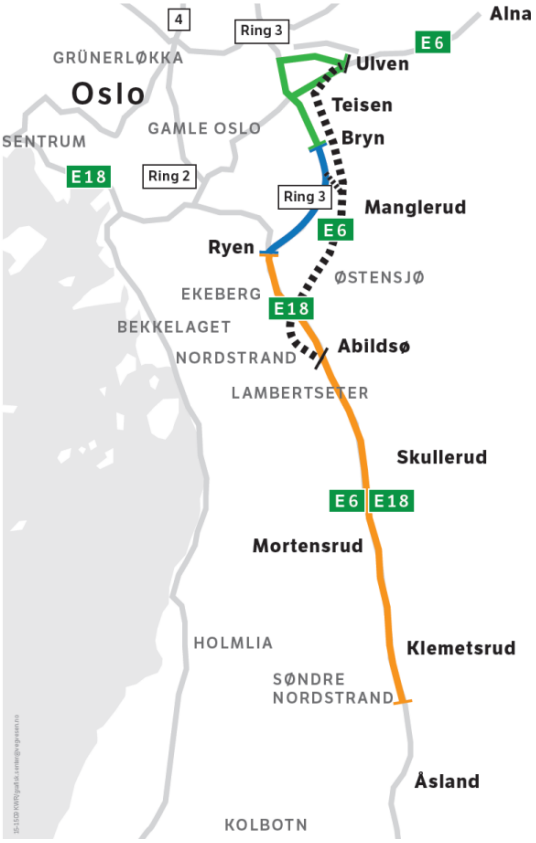

Figure 15 *E6 Tunnel near Oslo (Vegvesen, 2016)*

Barriers

The most impactful barrier for the E6 Oslo East project proves to be the political influence of the national government (R5; R11). The ambition of the national government to stop funding construction projects for road infrastructure is expected to negatively impact the city of Oslo. As the population of the municipality of Oslo is expected to increase by 15,6% by 2050 as compared to 2022 (Statistics Norway, 2022), travel demands are expected to increase as well, resulting in more pressure on the existing infrastructure. In combination with the exclusion of the E6 Oslo East project from the National Transport Plan 2025-2036, even higher levels of noise and air pollution are expected, as well as increased congestion (R11). If the project will be reconsidered for the next revision of the National Transport Plan, it is of high importance to involve politicians

earlier in the planning process (R11). By doing so, both parties are challenged to better understand each other's interests at stake and to collaborate on finding a collective solution to the issues at hand. Perhaps by placing even more emphasis on shifting towards a transport system that is more oriented on public transport, slow modes and urban densification around these transport systems.

Next to that, the costs of the project can be seen as a barrier too. The relatively high costs of the tunnel, in comparison with the maintenance cost of the existing road segments, resulted in doubts with the local politicians in Oslo. As the municipality (including the politicians) has high influence in the decision-making, the project has become dependent on the local politicians. As the politicians governing the city of Oslo aim to reduce car-usage in and around the city to adhere to their sustainability missions, they have no interest in developing new road infrastructure. The politicians fear that the realisation of the tunnel will lead to a substantial increase in traffic. Therefore, they only want to maintain the existing road network and thus not expand the network with the tunnel. Therefore, it is up to Vegvesen to involve the influential and opposing local politicians into their planning projects to exchange ideas and interests, and to convince these stakeholders through extensive joint collaboration.

The political influence that Vegvesen is subject to thus comes from two levels or government: national and local. This demonstrates the importance of collaborative planning in the Norwegian context. Vegvesen cannot develop such large projects on their own and are highly dependent on the political context. Early involvement and intensive collaboration between Vegvesen and the political parties is essential for the successful development of road infrastructure projects.

Success factors

Although the interests of Vegvesen and the national government were institutionally fragmented, the relationship between Vegvesen and the municipality of Oslo was collaborative (R5; R11). R5 explains that the partnership with the local government and administration is good, but that the result depends on the local politicians. Even though the latter share the same priorities as Vegvesen, collaborations often do not result in implementation of the project due to differences in how to obtain goals. The local politicians prioritise a reduction in motorised traffic flows to enhance the liveability and adhere to their sustainability goals. Vegvesen in a way also prioritises liveability as the proposed tunnel would reduce the current air and noise pollution in the city, leaving room for local sustainability initiatives above ground. Even though both parties highly value sustainability and liveability, the politicians are rigid in their standpoints and in the end the decisions are being made by the local politicians (R5). The good and longstanding relationship between the municipality of Oslo and Vegvesen could potentially be used to better the relationship with the local politicians, and to jointly draw plans in which the needs and interests of all parties are successfully included.

Role of Vegvesen

The main responsibility of the Norwegian Public Roads Administration, or Vegvesen, is the planning, building, operating and maintaining of the national and European road network in Norway. Next to this, Vegvesen is also responsible for the safety of road users and vehicles. The road network developed and maintained by Vegvesen makes up for approximately two-thirds of all national traffic (Vegvesen, n.d.). In the E6 Oslo East project Vegvesen acted as the coordinator of the project, actively maintaining the overview of the project together with the municipality of Oslo (R5). Within the planning process Vegvesen included a broad variety of stakeholders, including local businesses, residents and other interest groups. Meetings with these groups of stakeholders were both used to provide them with information and to use their local knowledge

and experience. These meetings were a necessity as the plan could potentially negatively affect the value of the houses in the neighbourhood surrounding the project. In that case residents needed to be compensated for the value lost. As this is often a difficult conversation to have, Vegvesen informed and consulted the local residents before plans were drawn and finalised (R5). To conclude, the role of Vegvesen in this project was not that of a decision-maker as they were dependent on politicians, but they have acted as a coordinator within the project, bringing together stakeholders and setting up collaborations.

6.4 Norrköping, Sweden

Background

Improving the railway connection between Stockholm and Linköping (East Link) has been on the agenda of Trafikverket for almost three decades as the Swedish railways are severely congested. Alongside the East Link travel hubs were scheduled to be located, under which one at the city of Norrköping. The main project objectives for the case of Norrköping are the reducing travel times for both commute and freight, expanding the railway capacity and creating better conditions for regional development (Trafikverket, 2019; Trafikverket, 2021a). The High-Speed Line was planned to cross five municipalities, each with its own travel hub. The planning was decentralised in the beginning and therefore dependent on municipalities. However, later the East Link became part of the national programme New Main Lines: a new generation of railways with connections between Gothenburg–Borås and Hässleholm–Lund as well (Trafikverket, 2021b; R1). Because the East Link was incorporated in this programme, the planning process was altered as there were new standards for the project (R1; R2). During the FLUXNET programme, the FLUXNET toolbox was developed using the planning experiences of the High Speed Line and the node of Norrköping (MUST and TEMAH, 2018). After the pilot phase, the New Main Lines programme was stopped in 2022 by the national government due to the high costs of the infrastructure developments (Trafikverket, 2023; R1; R2). The development of the East Link is however not definitely stopped, but put on hold as the national government recognize the importance of this rail connection (R1; R2; R6). The original plan for a High Speed Line is currently being adjusted (R1; R2). For instance, in the new planning the trains are allowed with a maximum speed of 250 kmh, rather than the original speed of 320 kmh, this to reduce costs.

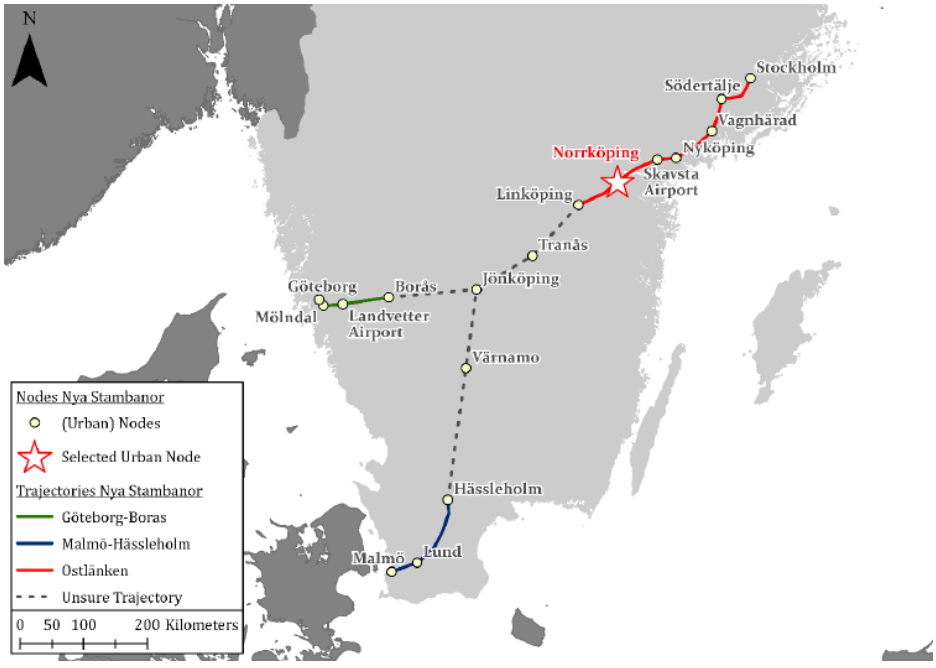

Figure 16 *The New Main Lines (Trafikverket, 2021a)*

Barriers

In the planning of the East Link, Trafikverket was prone to several barriers. The foremost barrier is the political influence of the national government on the project. With the establishment of a new parliament in September 2022, the New Main Lines programme was severely impacted (R1; R2). The East Link had to be altered to new standards to lower the overall costs, the planning of the Malmö-Hässleholm trajectory and the Göteborg-Boras trajectory were put on hold until a new decision is being made in September 2023 (Trafikverket, 2023).

A second barrier for the East Link are environmental considerations (R2). As the planned route passes through several critical areas. If in the construction nature is damaged this could possibly lead to severe public and political backlash as nature in general is highly valued by the Swedish population. Because of the high value of nature, parts of the trajectory are planned through long tunnels. However, there is a risk that water will flood the tunnels and that the changed ground water level will have a large negative impact on nature (R2).

Lastly, there have been issues within the collaboration between Trafikverket and the municipality of Linköping (R1; R2). Though Linköping does not fall within the Norrköping case, both cases fall under the New Main Lines programme, and are in a similar position. The case of Linköping demonstrates the difficulties that can occur in the relationship between Trafikverket and municipalities, and therefore it demonstrates a barrier that could have occurred at the case of Norrköping as well. A conflict between the project leaders of both parties arose as the municipal council decided they wanted a tunnel through Linköping, while Trafikverket was in doubt due to the high costs of a tunnel. This dispute resulted in no contact between the two parties for a period of approximately 1,5 years (R1). Eventually this institutional fragmentation was resolved by appointing new project leaders from both sides and creating a better environment for discussions (by use of a mediator) (R2). The key to this improved collaboration was to better involve each other and to be transparent in communication and decision-making (R1; R2). The relationship between the municipality and Trafikverket is of high importance as the municipality functions as a connector between Trafikverket and the local politicians as well. The conflict between project leaders in this case demonstrates how two people can affect a planning process for the worse.

Success factors

Besides these barriers, and the dispute with the municipality of Linköping, relationships and collaborations between Trafikverket and other municipalities in general are considered good (R1; R2; R6). There is a safe environment for discussion and decision-making. Next to that, Trafikverket in general has the mandate to perform such large-scale projects.

Furthermore, Trafikverket did outstanding work in developing a plan in which the interaction between transport and land use is central. The high value of nature is also being accounted for in the plan to avoid negative impacts on nature and the environment.

Lastly, the role of Trafikverket as the coordinator of the project is considered a success factor. Trafikverket has always been actively involved in the developments and has had the overview over the entire East Link project, staying in contact with a large amount and variety of stakeholders (R1).

Role of Trafikverket

As the Swedish Transport Administration, Trafikverket is responsible for the long-term planning of the transport system. This includes all types of traffic and infrastructure, such as the construction, operation and maintenance of public roads, railways, sea and air transport (Trafikverket, 2021b). Within the East Link project Trafikverket acted as a coordinator between

the five different municipalities involved in the project. In this active position as the coordinator, Trafikverket has the helicopter view of the activities of the municipalities as well as the 13 different Railway Plans the entire corridor is divided in (R1). However, the conflicted relationship with the municipality of Linköping also demonstrates a need for improvement of the collaborative skills of Trafikverket. The Swedish NRA allowed the conflict to escalate to a point of no communication for a substantial amount of time (approximately 1,5 years). As differences in opinions and interests often occurs in a collaborative process, Trafikverket as a coordinator should be able to handle such situations without resulting in escalations. The steps taken to mend the disturbed relationship after 1,5 years of lacking communication did result in a successful continuation of the collaboration, but these steps should have been taken earlier in the process.

6.5 Cross-case analysis

General barriers

Next to the case-specific barriers identified in the previous sections, the findings suggest also generic barriers that come with an area-oriented planning approach. A general barrier that was present in all cases analysed is that of limited capacities. These may be insufficient financial resources, inadequate knowledge, experience or personnel, or temporal limitations (R1; R2; R4; R8; R9; R10; R11; R12). All these capacity issues are related to an area-oriented approach, as opposed to a line-oriented or project-oriented approach. Whereas for the latter mainly technical knowledge and a straight-forward approach are required, the former approach requires broader knowledge of multiple sectors and area-specific knowledge. For such an approach more diverse personnel is needed to fully understand the infrastructural and spatial issues, and more time is needed to collaborate and discuss the potential solutions together. Therefore, an area-oriented approach requires more resources compared to a line-oriented approach. Almost all respondents explained that having too little of some of these resources occurs frequently within NRAs.

> "You notice that it is extremely difficult to have sufficient capacity from all involved sectors from a municipality. They try to work integral because they know it adds value. But coordinating with the environmental department and then with the traffic department… There is not always enough capacity to do so and the priorities of the departments may be different." (R12)

Another barrier is that even when NRAs have sufficient resources to use an area-oriented approach, they often choose to not do so, as they do not prioritise area-oriented approach over other approaches (e.g., line-oriented), due to its higher complexity (R3; R4; R7; R8; R9). For example, in the Dutch NRA using an area-oriented approach is labelled as 'nice to have' rather than as 'need to have'. Therefore, on the list of project requirements, using an integral approach often ends up below the threshold of what is needed and financially possible (R4). Prioritising an integral approach is not always required, but it is highly recommended for complex projects, such as large-scale infrastructure developments (R8).

General success factors

The general success factor within all four cases is communication and collaboration. For area-oriented planning to be successful it is essential for NRAs to invest in long-standing and continuous collaborations with stakeholders. To which extent this was done in the cases differs, however all NRAs have demonstrated the importance of relationship management in relation to successful area-oriented planning (R1; R2; R4; R8; R11; R12). This was done most successfully in the case of Rotterdam, where the project became a part of a larger scale cross-border and integral program. In this program, multiple national and regional stakeholders are connected and bound to each other to share responsibilities concerning the development and maintenance of corridors

(R12). In the case of Linz, the NRA showed its ability to collaborate, but lacked mandate to stay connected, resulting in disengagement from the other stakeholders (R7). This was vice versa in the case of Oslo and Norrköping, where the NRAs were willing to work together with other parties, but were not able to reach consensus with political parties, resulting in projects being discontinued or put on hold (R1; R2; R5; R11). Only when the willingness and abilities of the NRA are up to par, collaborations can lead to successful area-oriented planning. The role of NRAs should not be passive, as was the case for Linz, but should be that of an area partner, e.g., Rotterdam case. The role an NRA takes on during the project partially determines the success of collaborations. Therefore, NRAs must determine their role within project strategically, rather than awaiting the roles other stakeholders take on.

Conditions for upscaling

In terms of area-oriented planning, only the case of Rotterdam can be considered somewhat successful through its link with the Topcorridors program. The cases of Oslo and Norrköping have demonstrated that their planning processes were prone to, and heavily affected by, political influences from both the national and the local level. The barrier of political influence could be overcome by involving political stakeholders more and also earlier in the planning process, as well as keeping them involved throughout the entire planning process (R1; R2; R11). Doing so improves the understanding of each other's interests and improves collaborative relationships (R1; R2). Lastly, the case of Linz demonstrated limited involvement from the NRA in an otherwise integral project where multiple transport modes and area development are combined (R7). The case of Linz demonstrates that NRAs are not always the leading or initiating party for infrastructure development. NRAs should therefore pay close attention to the developments in an area that may have consequences for their infrastructure networks. Area-oriented planning does not only concern the development of own infrastructure networks, but also concerns the spatial functions of other parties in the same area. Maintaining relationships with important stakeholders in an area helps NRAs to stay up to date on such developments and having a pro-active attitude towards collaboration with such parties is therefore a necessity for area-oriented planning.

7. Discussion

In this chapter the results discussed in the previous sections (Section 4, 5 and 6) are interpreted in relation to the theoretical foundation established in Section 2 of this study. The influence of the pilots or niche innovations on both transitions (NPM to PVM and line-oriented to area-oriented) is discussed as they are currently not being sufficiently retained by the regime. Causes for this can be found on both sides of the interaction between the regime and niche level: niche innovations may be prone to the pilot syndrome, while the regime capacity to retain innovations may not be sufficiently open. To ensure the position of area-oriented approaches in regular planning practice, the functional interrelations between land use and transport have to be utilised by creating meaningful collaborations between institutions. Furthermore, the results of the study have been discussed by the CEDR working group Collaborative Planning and the contributions from this discussion are incorporated in this section as well.

Multi-level perspective on the transition to area-oriented planning

Shifting from one planning paradigm to another proves to be difficult. In order to transition from the traditional line-oriented approach to planning towards the area-oriented approach planning, pressures from the landscape on the socio-technical system are needed in order to change the current regime. These pressures stimulate the development of niches with the need and opportunity to innovate. At this niche-level, technological developments, innovations and pilot projects can cause change processes at the regime level. The latter is the upscaling of such an innovation. In order to upscale the area-oriented approach of the pilot projects, the niche innovations need to be retained by the regime. This would entail that the area-oriented approach becomes increasingly a part of regular planning practice or even the generic approach of planning. This development is not visible yet from the studied cases (CEDR WG CP, 2023). Although NRAs have (incrementally) learned about the essence and necessity of area-oriented planning approaches from the pilot projects and the research programs, the lessons learned are not actively used in regular planning practice (no system change). This possibly entails that there is not enough pressure on the current regime yet, or that the regime's capacity to incorporate change is limited. Thus, based on the cases, the European NRAs are only slightly in transition thus far.

An NRA, such as the Netherlands' Rijkswaterstaat, has formulated its goal to become an area partner, thus aiming for the use of area-oriented approaches. However, limited action is currently taken to adhere to this goal (R8; R9; R10). The Scandinavian NRAs are a little further in their area-oriented approaches, but are lacking political involvement. The Austrian NRA remains at the start of the transition. The transition pathway currently taken is that of the transformation pathway as defined by Geels and Schot (2007). This pathway refers to a situation in which there is moderate landscape pressure (social and environmental pressure), but niche innovations (area-oriented approaches) are not adequately developed. In such a case, regime actors – such as NRAs and other governmental organisations – should reorient the direction of development paths and innovation activities. Important here is that landscape changes are only able to exert pressure if perceived and acted upon by the regime actors (Geels and Schot, 2007). Therefore, outside groups, such as social movements and societal pressure groups, are important as they voice criticism and draw attention to the pressures and "force" regime actors to operate under these pressures (Verhees, 2013). Doing so does not directly incentivises regime actors to change their way of doing. However, by societal criticism or changing public opinions, regime actors try to reorient their development trajectories. By doing so repeatedly, new regimes might be created out of accumulated reorientations of the old regime.

The Pilot Syndrome as a barrier

One of the reasons why it is difficult to retain niche innovation in the regime, is because of the different context in which pilots are executed compared to the regular planning arena. With more room for innovation, dynamic development and additional resources, a lot more is possible in the planning process as capacity issues are less likely to occur (see Section 2.5). Next to that, the role and attitude of the involved parties differs between the two situations. During a pilot project participants tend to be more enthusiastic about the process. There is a distinct way of working within pilot projects that significantly differs from the rules of the game and conditions of the regular planning arena. The different conditions of pilot projects, in combination with the lack of niche innovations being retained by the regime, ask for a change in approach in order to transition towards area-oriented planning. For instance, the improvement of institutional memory (CEDR WG CP, 2023) (see *The institutional memory of NRAs* below).

New Public Management (NPM) vs. Public Value Management (PVM)

As well as the transition to area-oriented planning, the larger scale transition from NPM to PVM is slightly coming along. In the researched cases elements from both management styles are visible. For example, in the cases of Norrköping and Oslo public interests are still being determined by politicians (NPM), while there is inclusive dialogue with stakeholders and interest groups (PVM) (Bryson, 2014) (R1; R2; R11). In the researched cases it does become clear that the role of the citizen is becoming more important in the planning process. Citizens are not seen as customers (NPM) or as problem-solvers and co-creators (PVM) (Stoker, 2006), but are somewhere in the middle (R1; R2; R4; R5; R9; R10; R11). This demonstrates that NRAs are in transition, but are in need of more upscaling of niche innovation before a new regime can be reached.

The institutional memory of NRAs

Within the research process difficulties in acquiring the needed documentation and finding suitable case representatives were experienced. NRAs have lost case specific knowledge and representatives of NRAs were not always able to tell which of their colleagues could assist in finding the right information and providing contact details for interviews. The difficulties in the research process can partially be linked to the outcomes of the study. During the research programs, NRAs were mostly involved in the workshops of the pilot cases. During these workshops their contributions on the situation-specific context and the infrastructural and spatial issues was shared. These workshops were mostly used to test or apply a toolbox to a specific case, after which the toolbox would be adjusted and updated (e.g. Vital Nodes, 2018). The final product of the programmes would be presented to the involved NRAs, but no further active involvement was required (R8). As the NRAs have never sufficiently practiced how to use the toolboxes and how these can serve as an aid in planning, it is not surprising that the use of the toolboxes is limited. As the toolboxes and guides on how to use them are also somewhat difficult to retrieve through CEDR and are not available through public websites, the end results and the findings of the programmes are easily forgotten (CEDR WG CP meeting Oslo, 1-2 June 2023).

Although NRAs do use area-oriented approaches to infrastructure planning, none of the interview respondents actively use the SPINdesign, FLUXNET or Vital Nodes toolboxes. During the data collection it was found that representatives of NRAs are often unaware of the developments of projects within their area (R4, R5, R7). They are often unable to retrieve documentation on the projects and they are often unaware of the correct representatives for retrieving information. Although not every representative is required to possess knowledge on the development of the cases, they should be able to find a representative that does have the requested knowledge or have

access to the documentation. The inability to find the documentation may be the result of lacking archiving or limited documentation. These issues demonstrate concerns with the institutional memory within NRAs.

The upscaling of pilot experiences, and thus retaining the innovations at the regime level, implies that the regime actors (NRAs) should incorporate the niche innovations in their daily planning tasks and activities. The regime needs to become more open to allow for institutionalisation. Advancing knowledge gained from pilots within an organisation can be achieved through "learning-by-doing" (Kemp et al., 1998). However, if the niche innovations are not used by regime actors, such as NRAs, it is likely that instead of learning-by-doing, this may result in "forgetting-by-not-doing" (Lawrence et al., 2019). Retaining the institutional memory therefore contributes to the transition towards area-oriented planning, as well as to the upscaling of niche innovations in general. Thus, improving the institutional memory is one of the next, major steps in the transition for the NRAs and CEDR.

The next step

In order to advance and accelerate the transition towards area-oriented planning approaches, NRAs need to take active steps. During the group discussion with the CEDR working group Collaborative Planning (CEDR WG CP, 2023), the representatives of NRAs were asked what is needed for the institutionalisation of area-oriented planning approaches in the future. In this discussion it was argued that NRAs are currently attempting to use area-oriented approaches for large-scale projects, while a better starting point to experiment with the approach might be projects of a smaller scale. This way the lessons learned from small successes can be used for other projects, gradually increasing in scale and scope. Starting area-oriented planning with large-scale projects might be in reversed order.

A second point of attention raised during the discussion session of the Working Group is the that of the bystander syndrome. The bystander syndrome is a situation in which there are multiple parties witnessing a process and that do not provide aid to a party in need, because they do not feel responsible as there are other parties that could provide help as well (Chekraun and Brauer, 2002). This syndrome can be illustrated by a thought experiment as done during the discussion: imagine walking through a park near a pond. There is no one else around as you suddenly see a person falling into the pond. As the person calls for help because they cannot swim, you immediately jump into the pond to help them out. Now imagine a similar situation, but this time you are not alone in the park: there are a dozen of other people walking around near the pond. Again, someone falls into the pond and requests help getting out. Instead of jumping in directly, you now await the response of others. Is another bystander going to help? Are you really responsible for helping the person in need if there are other people that could provide help as well? As all bystanders wait and see, the person in need drowns. This type of passive behaviour can be observed in collaborations in the planning process as well. When a relatively large group of stakeholders is involved in a planning development (e.g., an area-oriented project), none of them might feel a sense of ownership when the project runs into problems, simply because they are not solely responsible for the solution. Therefore, an important step to take is starting collaborations with stakeholders as early as possible and create a sense of joint ownership that is strengthened by creating a sense of urgency as well. By doing so, stakeholders feel directly involved and can contribute and share their specific knowledge before important decisions are made. This sense of ownership relates to the mandate of NRAs: the more limited or restricted the mandate, the lower the sense of ownership, and a higher expected chance for issues related to ownership. In order to do so successfully, it is vital to identify the stakeholders and their interests and needs early in the planning process as well. For NRAs this entails challenging stakeholders to

actively participate in the planning process to ensure a joint sense of ownership (e.g. through a (in)formal agreement).

Another focal point of the WG discussion session are institutional and governance issues, such as the fragmentation within and across organisations. An example of this is the sectoral organisational structure of Rijkswaterstaat (as was illustrated with the case of Rotterdam/Tilburg in the Netherlands). Another way of fragmentation can be found in having separate organisations for different types of infrastructure, e.g. a different administrator for road infrastructure and for railway infrastructure as the case for ASFiNAG or CEDR itself. This fragmentation between sectors and organisations asks for organisational restructuring. As such a large-scale restructuring does not happen overnight, meaningful connections and relationships between sectors and organisations need to be set up and maintained. Local and regional governments in the Netherlands, such as water boards, municipalities and provinces, expressed their concerns regarding project-oriented collaborations (Rijkswaterstaat, 2023). In their view it is more valuable to engage in structural collaboration. They proposed for instance to schedule structural meetings (e.g., quarterly) in which consultants and policy makers come together to discuss their work activities and collaboratively seek for opportunities for further collaboration. Due to such a structural form of collaboration, it is easier to reach out to the other governmental organisations and it is clear who to approach for potential collaborations. These local and regional governments argue that through such an approach to collaboration, relationships become more meaningful and a better arena for area-oriented planning is developed. Key to these structural collaborations is to allow employees from different levels within their respective organisations join the discussion, as opposed to mainly the project managers that are currently coming together for collaboration.

Thus, the next step to be taken consists of creating meaningful collaborations between an active group of stakeholders that are involved from the starting of a project. NRAs can experiment with these collaborations by starting with smaller scale projects. It is important to prioritise these collaborations and build a network of relations both inside and outside the organisation (boundary spanning). The key to successful area-oriented infrastructure planning is not for actors to compete between their interests, but to collaborate and make places better together.

8. Conclusion

The aim of this research was to study a variety of European area-oriented pilot projects to examine the planning and development of transport infrastructure, and to analyse the role of NRAs in the upscaling of pilot projects and the success of area-oriented approaches. The primary research question central to this study is formulated as follows:

> *How does the role of National Road Authorities affect the upscaling of area-oriented transport infrastructure planning pilot projects into regular planning practice?*

This research question is dissected into five sub-questions that combined comprise the answer to the question. These sub-questions are concerned with the development of transport infrastructure and are distinguished as (1) the definition and position of area-oriented planning in literature, (2) the post-pilot development of projects, (3) the role of NRAs in area-oriented projects, (4) the barriers, success factors and conditions of upscaling, and (5) the role of NRAs in ensuring suitable conditions for upscaling. First, the key findings of the first four sub-questions are discussed. This is followed by recommendations for the CEDR working group Collaborative Planning based on the fifth sub-question, and recommendations for future research. Lastly, the limitations and final reflections of this study are discussed.

8.1 Key findings

Definition and position of area-oriented planning in literature

The theoretical framework of this study discusses a transition model with essential components for collaborative or area-oriented planning of transport infrastructure development. Central to this planning approach is the reciprocal relationship between land use and transport (LUTI). This reciprocity entails that the patterns of land use determine the need for transport, while the development of transport in turn influences the accessibility and attractiveness of locations for land uses. Therefore, transport infrastructure planning has a need to become area-oriented, rather than operating in a line-oriented manner. The area-oriented approach emphasizes development from an area perspective instead of development from a siloed transport perspective. Managing projects with an area-oriented approach is characterised by intersectoral collaboration within problem-solving and decision-making. Even though more emphasis is placed on the creation of social value (PVM), most NRAs are focused on NPM as this has been the system they have worked towards for the last years. Transitioning from one system or approach to another is extremely complex and can be understood in multiple levels. Transitions in the planning regime occur when the landscape exerts pressure, and while niche innovations find momentum and are upscaled to the regime. Additionally, ensuring the right conditions for a potential shift is complex as well. Although projects may be successful at a small scale, difficulties are faced in the upscaling, mainstreaming and integrating into regular planning practice. This is due to pilot-specific characteristics that are distinctly different from the regular planning arena, such as additional resources or an environment with lesser rules and regulations, resulting in more room for innovation and dynamic development.

Post-pilot development of projects

How the selected seventeen cases have developed after the pilot phase is difficult to assess. This is the result of severe difficulties in the acquisition of documentation and in the acquisition of representatives of NRAs. These difficulties are further discussed in Section 8.4. However, the inventory of SPINdesign, FLUXNET and Vital Nodes cases demonstrates the similarity in infrastructural and land use challenges each NRA faces in the development of transport infrastructure, e.g., increasing needs, environmental standards and limited space. To find

solutions to these complexities, NRAs have experimented with integrated strategies to satisfy their respective area-based needs, such as the enhancement of multi-modal connections in Gothenburg or to increase network capacities while considering environmental factors. However, the broad scope of these area-oriented projects often conflicts with the (narrow) mandate of NRAs, although their role is influential to the success of the project.

Role of NRAs in area-oriented projects

As NRAs comprise an important part of planning practice, their role in the upscaling process of niche innovations or pilots to the regular planning regime, is vital. As large-scale and government-driven organisations, NRAs are in the position to be change agents and policy entrepreneurs. To do so, NRAs need to position themselves as area partners within collaborative structures. A best practice example for this is Rijkswaterstaat in the border crossing and integral Topcorridors program, where corridors are developed, maintained and enhanced in close collaboration with other area partners. Positioning an NRA as an area partner may be restricted by the mandate of an organisation. For example, ASFiNAG was deprived of the opportunity to remain involved in the Linz project since the project no longer required road infrastructural measures. Although the project still has a large impact on the road network of ASFiNAG, their narrow mandate limited them in engaging in the project from an area perspective. Despite that NRAs often do possess the right knowledge and know-how, they are prone to significant barriers, influencing the success of upscaling.

Barriers, success factors and conditions for upscaling

In the process of upscaling area-oriented practices to regular planning practices, the main barrier for NRAs is lacking specific capacities. This includes insufficient financial resources, knowledge, experience, personnel and time. Area-oriented planning requires broader knowledge and collaboration across multiple sectors, therewith demanding more diverse personnel and resources compared to line-oriented or project-oriented approaches. Next to this, NRAs often prioritise other well-known approaches over the area-oriented one, as the latter is not sufficiently seen as a necessity within complex infrastructure development projects. The overall success factor in area-oriented planning lies in communication and collaboration. Long-standing and continuous relationships and collaborations are crucial for the success of the project. NRAs must take on an active role as an area partner to achieve success through joint collaborations with other stakeholders or area partners. Only through a sense of joint ownership and joint collaboration, NRAs can establish the right environment for upscaling area-oriented planning practices.

8.2 Recommendations for CEDR working group Collaborative Planning

As NRAs play a key role in creating and ensuring a good environment and the right conditions for the upscaling of area-oriented practices, it is essential to consider their position within projects, the type of relationships with stakeholders and the aftercare of project documentation. Based on the post-pilot development, the role of NRAs and the barriers, success factors and conditions studied by use of seventeen cases, the set of recommendations for NRAs is made.

1. Broaden the mandate: NRAs as area partners

Within projects NRAs need to distinguish themselves as area partners. Their focus should go beyond the development of transport infrastructure. As the networks of different modes interact and influence land uses, solely looking at their own infrastructure network will not suffice. In order to become more integral and look beyond the sectoral and physical borders (e.g. municipal), NRAs need to broaden their mandate. Such a radical change is however incredibly difficult and complex. Smaller steps can be taken by prioritising area-oriented perspectives. For instance, by

making it a requirement for projects or by including it into the organisation strategy. During the CEDR working group Collaborative Planning meeting (Oslo, June 2023) the creation of a vision was discussed as well. Priorities that determine the future of the European road network are formulated in the vision document CEDR Compass.

2. Long term, structural and integral partnerships and collaborations

To gain better results from an area-oriented planning approach, the type and intensity of relationships is of high importance. Although building lasting connections between departments and organisations and engaging in structural contact and collaboration is a time-consuming process, the long-term effects will be promising. By sharing responsibilities and accountability of projects, a number of benefits helps enhance the planning process. E.g., improved decision-making, resource sharing, risk sharing, community engagement, broader expertise, long-term vision.

3. Aftercare to create institutional memory

Furthermore, steps need to be taken in the aftercare of pilots. In the process of upscaling area-oriented practices to regular planning practice, it is crucial to have all documentation and the organisational archive in order. This serves as a physical back-up so organisations do not have to rely on the mind of their representatives. During the research process difficulties were found in acquiring documentation on the cases. To prevent this loss of valuable knowledge in the future, NRAs have to create institutional memory and therewith ensure their continuous learning process. The documentation serves as an aid in reproducing results from the pilots and learning from them to enhance the planning process for future projects. Currently, area-oriented planning is a side task for all employees. Instead, appointing a specific team with as a main task ensuring area-oriented planning creates clear responsibilities. One of the responsibilities of such a specific appointed team would be the documentation of all area-oriented planning, therewith improving the institutional memory of the organisation.

8.3 Recommendations for future research

The three recommendations provided for the CEDR working group Collaborative Planning above, need to be studied in further detail. As broadening the mandate of a large-scale organisation is both difficult and complex, this asks for organisation specific plans. Substantial changes in the mandate of an NRA is extremely complex due to its embeddedness and relation to ministries and national governments. The difficulty in radical organisational changes lies in the impact and effects it will have on the functioning of the organisation. Therefore, more research is needed into the influences of a radical change in mandate or NRAs.

Next to this, further research is needed to look into the causes of inadequate institutional memory and to seek for strategies to enhance the institutional memory of organisations. This is essential for any organisation that strives to learn from past projects and new innovations. Without sufficient institutional memory, organisations risk forgetting their accomplishments, obstruct their own learning process and take away their own opportunities to innovate.

8.4 Limitations of the study

During the research process issues with the acquisition of documents and interview candidates were experienced. For example, the websites of the SPINdesign and FLUXNET programmes proved to be inactive and access to the CEDR website and archive was to some extent restricted. Considering the working group was set up in the near past, the available archive did not contain the needed documents. These were to be found elsewhere on the website, however access to the

documents archived there could only be requested to the NRA leading the respective programme, which proved to be a bureaucratic process that required a lot of time.

As only documents from the Vital Nodes cases could be extracted from their website, the collection of documents had to be done differently. By reaching out to representatives of the NRA of each case, the collection of documents and the collection of contact information for potential interview candidates was combined. To create an overview of the cases and determine their development was vital to conduct preliminary interviews with these representatives and other potential candidates they might recommend. The representatives of NRAs that are member of the CEDR working group shared their contributions through these preliminary interviews. Most interviewees shared documentation of the respective cases, shared websites to find information on or provided contact information for potential interview candidates for a second round of interviews later in the research process. Unfortunately, only not enough data could be collected as NRAs outside of the working group proved to be difficult to contact – despite the help of the working group members. These NRAs showed very limited interest or willingness to contribute to the study.

The documents collected often proved to be unsuitable to use for creating an extensive case overview. Most of the documents collected provided an understanding of the development of the cases before and during the pilot phase, but limited information was available on the development after the projects. In the post-pilot phases, NRA representatives are not always up-to-date on the developments of a project, and are uncertain which of their colleagues might be a further help. It was often explained that this happened as the pilots were executed a long time ago and that employees often switch functions and positions. This demonstrates that valuable information may be lost due to an inadequate institutional memory.

8.5 Reflection

Looking back on the research process it has been quite challenging, but also energizing. The difficulties I have experienced with data collection and interviewee acquisition are common setbacks within any research process. Having gone through these setbacks and learning how to deal with them have given me more confidence in pursuing a career in academics after my studies. During my internship at Rijkswaterstaat I have learned about the organisational processes of the NRA and its relationships with other governmental stakeholders such as provinces, municipalities and water boards. Through the connection with CEDR I have also learned about the context of planning and influences outside of NRAs. Overall, I believe that both the content and the process of this research provides me with a solid basis and has prepared me to continue my academic career as a PhD student at the Faculty of Spatial Sciences. The constructive feedback from both supervisors and the enthusiasm of the CEDR working group have helped me advance in this research. I am eager to continue using this research in my future academic encounters and look forward to giving a seminar about this thesis for the CEDR organisation later this year.

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10. Appendices

Appendix 1 – Sources for document analysis of the research program (tier 1)

1. Böhler, S., Franco, D. & Rupprecht, S. (2018). D4.1 Vital Nodes transferability, outreach and node-integration strategy: Knowledge exchange concept, operational cooperation and integration plans.
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17. Werf, S. van der., Arts, J. & Linden, K. van der. (2019). Validated Recommendations for funding instruments and needs, future research needs and integration of Urban Nodes of the TEN-T corridors.

Appendix 2 – Sources for document analysis for the case inventory (tier 2)

1. Vital Nodes workshop report Mannheim
2. Vital Nodes workshop report Strasbourg
3. Vital Nodes workshop report Turku
4. Vital Nodes workshop report Genova
5. Vital Nodes workshop report Hamburg
6. Vital Nodes workshop report Budapest
7. Vital Nodes workshop report Gothenburg
8. Vital Nodes workshop report Rotterdam
9. Vital Nodes workshop report short Vienna
10. FLUXNET report def Cologne
11. FLUXNET report def Norrköping
12. FLUXNET report def Rotterdam
13. FLUXNET report def Milano
14. FLUXNET test bed Norrköping minutes
15. FLUXNET test bed Rotterdam minutes
16. SPINdesign Oslo workshop minutes
17. SPINdesign workshop Linz protocol
18. SPINdesign Toolbox final print
19. SPINdesign Oslo workshop agenda
20. SPINdesign Oslo workshop recap
21. SPINdesign Oslo presentative
22. Test Bed Norrköping minutes
23. Test Bed Rotterdam minutes
24. Vital Nodes Recommendations Urban Node Rotterdam
25. Vital Nodes Recommendations Urban Node Vienna
26. Vital Nodes Recommendations Urban Node Gothenburg
27. Terugkoppeling Örebro pilot case

Appendix 3 – Interview guide (tier 3)

Introductory questions

1. Can I make a recording of this interview? (for transcription).
2. What is your function and how are you involved in this case?
3. What were your roles and responsibilities in the case?

Development of the project

4. How would you describe the development of infrastructure planning in general in Oslo?
5. Which infrastructure issues were there in [case]?
6. Which spatial issues were there in [case]?
7. Were both issues integrated in the urban planning of [case]?
8. What were the main project objectives or policy objectives?
9. Have these objectives changed? If yes, during which phase and why?
10. What is the current situation of the project? (Which objectives have been reached?/Is the project still ongoing?/Are there new policy goals or organisational goals?)

Role of the NRA

11. What are the general tasks and responsibilities of the NRA?
12. What are the long-term goals of the NRA and how is this translated into the project?
13. How would you describe your role or the involvement of the NRA in the project?
14. To what extent is integrative planning (combining infrastructure planning and area development) important to the NRA? (ambition?/when use it?)
15. Which actions (during which phases) is the NRA allowed to decide upon? What is NRA's mandate?
16. Which parties are involved in the project, and how did you manage their expectations?
17. Which party has the final say/final responsibility in the project?
18. How do/would you prioritize and manage different interests of parties?
19. Have there been any conflicts between different parties? If yes, how did you deal with this?

Barriers, success factors and conditions of upscaling of integrative planning

20. Which are the most important risks of this project? How have these been identified and mitigated?
21. What challenges were faced during the project in the past and how did you overcome them? (e.g., financial constraints, changing politics, diverting stakeholder interests, project-oriented approach, etc.)
22. How do these challenges relate to area-oriented planning approaches?
23. Which challenges are still present in the project?
24. Would you consider the project to be a success? Why? Which factors contributed to its success? Ask for examples/ask to describe specific situations
25. What factors do you consider in determining the success of the/a project? How do you determine these?
26. How do these (evaluation) factors relate to area-oriented planning?
27. What is necessary for successful integrative planning?
28. Is the importance of integrative planning growing within NRA?

Final questions

29. Do you think there are important questions I did not ask, but should have asked?
30. What would you do different next time in a similar project?
31. Do you have any additional documents I could use?
32. Are there relevant potential interview candidates?
33. Do you have anything else to add?

Appendix 4 – List of interviewees (tier 2 and tier 3)

Table 6 *List of interviewees*

Interviewee	Date(s)	Case	Role
R1	20 February 2023 4 May 2023	Norrköpping	Regional Director Region Öst, Trafikverket
R2	4 May 2023	Norrköpping	Stakeholder Manager, Trafikverket
R3	20 February 2023	Turku	Senior Advisor, Liikeneirasto
R4	21 February 2023 26 April 2023	Rotterdam	Senior advisor, Rijkswaterstaat
R5	22 February 2023	Oslo	Professor of transport economics and planning/Senior research economist Vegvesen
R6	23 February 2023	Gothenburg	International coordinator
R7	2 March 2023 6 June 2023	Linz	Corporate strategy specialist
R8	9 March 2023 10 May 2023	Rotterdam	Consultant
R9	8 May 2023	Rotterdam	Topspecialist
R10	9 May 2023	Rotterdam	Former advisor Rijkswaterstaat/ current project leader PZH
R11	16 May 2023	Oslo	Chief engineer Vegvesen
R12	5 June 2023	Tilburg/Waalwijk	Consultant

Appendix 5 – Coding scheme

Table 7 *Coding scheme*

Code Group	Code	Deductive	Number
Functional Interrelatedness/ Project scope	Line-oriented/Sectoral	D	1.1
	Internal integration	D	1.2
	External integration	D	1.3
	Transit-oriented development/Logistics- oriented development	D	1.4
	Area-oriented/Intersectoral	D	1.5
Institutional interdependencies	Coalition type: no cooperation	D	2.1
	Coalition type: coordinated action	D	2.2
	Coalition type: co-production	D	2.3
Spatial-governmental scale	Node	D	3.1
	Corridor	D	3.2
	Functional Urban Area	D	3.3
	Daily Urban System	D	3.4
	Regional	D	3.5
	National	D	3.6
Transition level	Micro-level: niche	D	4.1
	Meso-level: regime	D	4.2
	Macro-level: landscape	D	4.3
Transition pathway	Transformation	D	5.1
	Technological substitution	D	5.2
	Reconfiguration	D	5.3
	De-alignment and re-alignment	D	5.4
Management style	Performance-oriented (NPM)	D	6.1
	Pubic value-oriented (PVM)	D	6.2
Conditions	Barriers and challenges	D	7.1
	Success factors	D	7.2