university of groningen

# BICYCLE HIGHWAY IMPLEMENTATION

## THE CONTRIBUTION OF PUBLIC PROVINCIAL ACTORS IN REALIZING AMBITIONS

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# Colophon


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# Abstract

Bicycle highways are a rather novel and promising concept of cycling infrastructure that aim at positioning cycling as viable mode of transport in the daily urban system. This high-end infrastructure can therefore be considered an innovation. Research has shown interest in evaluating their use, their users and offering engineering insights. However, little is known of the governance arrangements employed to direct and facilitate the implementation of such an infrastructural innovation. Thus, this thesis aimed at understanding the factors that influence bicycle highway implementation, as well as the strategies employed by relevant public actors. The thesis relied on policy arrangements, diffusion of innovations and change agency theory. National maps with bicycle highway ambitions (2010-2019) were used to make sense of implementation patterns, and interviews with provincial actors were performed to gather in-depth knowledge of the strategies they use to overcome challenges. Findings show that change agency of public actors contributes in four main ways: transition management thinking, building and managing coalitions, navigating political venues and designing new institutions



Keywords: bicycle highways, policy innovations, sustainable mobility, cycling, change agency, policy entrepreneur, infrastructure planning, diffusion of innovations

# List of Abbreviations

BH – Bicycle Highways

HI – High Implementation

HAP – High Acceleration Phase

IR – Implementation Rate

LAP – Low Acceleration Phase

LI – Low Implementation

WIR – Weighted Implementation Rate

## Provinces

DR – Drenthe

FR – Friesland

FL – Flevoland

GE – Gelderland

GR – Groningen

LI – Limburg

NB – Noord Brabant

NH – Noord Holland

OV – Overijssel

ZE – Zeeland

ZH – Zuid Holland

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# 1. Introduction

Cycling has seen over the past decades a steady increase in popularity, in many countries being considered a significant mode of transport. The bicycle is not only a viable and sustainable solution against the current issues of car congestion and pollution, but also a practical vehicle due to its small dimensions and relative affordability (Heinen et al, 2010). Additional benefits include improvements in health conditions and social equity.

Traditionally, cycling has been viewed from a mobility perspective as a means of short distance travel. Due to the limited speed, a greater physical effort and the exposure to the weather, cycling policy has focused on design at an urban level. However, with the recent developments in electric bicycle (e-bike) technology, potential cycling distance has been greatly expanded, and physical effort reduced. These new developments offer the potential of framing the bicycle as a feasible mode of transport not only at the urban level but expanded to the regional and cross-regional level (Behrendt, 2018).

FIGURE 1. SECTION OF THE RIJNWAALPAD, BICYCLE HIGHWAY IN GELDERLAND (THE NETHERLANDS)

In order to accomplish so, there is a contingent need of new infrastructure to accommodate the new possibilities of the bicycle as a mode of transport. The cycling highway – *fietssnelweg* in The Netherlands – is a transport infrastructure concept that attempts at bridging this missing gap in infrastructure. This type of cycling path differs in that it is at least 5km in length, avoids intersections with other types of paths, and presents wide lanes to enable safe overtaking (Cabral Dias & Gomes Ribeiro, 2020; Rayaproly, 2020).

In The Netherlands, bicycle highways were principally brought forward along the national plan “Met de Fiets Minder Files”, as a potential solution to car congestion. During the period of the project, the Ministry of Infrastructure and Water Management developed a subsidy scheme for regions to implement such infrastructure. However, with the termination of the

plan in 2012, regions and municipalities were left without a centralised source of governance and financing.

With almost a decade past, the development of cycling highways remains decentralised in the Netherlands, and progress is slow. However, the aforementioned e-bike developments combined with the still recurring issues of car congestion and pollution can be seen as a force for change in the institutional view of cycling highways. The Tour de Force, a recent national plan aiming to centralise knowledge and co-governance of cycling policy, emphasizes the need for strengthening the quality and network of regional cycle routes (Tour de Force, 2017). Much research regarding cycling highways has focused either on their feasibility and financing, or on the user choice and behavioural mobility. However, little is known of the overarching mechanisms that help bring about change in the institutional setting that governs the development and implementation of such infrastructure in the Dutch regions. For this purpose, this study aims to delve into the following question:

*How do provincial cycling managers contribute to the implementation of bicycle highway ambitions in The Netherlands?*

Naturally, several subquestions are developed in order to properly answer the main question in a more focused manner:

- *What is the implementation rate of bicycle highways across Dutch provinces?*
- *How does it compare to the perceived implementation rate of provincial cycling managers?*
- *What factors are perceived to affect the implementation rate of bicycle highways?*
- *What strategies do provincial cycling managers employ to overcome or leverage these factors?*

In order to answer these questions in an academic manner, this thesis follows a clear structure. First, the literature's theories were studied and expanded upon, and a conceptual model is introduced. Secondly, all data collection methods as well as the empirical processes are presented under a methodology section. Afterwards, the results of the analysis are exposed, explained, and interpreted. Finally, this thesis ends with conclusions based on the whole research development process.

# 2. Theoretical Framework

In the following chapter, the theoretical blocks upon which this thesis is built are developed. These blocks are principally diffusion of innovations theory, policy arrangements research and change agency literature. The first section argues why and how bicycle highways can be viewed as innovations. The next section delves into the diffusion of innovations and the variables affecting this diffusion. A third block argues how governmental actors (in this case cycling policy managers) can be viewed as change agents, and an overview of change agent strategies is developed. Last, a conceptual model is developed to synthesize all theoretical findings.

## 2.1. Bicycle Highways as Innovations

From a theoretical perspective, bicycle highways can be considered an innovation. The term of innovation has been used in many disciplines to define new ideas or concepts and explain how they integrate into society. In particular, the social sciences have shown ample interest in the research of this concept across many decades, and various definitions can be found depending on the sectoral and philosophical lens (Baregheh, 2009). Therefore, it is important to clearly define what is meant by innovation in the context of mobility infrastructure. In the early stages of innovation research, innovation has been defined as:

> *"A process whereby a new 'thought, behavior, or thing,' which is 'qualitatively different from existing forms,' is conceived of and brought into reality" (Barnett, 1953, as cited in Robertson, 1967, p. 14).*

Although this definition was formulated within the field of marketing processes, its generic nature makes it easily transferrable to other contexts. Because of this generic nature, it has also withstood the passing of time and is still applicable to this day. There are three key elements to this definition that can be explored in a more context-sensitive manner: the object (i.e. the new thought, behavior or thing), the attributes (i.e. what makes it qualitatively different) and the diffusion (i.e. the process whereby is brought into reality).

The object, in the case of this research, is the concept of bicycle highways. The attributes of this object are closely linked to its nature, making it relevant to be discussed within the same section. Despite the introduction of the bicycle highway concept more than a decade ago, this type of infrastructure is still viewed as a novel concept within mobility infrastructure planning (Agarwal et al., 2020; Grigoropoulos et al., 2021). There are various aspects to bicycle highways that make it useful to be studied from the lens of innovation (Ploegmakers & Sharmeen, 2018).

From a technical perspective, bicycle highways are bicycle paths that cover longer distances, are wider for safe overtaking, and aim to have little to no crossings (Cabral Dias & Gomes Ribeiro, 2020). These aspects contribute to the formation of a new mobility infrastructure concept, but the intrinsic differences with traditional cycling paths are not radical. Seen this way, bicycle highways appear like no more than upgraded bicycle paths, and their innovativeness is not too apparent. From a more holistic approach, however, bicycle highways hold certain values and intentions that make it significantly distant from existing forms of mobility infrastructure. Namely, three innovative notions can be distinguished.

First, a bicycle highway is an infrastructure concept based on the idea of further increasing the presence and priority of cycling traffic within the mobility system. Although the local and daily urban system contexts are increasingly acknowledging the diversity and complexity of the transport system, it remains a fact that motorized traffic is still the core of mobility planning around the world (Cascetta et al., 2007). Globally speaking, urban cycling is treated as a second-tier transport to motorized transit, often underestimated in traffic planning, and grouped together with pedestrians under the category "active modes of transport" (Meschik, 2012; Grzebieta et al., 2011). In inter-urban and regional contexts this fact is exacerbated, with bicycle infrastructure relegated to poor-quality networks or mostly disregarded altogether.

This lack (or poor quality) of cycling infrastructure contributes to a decrease in the modal share of cycling users, who opt for modes with better built infrastructure (Agrawal et al., 2020). By introducing bicycle highways into the equation of urban and regional planning, existing regimes are challenged with adapting to new realities. As Grigoropuolos et al. (2021) suggest, bicycle highways can serve as the backbone of a consolidated cycling network at different spatial scales. Therefore, bicycle highways can provide the foundations towards reshaping mobility infrastructure institutions.

The second notion refers to bicycle highways as a means of expanding cycling mobility past the traditional boundaries of the urban/municipal level. This last statement is very tied to the increasing potential of light electric vehicles, especially the electric bicycle, as a feasible mid-distance mode of transport (Cairns et al., 2017). Because of the electric assistance design, electric bikes can reach higher speeds, with a legally imposed cap at 25km/h in the EU. Speed pedelecs, also called high-speed e-bikes, can reach maximum speeds of 45km/h (Rijksoverheid, 2021). Therefore, electric bicycles are opening a new window of travel distance potential.

Paired to this potential is the increasing number of users that are adopting such mode of transport, as well as is the distance they are willing to travel with it (Harms & Kansen, 2018; Plazier, 2019). Other drivers of the e-bike uptake are the increasing awareness of motorized traffic's pollutant effects, the health benefits of cycling and the avoidance of traffic congestion (Hendriksen & van Gijlswijk, 2010). However, due to safety issues, users are mostly discouraged from sharing infrastructure spaces with motorized traffic. For this purpose, bicycle

highways can meet the demand of high-quality, safe, comfortable infrastructure for longer distances.

The third innovative notion refers to bicycle highways as a contributor to the shift towards a more multi-modal, sustainable mobility system (Pucher & Buehler, 2017). This notion is tightly bound to the relationship between transport use and the built infrastructure that enables it to function (Ewing & Cervero, 2010). It can be argued that there is a contingent aspect to both dimensions of a mobility system. In the context of cycling, Nelson & Allen (1997) pioneered in academically backing this notion, by showing the existence of a positive association between miles of bicycle pathways and the percentage of cycling commuters. Later academic reviews also concluded that the availability of cycling infrastructure led to higher cycling use and an increase in cycling behavior in urban areas (Blitz & Lanzendorf, 2020; Möhlenberg et al., 2019; Yang et al., 2019). Recent case study research has corroborated these findings, albeit acknowledging the existence of other factors such as provision of bicycle-sharing schemes (Félix et al., 2020; Frank et al., 2021). By taking advantage of this association, bicycle highways can provide the infrastructure needed to promote and increase regional cycling use.

These factors contribute to the framing of bicycle highways as an innovation within mobility planning. More specifically, bicycle highways can be viewed as an innovation that diffuses into the current mobility planning regime through time. For this reason, it is useful to understand how innovations are diffused.

## 2.2. Defining Implementation Rate of Bicycle Highways

The diffusion of the innovation is the third key element of Barnett's definition. Special emphasis is given to innovation as a process, acknowledging the importance of studying how an innovation is brought into reality. Innovation, thus, does not integrate instantly into society but has rather a time component through which it gradually gets adopted by the existing reality. An important element of diffusion is the adoption of the innovation by its intended users.

Rogers (2003) develops a theory around common patterns and factors that determine how an innovation is adopted. Adoption entails the process through which an individual encounters an innovation, decides to use it and ultimately adopts it into their life. Because this research is interested in the policy arena of implementation, adoption rate can be transformed into implementation rate (Gironés et al., 2020). Rogers' work is compatible with the aim of this research, and theoretical premises can be drawn from it in conjunction with policy arrangements literature. For this reason, and because the implementation rate of bicycle highways is the intended dependent variable of this study, it is useful to flesh out the wider theory on diffusion of innovations.

## 2.3. Variables Determining Implementation Rate of Bicycle Highways

Diffusion of innovations theory, developed by Rogers (2003), can help break down and visualize the different elements that affect adoption. In his book, Rogers (2003, p. 207) develops a framework to analyze adoption. Due to the time component of the innovation process, adoption is referred to as a rate. This framework positions the adoption rate as the dependent variable and identifies five principal factors that influence it: 1) the perceived attributes of innovations, 2) the type of innovation-decision, 3) communication channels, 4) the nature of the social system, and 5) the extent of change agents' promotion effects (Figure 2).

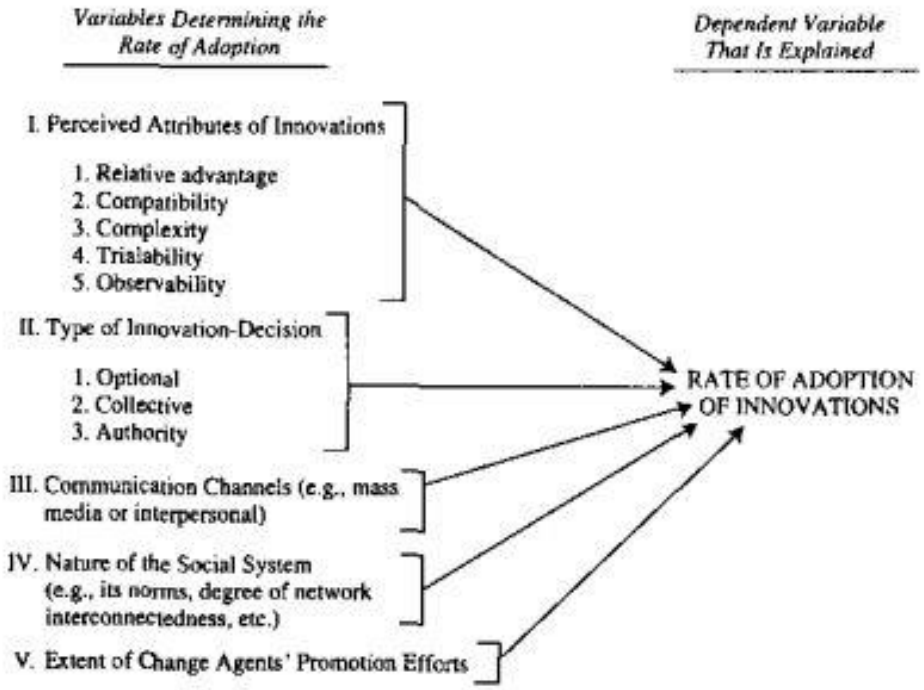



FIGURE 2. VARIABLES INFLUENCING THE RATE OF ADOPTION OF INNOVATIONS (ROGERS, 2003).

Although these variables are designed to be applied on any kind of innovation adoption rates, the research by Rogers (2003) mainly stems from organizational and business-oriented fields. This means that the intended adopters of such model are individuals in large numbers (e.g., consumers, firm employees, citizens, etc.). However, the implementation rate of infrastructure policy innovations such as bicycle highways has limited intended 'users', namely public authorities with the decision power to greenlight their implementation. Therefore, the variables need to be examined to see how they fit the context of bicycle highway implementation.

To help translate the variables of innovation adoption rates into a more context-sensitive policy innovation field, the work of Arts et al. (2000) becomes useful. In their study of policy

arrangements, Arts et al. break down policy arrangements into four distinct dimensions: policy coalitions, power and *resources*, the *rules of the game* and policy *discourses.* In a later study, Arts et al. (2006) consolidate these dimensions into a framework (Figure 3) with the following definitions (the main concepts highlighted in italics):

- Policy coalitions: the *actors* and their coalitions involved in a policy arrangement (individuals and organizations)
- Power and *resources*: the division of power and influence between these actors, in terms of financial, regulatory, and organizational resources.
- *Rules of the game*: the institutional rules currently in operation, both in terms of actual rules of interaction and in terms of formal procedures to develop the policy in question.
- Policy *discourses*: the current views and narratives of the actors involved, as well as the specific content of documents and measures.

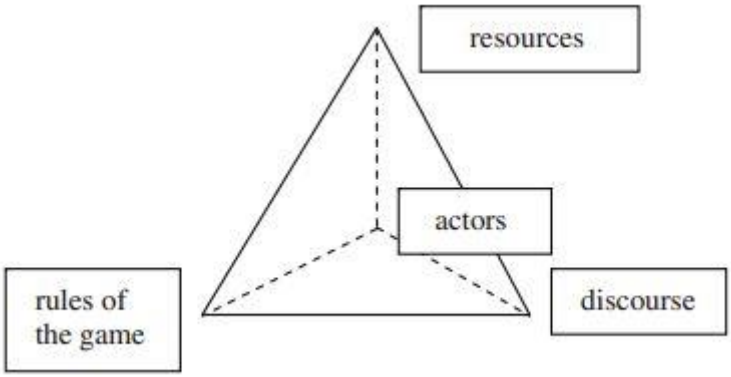



**FIGURE 3. THE TETRAHEDRON OF POLICY ARRANGEMENTS, FEATURING ITS FOUR DIMENSIONS AND RELATIONSHIPS (ARTS ET AL., 2006).**

With the work of Rogers (2003) and Arts et al. (2006), an adapted set of variables can be developed and argued for the context of bicycle highway implementation rate. The variables will follow the order of Rogers' framework, a total of five, and are condensed into four final variables. The variables are the following, for which an argumentation is given in the paragraphs below:

1. Perceived Attributes of Innovation
2. Communication Effects
3. Rules of the Institutional System
4. Influence of Change Agents

First, the variable *'perceived attributes of innovations'* can be translated into the field of policy innovation through the dimension of discourse. Bicycle highways hold certain attributes that are perceived and agreed upon by the actors involved, and these may or may not affect their implementation rate. This variable can be split into two distinct subvariables: one linked to its physical attributes as an infrastructure concept, and one linked to its policy attributes within mobility planning policy.

The second and third variables, i.e. *'type of innovation-decision' and* '*communication channels'*, cannot be directly translated, due to 1) the closed nature of institutional arenas in which such decisions are made (Gironés et al., 2020), 2) governmental decisions almost always being of an authority type (Rogers, 2003), and 3) the fact that it is a variable tied to the assumption of adopters being individuals. However, Tews (2005) does acknowledge certain communication signals at both international and national levels, and Arts et al. (2000) understand the importance of communication in the development of a policy arrangement. This leads to the variable of 'communication effects', which can show the degree to which communication channels of innovation knowledge affect the implementation rate in a specific region.

Fourth, the variable *'nature of the social system'* should be modified to better fit the policy arena, following the dimension of the rules of the game. The social system is not relevant in this context since civil society is not the focus of this research. However, the institutional system embedded in a policy arena holds certain rules (Arts et al. 2000), that may challenge or facilitate this innovation's implementation. Therefore, the modified variable of 'rules of the institutional system' is formulated.

The fifth variable of *'extent of change agents' promotion effects'* can reveal the influence of agency (e.g. private entities, public actors, civil society, lobby organizations, etc.) on the implementation rate of bicycle highways. This variable is strongly linked to the dimension of actors, the subjects partaking in a policy domain. For conciseness purposes, the variable is renamed to 'Influence of Change Agents'.

The following paragraphs will develop each of the variables by drawing from specific theory, dividing them into subdimensions if needed and explaining them. The operationalization of these variables for the specific empirical case can be seen in Section 3.3.2.

### 2.3.1. Perceived Attributes of Innovation

As developed in earlier sections, the attributes to bicycle highways can be seen as either physical/observable attributes or as policy attributes. On the one hand, physical attributes are linked to the physical properties that BH might hold as agreed upon the actors that adopt them. These properties can be developed into *definition rigidity* and *spatial compatibility*. On the other hand, policy attributes refer to those properties that BH hold as a policy innovation, that in themselves may or may not affect the implementation rate of said infrastructure. In her study, Tews (2005) developed three main subdimensions that build up the notion of policy attributes: *problem structure*, *compatibility*, and *political feasibility*. These subdimensions are listed and explained in Table 1.

TABLE 1. LIST AND DESCRIPTION OF SUBDIMENSIONS OF "PERCEIVED ATTRIBUTES OF INNOVATION".

| SUBDIMENSION | DESCRIPTION |
|---|---|
| **Definition Rigidity (Physical)** | The extent to which BH stick to the expected physical standards. A definition can bring clarity and common understanding but can also bring stiffness and inflexibility to the concept. |
| **Spatial Compatibility (Physical)** | The extent to which the spatial configuration of the region under which BH are planned is suited for their implementation. Factors such as the geography, demography, the number of intersections with major infrastructure or the available space may exert pressure on BH implementation. |
| **Problem Structure (Policy)** | The problem structure of BH refers to the issues that BH as a policy aims to solve in a certain policy arena. Such a structure can be one of, or a combination of, different solutions to: car congestion, car pollution, accessibility, social equity, etc. |
| **Policy Compatibility (Policy)** | The degree of perceived compatibility of BH with the current mobility paradigm may influence their implementation rate. Policy arenas with a consolidated cycling policy may show high levels of compatibility of BH, and vice versa. |
| **Political Feasibility (Policy)** | The degree to which politicians see BH as a feasible policy instrument can also be a key determinant on their implementation. Overall support may lead to swifter implementation, while a lack of enthusiasm may render little financial support for BH. |

### 2.3.2. Communication Effects

The variable of communication effects reflects the interactions that actors in the policy arena may have with other actors/organizations with regards to relevant knowledge. This variable exemplifies the link between the dimensions of actors and resources (Arts et al. 2006). From an institutional point of view, this type of knowledge interaction is a rather informal interaction process, very particular of policy innovation diffusion (Arts et al., 2000; Tews, 2005). Knowledge transfer tends to occur in geographically localized areas (Autant-Bernard et al., 2007), and interpersonal networks can contribute to its diffusion (Singh, 2005). In the case of bicycle highway implementation, knowledge can happen between projects within a province (within the jurisdictional boundary), but also across provinces and even countries (across jurisdictional boundaries).

### 2.3.3. Rules of the Institutional System

Institutions have an important role to play in determining the implementation rate of policy innovation. Institutions tend towards formalized, robust rules over time, and therefore may pose a barrier to the introduction of policy innovations (Salet 2018). In the case of bicycle

highways, the province as an institution can affect their implementation rate depending on the rules being applied. Arts et al. (2000) distinguish between three rules that define the *rules of the game* in a policy arrangement: interaction rules, regulatory power, and rules of governance. Each of them can be composed of formal and informal rules. First, 'interaction rules' refers to all relations, both formal and informal, between actors involved in a policy implementation. Second, 'regulatory power' covers the relation between the policy innovation and the established laws and formal rules of the institution. The first two rules are relevant to this study and are developed in Table 2. Conversely, the 'rules of governance' is deemed not relevant for this study; the rule refers to the relationship between state, market, and civil society, and neither market nor civil society play a role in the policy arrangements of bicycle highways (Moed, 2012). Additionally, financial resources can exert an effect on the rate of BH implementation, especially with regards to the source, amount, and allocation (Oliveira & Hersperger, 2018); these are considered within the regulatory power.

TABLE 2. LIST AND DESCRIPTION OF SUBDIMENSIONS OF "RULES OF THE INSTITUTIONAL SYSTEM".

| SUBDIMENSION | DESCRIPTION |
|---|---|
| **Formal Interaction Rules** | This dimension refers to all the formal roles that actors involved in a policy arrangement are assigned to carry out. It is concerned with the question of 'who does what', in terms of content and process. |
| **Informal Interaction Rules** | This dimension develops the informal interaction between actors involved in a policy arrangement. This can entail additional roles that certain actors may play off the book, power relations and arrangements between different actors, working methods and proactiveness of the actors involved, etc. |
| **Formal Regulatory Power** | This dimension is concerned with all formal rules within which bicycle highways are allowed to be implemented. This can be financial arrangements, the jurisdictional setting of the region (who owns what), the existence of certain laws or programs affecting their implementation, etc. |

### 2.3.4. Influence of Change Agents

Within a policy arrangement, specific individuals or organizations can play an extraordinary role in pushing and directing a policy towards its implementation (Huitema et al., 2011; Mintrom, 1997). As mentioned previously, this variable is tied to the dimension of *actors* within a policy arrangement. This variable is intended to identify external change agency effects and is not to be confused with the notion of cycling managers as change agents.

Change agency can be performed by all sorts of individuals pertaining to a variety of organizations or entities (Mintrom, 1997). In a policy innovation setting, a split can be made between change agency within the government, change agency by other members of the

state, or change agency from outside the government (Gironés et al., 2020). This study is mainly concerned with the role as change agents of governmental actors, but information on other change agents can help explain the implementation rate in a certain setting.

## 2.4. Bicycle Highways and Change Agency

This section aims to explore the theory relating to change agency in the public domain, structuring concepts from research in order to have a foundation upon which to investigate the strategies and tools used by public actors in the pursuit of infrastructural policy innovation implementation.

### 2.4.1. Change Agency and Governance

In any given public sector, actors can play a pivotal role in promoting certain policy or reshaping institutions (Hardy & Maguire, 2008). The potential for change by actors can happen at different levels of public governance – that is, from national ministers to local civil servants – and in different forms – i.e., as individuals or as an organization (Sundin & Tillmar, 2008). This figure of a public actor as an agent of change has been termed in several ways within academia. Two prominent forms are relevant for the purpose of this research: policy entrepreneurs and institutional entrepreneurs.

Policy entrepreneurs are individuals or organizations who invest considerable resources, time and effort in developing and directing certain policy towards implementation (Mintrom, 1997). Policy entrepreneurs are linked to achieving a content-driven outcome and use a diverse assortment of means to get there (*ends* focus). In turn, institutional entrepreneurs are individuals or organizations "who have an interest in particular institutional arrangements and who leverage resources to create new institutions or to transform existing ones" (Maguire et al., 2004, p. 657, as cited in Hardy & Maguire, 2008, p. 198). They are interested in changing structures and processes themselves, not so much pushing for a specific content (*means* focus). Both forms of change agency offer a wide range of strategies and tools used to achieve their goals.

Both policy and institutional entrepreneurship offer a large body of research. However, there are a few contingencies to these terms worth mentioning. The term institutional entrepreneur has been extensively used in different academic contexts and for various purposes, blurring its meaning and leading to misinterpretation (Weik, 2011). Additionally, it has been often used to describe institutional superheroes achieving above average feats of change (Abdelnour et al., 2017). Institutional entrepreneurship, and broader change agency in the public governance realm, have been mainly focused on extraordinary individuals as champions of institutional change. Less focus has been given to the action and strategies of less apparent change agents (Sundin & Tillmar, 2008).

This study is mainly interested in institutional and policy entrepreneurship due to their focus on agency within governance research. Most of the literature in the following sections stems from these branches of governance. However, the focus of this research is not on the subjects, but in the actions that public actors may exercise in the role of change agents. For these reasons, it is more prudent to talk of agents of change, as the umbrella term of institutional and policy entrepreneurs, to avoid confusion and misinterpretation.

### 2.4.2. Cycling Mobility Managers as Change Agents

In the context of bicycle highways, public actors in charge of planning cycling mobility (hereon referred to as public actors) have the potential of taking on the role of change agents. As such, they can play a key role in directing bicycle highway implementation. Bicycle highway policy can be classified as a discontinuous innovation, since it aims at transforming the behavior and mental modes of society in relation to mobility (Ploegmakers & Sharmeen, 2018; Robertson, 1967). In the realm of policy innovation, discontinuous innovations possess a transformative nature which aims at modifying or challenging existing policy regimes. In these situations, thus, it becomes difficult and uncertain to make decisions: there is little publicly available information, and policy directions are usually discussed within specific institutional arenas. This leads to a process of decision-making left to actors that have insight into policy venues and an active role in decision-making arenas (Gironés et al., 2020; Kingdon & Stano, 1984).

It has then been established that public actors responsible for cycling mobility planning can play a role as agents of change. However, to assume that public actors in discontinuous innovation contexts automatically take on the role of change agents is a bold statement. There are several conscious and unconscious reasons to consider public actors as agents of change. Public actors have an advantageous position with access to relevant knowledge and networks (Gironés et al., 2020). They too hold the knowledge and legitimacy to transform field-specific policy objectives into implementable plans, thus having a big understanding of and an interest on the innovation itself. Plus, field-specific innovations position the field-corresponding public actors in a role of employing, with or without intention, strategies and tools to pursue the implementation of said innovation (Huitema et al., 2011).

### 2.4.3. Strategies of Change Agents

The figure of the change agent is seen as an individual (or possibly an organization) that invests resources, time and effort in pushing for a certain innovation, in the belief that the implementation of such innovations will pay off such an investment (Mintrom, 1997). Therefore, change agents seek to manage change in a planned manner, in order to achieve change with the least amount of resistance (Westover, 2010). Change in organizations is a recurrent phenomenon, both internally and through external forces. In the social domain, change has been occurring at an accelerating pace over the past century (Kim et al., 2014). Therefore, there has been a growing number of research focused on identifying strategies and tools that change agents may use when managing or directing change.

In his paper on strategic change management, Tichy (1982) identifies three main tool areas that an organization possesses to tackle change: mission and strategy tools, organization structure tools, and human resource tools. Tichy defines them in the following way:

- Mission and strategy entails setting objectives and an overall strategy, including all the strategies employed to ensure so.
- Organization structure tools refer to the processes employed to ensure the establishment and functioning of proper structural arrangements.
- Human resource tools include all the processes of finding and training individuals that fit the needed roles for a specific change to happen.

These three tool areas can be translated into the policy innovation arena field by cross analyzing these tools with the framework by Arts et al. (2006), depicted in Figure 4. Because of the focus on agency, every tool area can be respectively paired to one of the three interactions between the dimension of 'actors' and each of the other dimensions. First, mission and strategy tools can be seen as any tools employed by public actors to affect the dimension of discourse. These strategies aim at channel the frame and story around policy innovations in a favorable direction towards implementation (Candel & Biesbroek, 2016; Westover, 2010). Second, organization structure tools refer to those strategies employed to affect the rules of the game within the policy arena. That means any tools aimed at changing the structure, the rules or the processes established within an institution to facilitate the implementation of a policy innovation (Lunenburg, 2010). Third, human resource tools can be modified into more generic resource tools, and englobe all strategies used by change agents to affect the dimension of resources. These resources are mainly knowledge and finance (Arts et al., 2006).

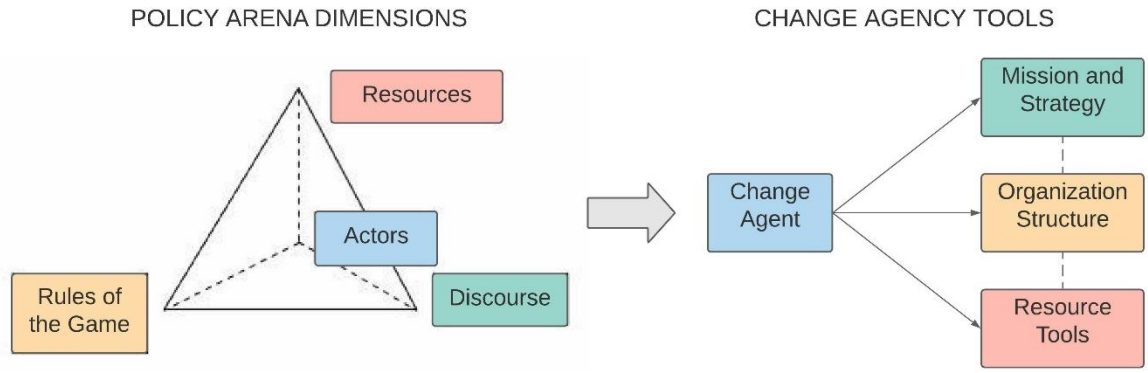



FIGURE 4. TRANSLATION OF THE POLICY ARRANGEMENTS TETRAHEDRON (ARTS ET AL., 2006) INTO STRATEGY BLOCKS OF CHANGE AGENTS. EACH DIMENSION IS COLOR-CODED TO THEIR HOMOLOGOUS.

## 2.5. Towards a Conceptual Model

The aim of this study is to find out how provincial actors contribute to the implementation rate of bicycle highway projects in The Netherlands. Provincial actors are of interest in this specific context because they pertain to the governance body in charge of the strategic planning and implementation of bicycle highways in said country. The investigation, following the secondary research questions, is two-fold: 1) to understand which factors play a role in facilitating or challenging the rate of bicycle highway implementation and 2) to identify which strategies and tools provincial actors use to overcome or leverage said factors.

On one hand, the factors affecting the implementation rate have been developed in section 2.3 through an extensive literature review on diffusion of innovations theory and policy arrangements theory. These variables are shown in the conceptual model (Figure 5) under the umbrella of 'Policy Arrangement Factors'. On the other hand, theory on the strategies and tools used by change agents has been laid out in section 2.4, the categories of which are depicted in Figure X under the concept of 'Change Agency Tools'. Following this conceptual model, certain theoretical expectations can be drawn:

- Higher provincial change agency leads to a higher implementation rate of bicycle highways
- Mission and strategy tools are most likely to overcome factors related to 'perceived attributes' and 'communication effects'
- Organization structure tools are most likely to overcome factors related to the 'rules of the institutional system', specifically 'interaction rules'.
- Resource tools are most likely to affect the 'rules of the institutional system', specifically 'regulatory power' rules.

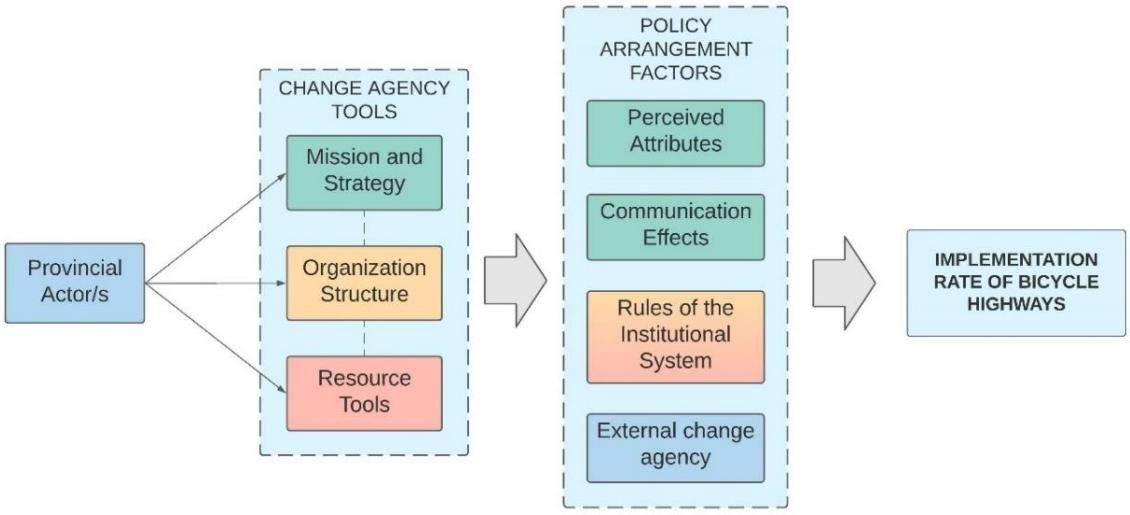



FIGURE 5. CONCEPTUAL MODEL OF THE STUDY.

# 3. Methodology

In this section, the methodology for this thesis will be laid out. First, the research design will be argued for and described. Second, the case selection for this thesis is explained, and the relevant information on the case is provided. As a last point, the data collection strategy for the thesis will be explained in detail.

## 3.1. Research Design

This thesis argues that public actors can act as an agent of change to direct the implementation of infrastructural innovations, in this case bicycle highways. In order to do so, this study has a two main aims: 1) to identify and explore the factors that influence the speed at which this infrastructure is implemented (the rate at which it is adopted) and 2) the strategies that public actors use to overcome negative factors and to leverage positive ones. Because this research is interested in an in-depth understanding of contextual, non-numerical data, a qualitative approach is chosen (Strauss, 1987).

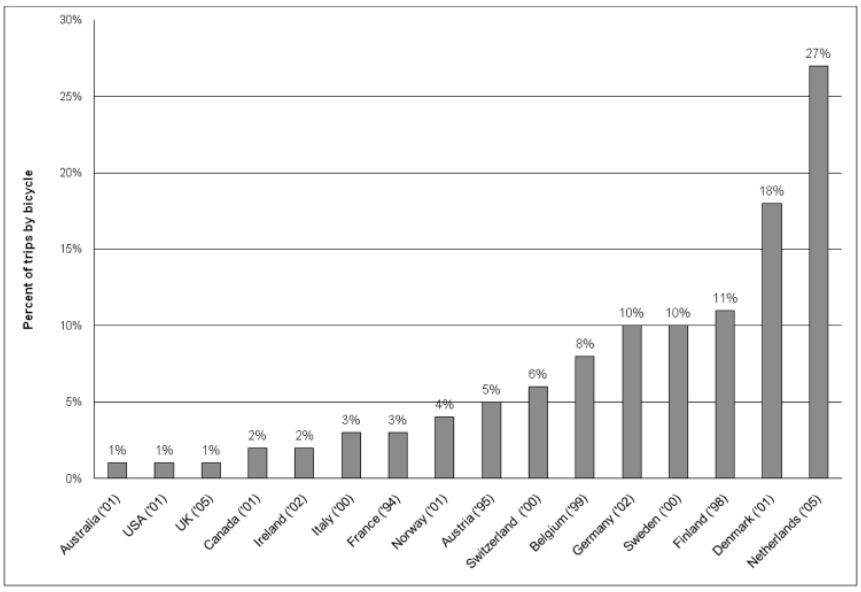
More specifically, a case study research is deemed appropriate to provide an empirical setting embedded in the real world whose findings can help answer the given research questions (Gillham, 2000). In order to study the research questions from a methodological point of view, a comparative research design is chosen. This method can reveal relationships and causal inferences between sets of conditions and the studied outcomes (Blau, 1965). In the case of this research, a comparative study can show the differing factors and strategies that lead to either high or low rates of bicycle highway implementation. Additionally, this research also has an exploratory component, this way keeping an open end on potential new discoveries and insights related to bicycle highway implementation that theory might have overlooked (Stebbins, 2001).

The dependent variable of this study is the rate of implementation of bicycle highways, i.e. the rate at which bicycle highways successfully turn from political ambitions into projects that start getting implemented (go into construction). The independent variables are the policy arrangement factors described in the theory, and the strategies are both independent and mediating variables to the rate of implementation.

## 3.2. Case Selection and Description

The case selected for this thesis is the country of The Netherlands, and the unit of analysis are its provinces. There are three main reasons as to why this case was chosen. First, The Netherlands has a long history of cycling use and cycling culture as a mode of transport (Pucher & Buehler, 2008), and that has played a part in embedding cycling infrastructure to the mobility agendas of its municipalities and provinces. The modal share of cycling for the entirety of The Netherlands is 28% (de Haas & Hamersma, 2020), with some cities reaching

modal shares of up to 40% (Ozisik & Kolstein, 2018; Province of Groningen, 2018). As Salet (2018, p. 93-101) discusses in his book, historical institutionalism can create a path of dependence towards a certain way of creating and managing policy. In the case of bicycle highways, this works in its favour, as Dutch institutions have internalized cycling as a feasible mode of transport over the decades, paving the way to an early implementation of cycling highways.




*Sources*: European Union (2003); German Federal Ministry of Transport (2003); U.S. Department of Transportation (2003); European Conference of the Ministers of Transport (2004); Department for Transport (2005); Organisation for Economic Cooperation and Development (2005); Netherlands Ministry of Transport (2006); Australian Bureau of Statistics (2007)

**FIGURE 6. BICYCLE SHARE OF TRIPS IN EUROPE, NORTH AMERICA AND AUSTRALIA; IN PERCENTAGE OF TOTAL TRIPS. (SOURCE: PUCHER & BUEHLER, 2008).**

Therefore, and only comes as natural of this cycling-oriented culture, the second reason for choosing The Netherlands as the case study is that the concept of "bicycle highways" originates from the country's own Ministry of Infrastructure and Water Management. In 2006, and as a measure to combat rising car congestion problems, the Ministry developed a subsidy program to encourage provinces and municipalities to build high-quality, intersection-free cycling paths – namely bicycle highways (Moed, 2012). This program, named *Met de Fiets Minder Files* (transl. "with the bike less traffic jams"), hoped that with the enhanced quality of cycling infrastructure, car commuters would start opting for the bicycle as an alternative commuting mode (van Boggelen, 2010). The subsidy ran until 2012, leaving then Dutch provinces with a novel infrastructure concept with a momentum up to each of them to maintain.

In 2015, the Tour de Force was created as an inter-provincial knowledge and lobby organization on cycling ("Tour de Force - Fietsberaad", 2021). Among many tasks, this cooperation follows and helps provinces direct the implementation of their bicycle highway ambitions. This leads to the third reason as to why The Netherlands was chosen as a case study; this thesis was performed along the department in charge of directing the Tour de Force cooperation. This department belongs to the Dutch national infrastructure implementation

and management organization *Rijkswaterstaa*t. Therefore, through this internship, secondary data collection and contacts with the relevant interviewees was of easier access.

### 3.2.1. Case Description

The Netherlands is a country situated in Northwest Europe, with a population of 17,52 million divided into 12 provinces ("CBS - Population Dashboard", 2021). This population is concentrated in the western side of the country, but the country is considered a predominantly urbanized region throughout (Pizzoli & Gong, 2007, p.3). The 12 provinces that compose the country, as seen in Figure 7, are the following: Drenthe, Flevoland, Friesland, Gelderland, Groningen, Limburg, Noord-Brabant, Noord-Holland, Overijssel, Utrecht, Zeeland, and Zuid-Holland. After 2012, with the end of the national program, these political entities hold the competences with regards to bicycle highway implementation.

In terms of bicycle highway properties, the national infrastructure, environment, and mobility knowledge platform CROW advises bicycle highways to be of a minimum width of 4 metres, be made of good-quality asphalt (preferably with a matching colour to cycling paths), be as direct a route as possible between the connected settlements, and present little to no intersections (ensuring the right-of-way for its users throughout the route) (Rik de Groot, 2016). These are not enforced measures, but an educated advice on the optimal standards of a bicycle highway.


FIGURE 7. POLITICAL MAP OF THE PROVINCES THAT COMPOSE THE NETHERLANDS.

## 3.3. Data Collection Strategy

The data collection strategy can be divided into two main sections: 1) data collection for the dependent variable (the rate of implementation of the different provinces) and 2) data collection for the independent variables (the factors influencing implementation and the strategies implemented by provincial cycling managers).

### 3.3.1. Operationalizing Rate of Bicycle Highway Implementation

The rate of implementation of innovations has been extensively operationalized in the fields of business, economics, and management with quantitative methods. A common concept used and drawn from Science and Technology Studies (STS) is that of the S-curve adoption pattern (Brown, 1992). This pattern helps in rationalizing the implementation of innovations, by categorizing them into different implementation groups. In the case of this study, the rate of bicycle highway implementation is categorized into low, high, and plateaued implementation rates. Because of the qualitative nature of this research, a specific number is not so much of importance as the ability to categorize provinces into groups of low, high and plateau stages of implementation. The number and stage of bicycle projects per province was deemed as an appropriate means to be able to obtain such a categorization.

To gather such data on bicycle highway projects per province, a mix of secondary data collection and interview data collection was employed. The secondary data method involved a primarily map data collection system with complimentary Excel file data, which allowed to operationalize the rate of implementation through numerical means. The interview data method allowed to compare these numerical findings with the perceived implementation rates of provincial cycling managers. Since 2010, the national cooperation in charge of following bicycle highway development started publishing maps of the entire Netherlands with bicycle highway project ambitions, planned projects, projects under implementation, and completed projects (Figure 8). These maps provide strategic information on the number and stage of different bicycle projects per Dutch province.

The obtained maps were of 2010, 2011, 2013, 2015, 2016, 2018 and 2019. Because the year intervals between publications was not balanced, and because this research was looking for a rather strategic qualitative overview of the rates of implementation, it was chosen to focus on the maps of 2010, 2013, 2016 and 2019. Specifically, the maps of 2010 and 2019 are of real value to calculate a rate of implementation, but the data of the in-between maps were used to provide a richer historic context.

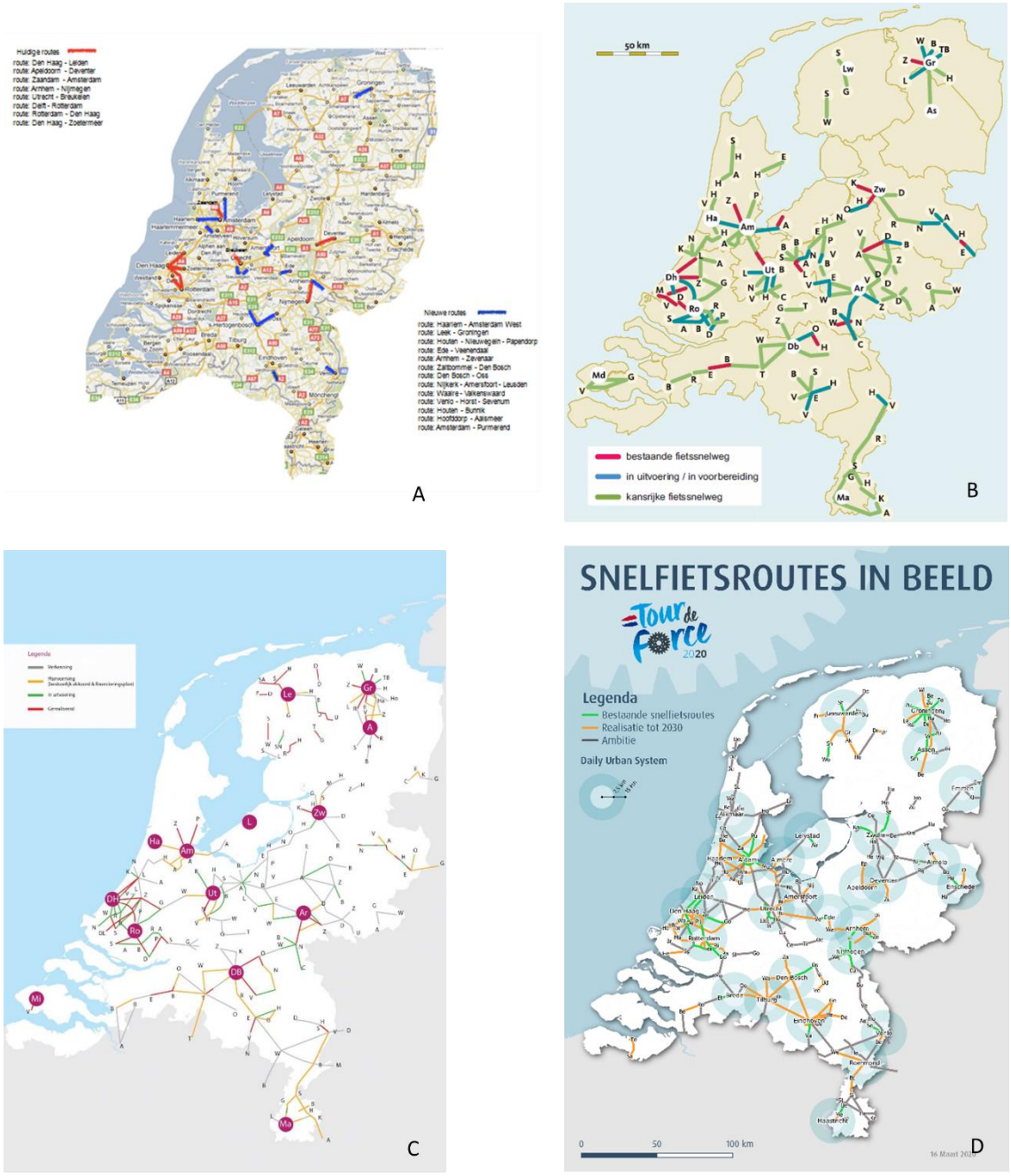



**FIGURE 8. OVERVIEW OF MAPS USED FOR THE COLLECTION OF BH PROJECT DATA. (A) 2010, (B) 2013, (C) 2016, (D) 2019 (FIETSVILEVRIJ, 2016; TOUR DE FORCE, 2019)**

The bicycle highway projects for each map publication were counted, and the 2019 publication was aided by a supplementary Excel sheet with a list of the state of all bicycle highway projects at the time. The Excel file aided in cross-checking projects with the 2019 map, since the latter was rather complex to analyse visually. With the raw data input into Excel, the bicycle highway projects per province were binned into two categories: 1) project ambitions + planned projects and 2) projects under implementation + completed projects. This categorisation of projects aided in calculating the rate of implementation through the following equations:

$$Rate\ of\ Implementation = \frac{a - b}{N}$$

$$Weighted\ Rate\ of Implementation = \frac{a - b}{T * W}$$

These equations make a comparison between the state of bicycle highway implementation for the given time interval of 2010-2019. In the first equation, letter $a$ refers to the number of bicycle highways completed or under implementation in 2019 for a given province. Letter $b$ refers, in turn, to the number of bicycle highways completed or under implementation in 2010 for a given province. The common denominator for both, *N*, is the total amount of bicycle highway projects in a given province in 2019; this includes ambitions, projects being planned, projects under implementation and completed projects. Essentially, this equation provides an implementation rate that may range from 0 to 1; the higher the score, the higher the implementation rate is in a particular case and vice versa. For example, provinces with a high number of ambitions and low number of implemented projects would result in a low implementation rate.

However, the first equation only works well in cases with mid- to high project numbers. Provinces with a low number of projects can easily score high implementation rates, and may lead to misinterpretation (e.g., a province with zero projects in 2010 and 1 completed project in 2019 scores a perfect implementation rate of 1). The second equation thus takes the "raw" rate of implementation and weighs it to the absolute number of bicycle highway projects per province. *T* is the total amount of bicycle highway projects in 2019 for the whole country (T = 299 projects). *W* is the sum of all the weighed implementation rates, to normalize rates again into a range of 0 to 1 (for visual purposes). This equation thus considers not only how fast ambitions turn into implementation projects, but also the amount of bicycle highway projects that a province is undergoing.

A scatter plot of the raw implementation rate against the weighted implementation rate was used to categorize the bicycle highway implementation rates of Dutch provinces. A comparison with interview information on the perceived rate of implementation provided further context-sensitive knowledge on the stage of implementation of a specific province.

### 3.3.2. Operationalizing Independent Variables

The data collection strategy for the independent variables was a qualitative method using semi-structured interviews to relevant subjects. In order to produce an interview guide, the dimensions laid out in the theoretical section were further operationalized into more tangible indicators. These indicators are shown and described in Table 3.

TABLE 3. LIST OF VARIABLES, INDICATORS AND RESULTING QUESTIONS FOR THE INTERVIEWS.

| | DIMENSIONS AND INDICATORS | QUESTIONS |
|---|---|---|
| DV | **Perceived Rate of Implementation**<br>How actors see the implementation rate of BH in their own provinces | - When does the concept of BH enter the province?<br>- Are there any key milestones or points of inflection worth elaborating?<br>- How do you perceive the progress of BH implementation in your province? Is it promising, slow, stagnant? |
| PERCEIVED ATTRIBUTES OF BICYCLE HIGHWAYS | **Definition Rigidity** | - How does the province define a bicycle highway?<br>- How strictly do you stick to the standards of a BH? |
| | Degree of strictness with standards | |
| | **Spatial Compatibility** | - How does the spatial distribution of cities affect bicycle highway implementation?<br>- How does the presence of existing cycle paths affect BH implementation?<br>- How does the geography of the province affect BH implementation?<br>- How do physical barriers affect BH implementation? |
| | Perceived spatial distribution of settlements in province | |
| | Presence of cycling infrastructure | |
| | Perceived physical barriers of the province | |
| | **Problem Structure** | - Which problems do bicycle highways aim to solve in your province? Traffic congestion, traffic safety, health…? |
| | Type of (policy) problem aiming to solve (traffic congestion, etc.) | |
| | **Policy Compatibility** | - How do cycling volumes affect BH implementation?<br>- How does cycling policy of the province affect BH implementation?<br>- How does the rise of the e-bike affect BH implementation? |
| | Inclusion of BH in mobility policy | |
| | Cycling volumes of province | |
| | E-bike and cycling innovations | |
| | **Political Feasibility** | - How do provincial politicians perceive the concept? Is it a partisan idea?<br>- What are the main difficulties that provincial politicians see with regards to BH implementation?<br>- How has the province team overcome those difficulties? |
| | Degree of political acceptance | |
| COMMUNICATION EFFECTS | Presence of iconic BH | - How does the implementation of a pilot/first BH affect the IR?<br>- How does communication with other provinces affect BH implementation in your province?<br>- How does the implementation of BH in other countries or international regions affect the implementation?<br>- What strategies are followed to leverage these? |
| | Presence of interprovincial BH directed by another province | |
| | Interprovincial communication signals | |
| | International communication signals | |

| | | |
|---|---|---|
| **NATURE OF THE INSITUTIONAL SYSTEM** | **Formal Interaction Rules** | - Which actors are involved in the process of BH planning?<br>- What are the formal roles of these actors? Who has what power?<br>- How does this organization of actors affect the implementation of BH? |
| | Provincial capacity (number of people working in BH) | |
| | Role division and definition | |
| | Degree of provincial direction | |
| | **Informal Interaction Rules** | - What is the willingness of actors to implement BH?<br>- What institutional barriers in the process of implementation have you come across?<br>- What strategies have you used to overcome these?<br>- How does the cycling culture of provincial institutions affect BH implementation? |
| | Provincial proactivity (informal roles taken by province) | |
| | Network-thinking culture | |
| | Municipal proactivity | |
| | Degree of cycling culture | |
| | **Formal Regulatory Power** | - How are BH projects financed?<br>- How have national subsidies/programs affected BH implementation?<br>- What barriers do financial aspects present?<br>- Which strategies does the province use to overcome these?<br>- What strategies are used to bring ambitions into implementation?<br>- Who has ownership of BH? |
| | Financial capacity | |
| | Financial distribution (percentage paid by province) | |
| | Access to national subsidies | |
| | Presence of formalized program | |
| | Ownership of BH | |
| **CHANGE AGENCY EFFORTS** | Perceived provincial change agency | - How would you see yourself/the provincial cycling team as being a force for change in relation to BH?<br>- Are there any other governmental bodies or individuals that acted as change agents?<br>- Are there any particular individuals or organizations that have pushed for BH implementation in your province? |
| | Perceived change agency by other governmental actors | |
| | Perceived change agency by non-governmental actors | |

Ideally, an interview was performed to the provincial cycling mobility manager of each of the 12 provinces of The Netherlands. This way, a strategic comparative overview on the factors and strategies across the country was obtained. For practical reasons, 8 out of the 12 provinces were interviewed. Hence, an additional interview of a relevant third-party actor (National coordinator of the *Fietsersbond* – Cycling Union) was employed to gather an external perspective on the different independent variables to be studied. Additionally, this third perspective allowed the collection of data from a different perspective, giving information that provincial actors would not otherwise share.

The interviews were conducted via Microsoft Teams, saved in an encrypted intranet (Rijkswaterstaat), and the interviewee was always asked for permission to be recorded for academic purposes. All interviewees agreed to this condition. The recorded interviews were transcribed using the artificial intelligence transcribing software Otter.ai, always with a final manual refinement of the transcripts. The interviews were coded and analyzed using the program Atlas.ti. For the data collection and analysis of factors influencing implementation, a more rigorous set of indicators was crafted (see Table 3). The interview transcripts can be accessed by following the shared drive link in Appendix 7.1.

Nonetheless, a combination of deductive coding (taken from the indicator list) and inductive coding (for possible information that the indicators might not include) was employed to find patterns and themes on the factors that affect bicycle highway implementation. On the other hand, the data collection and analysis of strategies followed a more exploratory method of pure inductive coding, to keep an open-ended procedure of understanding the strategies without falling into confirmation bias. Nonetheless, the strategies were paired to the specific factor they are aimed to tackle, thus maintaining a structure to the analysis.

# 4. Results & Discussion

## 4.1. Implementation Rate of Bicycle Highways

As mentioned in the methodology, the implementation rate of bicycle highways was obtained using a mix of methods. On one hand, a set of calculations were performed to obtain qualitative visualizations of the implementation rates per Dutch province. These visualizations allowed to categorize the provinces into clusters of different IR. On the other hand, interview data was used to get a more in-depth understanding of the IR for each province. It is worth mentioning that the numbers displayed on the graphs are not of relevance to this study, but rather the qualitative visualizations that these create.

The first two visualizations show, respectively, the implementation rate for each province and the weighted implementation rate (which takes into account the absolute number of projects every province follows). For the raw implementation rate, three main groups can be distinguished: high IR (composed of FL, GE, GR), balanced IR (composed of FR, ZH, NB, ZE, DR) and low IR (composed of NH, UT, OV, LI). Because IR shows the relation between the total amount of projects and the projects that have been completed, the graph can show the level of ambition/intentions for each province. This means that high IR provinces have little to no ambitions left to implement, balanced IR provinces have a balanced ratio of implemented VS ambition projects, and low IR provinces have many ambitions compared to the number of implemented projects.

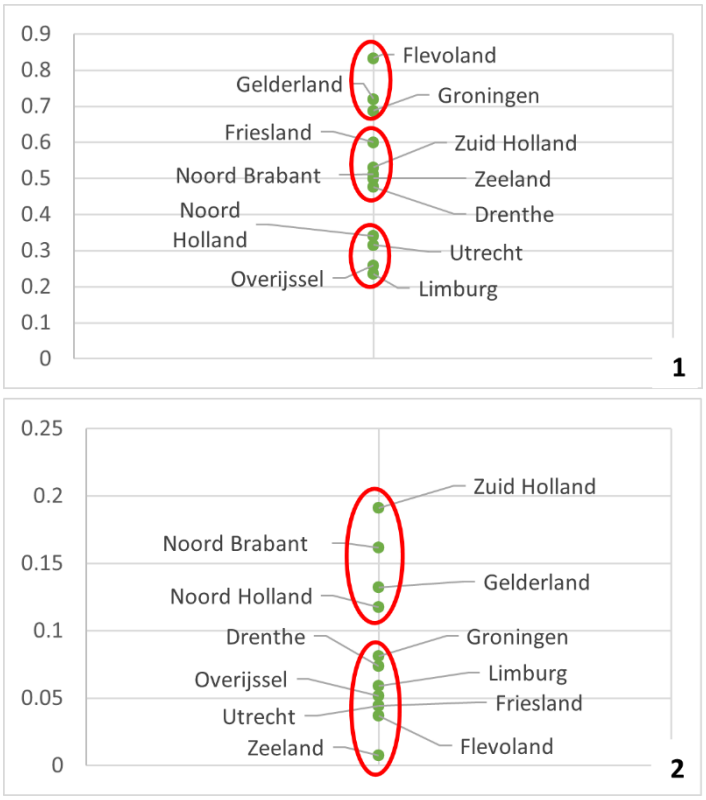



FIGURE 9. GRAPHS OF (1) IMPLEMENTATION RATE AND (2) WEIGHTED IMPLEMENTATION RATE OF PROVINCES.

However, because IR is a relative value that does not take absolute numbers into account, it is relevant to also analyze the Weighted Implementation Rate. This indicator's visualization distinguished between two main groups: a high implementation share (composed of ZH, NB, GE, NH) and a low implementation share (composed of the rest, including the very low-contributing ZE with 1 project). This indicator reveals information on the relative number of projects implemented compared to the entirety of projects across the country. By itself, this indicator cannot reveal much more, but when developed into its two components - that is IR and the Weight -, a two-dimensional plane forms that allows to cluster provinces into groups with different characteristics (Figure 10).

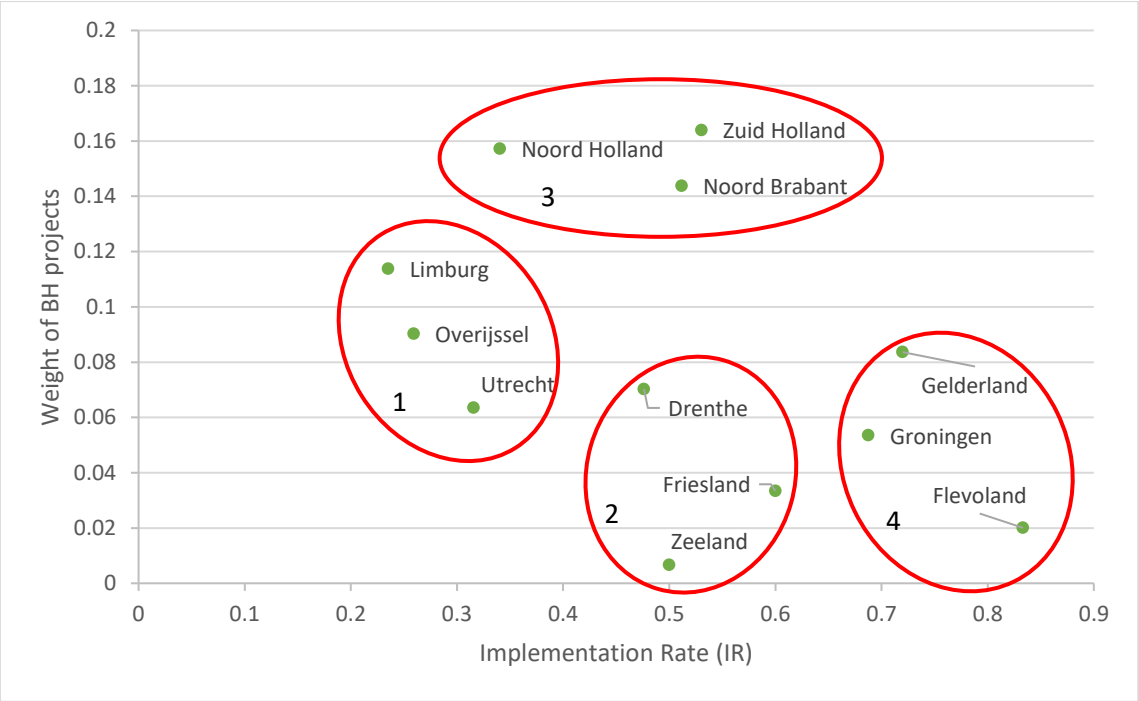



FIGURE 10. SCATTER PLOT OF THE WIR AGAINST THE IR OF PROVINCES.

The cluster analysis reveals four categories of provinces: 1) The first cluster (formed by LI, OV, UT) indicates provinces with a low IR, thus a high number of ambition projects compared to implemented projects, and a moderate share of BH projects with respect to the whole country. This could mean either provinces with many ambitions stored in a drawer, or provinces that are entering an acceleration phase of implementation; 2) The second cluster (formed by DR, FR, ZE) are provinces with a balanced IR and a low share of BH projects. The cross-analysis with interviews in Section 4.1.1 provides an in-depth interpretation; 3) The third cluster (formed by NB, NH, ZH) indicates provinces with a balanced IR and a high share of BH. These are provinces with a large count of projects and a balanced ratio of ambitions to implemented projects, most likely to be champion provinces in The Netherlands. 4) the fourth cluster (composed of FL, GE, GR) are provinces with a high IR and a low-to-moderate share of BH projects in The Netherlands. These are most likely provinces which have completed most of their ambitions and are entering a plateau phase.

### 4.1.1. Cross Analysis of Interview Data

The interviews revealed certain information that add context and meaning to the implementation stage of different provinces. Interviews were conducted for 8 of the 12 provinces and resulted in an updated categorization of IR clusters, for which a reasoning through the interview findings is provided below:

1) High Implementation Cluster: Gelderland, Noord Brabant, Zuid Holland
2) Low Implementation Cluster:
    a. High acceleration Phase (HAP) Cluster: Limburg, Overijssel, Utrecht
    b. Low Acceleration Phase (LAP) Cluster: Drenthe, Friesland

For the most part, the interview data confirmed the clusters created by secondary data means. The clusters are renamed into High Implementation Cluster and Low Implementation Cluster, referring back to the S-curve stage. The second cluster is divided up into High Acceleration Phase and Low Acceleration Phase clusters and may be referred to either as a whole or separately throughout the results chapter, depending on the relevance for each section.

The High Implementation Cluster consisted of provinces with a consolidated level of bicycle highway implementation. These provinces saw a steady IR throughout the period of 2010-2019, with a steady growth of both ambitions and implemented projects. The main change with regards to the secondary data is the addition of Gelderland, because 1) it was the only province of the fourth cluster and tended towards a high share of BH projects (above average) and 2) the Weighted IR positioned Gelderland in the cluster of high implementation share, together with NB, NH and ZH (see Figure 9).

The Low Implementation Cluster consisted of provinces that did not show a steady implementation rate of bicycle highways. This cluster can be divided into two subcategories, which correspond to the clusters 1 and 2 in Figure 10. This division was done because of the apparent differences when analyzing the interviews. On the one hand, the HAP subcategory consisted of provinces that showed strong signals towards implementation. Thus, the high number of ambitions turn out to be intended ambitions that are being planned for and are to be implemented in the coming years. On the other hand, the LAP subcategory englobed provinces that had a much lower IR than the secondary data lead to believe.

TABLE 4. TYPES AND DESCRIPTION OF IMPLEMENTATION RATE CLUSTERS.

| | PROVINCES | DESCRIPTION OF CLUSTER |
|---|---|---|
| HIGH IR | Gelderland<br>Noord Brabant<br>Zuid Holland | Consolidated level of bicycle highway implementation. Early adoption in the late 2000s or prior to the concept being formalized. New ambitions have developed as older ambitions have been steadily transformed into implemented projects. |
| LOW IR | **High Acceleration Phase (HAP)**<br>Limburg<br>Overijssel<br>Utrecht | Strong signals of entering a steady implementation phase. Concrete number of and plan for projects soon to enter implementation, and projects implemented during 2010-2019 do fall under the definition and intention of BH. |
| | **Low Acceleration Phase (LAP)**<br>Drenthe<br>Friesland | Weak signals of entering a steady implementation phase. Unclear plans for ambition projects, plus implemented projects in 2010-2019 are not projects with BH intention, but already built projects whose name was changed to appear to be BH. |

## 4.2. Transition Management VS Infrastructure Incrementalism

When analyzing the different components of the variable of 'Perceived Attributes of Bicycle Highways', a general pattern emerged regarding the intentions of the provincial actor. First, High Acceleration provinces showed a rather disruptive view of what bicycle highways entail for the regional mobility system. They presented a high change agency, with a will to implement bicycle highways as a means to an end: pushing active modes of transport to become the priority in short to mid-range distances. Second, High Implementation provinces showed a moderate change agency, but the consolidated institutionalization of bicycle highway implementation in these provinces made it less of a need for actors to push such a policy innovation.

Low Acceleration provinces had a more incremental view, seeking to add bicycle highways to their network as a way to upgrade routes with safety problems. Additionally, LAP provinces presented signals of following the trend, as "*it's also a result of what we see in the whole country, the whole Netherlands throughout, they're thinking about bicycle highways. So we see that in Drenthe and then (politicians) also wanted to*" (Interwiewee 1). This finding is supported in the following paragraphs through the analysis of the different indicators.

### 4.2.1. Problem Structure defines Standards

A relationship was found between the problem structure and the strictness of bicycle highway standards. Where High Implementation and High Acceleration provinces mainly leveraged problems of traffic congestion and developed strict standard rules to ensure a long-lasting infrastructural investment, Low Acceleration provinces tended towards a more flexible approach, adapting the standards to their needs, cycling volumes and finances (Table 5).

High implementation provinces showed homogenously the need for bicycle highways as a solution to car traffic congestion. These regions, which feature highly urbanized and densely populated municipalities, have had increasing problems of car congestion since the 90's. The successful coupling of the bicycle as a solution to traffic jams led to the early developments of bicycle highways, Zuid Holland being in the late 90's the first province where the idea of bicycle highways became part of their policy. There was a need for high-functioning infrastructure that could successfully allocate commuters out of the car highways, and bicycle highways *"fitted the main reason for a province to work on it because it was good for the people in cars, but it was also good for people on bikes"* (Interviewee 3). Thus, it can be interpreted that the sense of urgency plays a key role in the development of strict standards, as well as an overall high implementation rate.

It is worth pointing out that HI provinces also succesfully coupled bicycle highways with the wider energy transition policy of the provinces: "*Gelderland and Brabant got a lot of money from selling their energy companies, and they invested that into bicycle highways*" (Interviewee 10). By integrating several policies and framing bicycle highways as a multi-solution innovation, these provinces got access to the substantial amount of money needed to invest in such infrastructure.

High Acceleration Phase showed a very similar pattern as the High Implementation provinces. The year 2015 saw the creation of new bicycle highway ambitions for HAP provinces, with the main starting problem to solve being that of car congestion and traffic jams: "*we have a province with… a lot of traffic jams. So it helps with the sense of urgency, we need to do something else, we need to do it differently*" (Interviewee 9). This problem structure has worked very efficiently with gaining political enthusiasm and has allowed provincial actors to ride the momentum by stressing additional trending benefits such as pollution, health, and environmental factors. These provinces look to connect major mobility hotspots and have a network-oriented mentality. In a sense, it seems HAP provinces are following the steps of HI provinces in a 5–10-year delay. It is possible that HI provinces showed this level of change agency when bicycle highways were still a novelty in their province, but the current cycling policy managers were not present back then and could not be sure.

Low Acceleration Phase provinces lack the urgency of car congestions. These provinces appeal to problems of road safety and rural accessibility and look to upgrade existing infrastructure as much as possible, instead of creating new routes. In their setting, sticking to the standards is overly expensive compared to the number of cyclists in their provinces, thus creating a custom version for rural areas. When talking about the flexible standards, Friesland adds *"for us it works because it can host that amount of cyclists and it's safe… But in the point of view of the country, they will say it's not a bicycle highway because it's not four meters".* In this case, the sense of urgency is lower, leading to planning processes that are not a priority within the province.

TABLE 5. COMPARATIVE TABLE OF 'PROBLEM STRUCTURE' AND 'STRICTNESS OF STANDARDS' PER IR CLUSTER.

| IMPLEMENTATION CLUSTER | PROBLEM STRUCTURE | KEY FINDING |
|---|---|---|
| **High Implementation Cluster**<br>Width: yes<br>Path quality: yes<br>Directness: yes<br>No crossings: flexible<br>Signage: flexible | Car congestion, mobility, and accessibility problems.<br><br>Pollution and health in recent years. | Strong adherence to the standards provided by the CROW, most notably with regards to width, path quality and directness. No-crossings rule differs per case and crossing, due to the high costs, but prioritizing right-of-way. |
| **HAP Cluster**<br>Width: yes<br>Path quality: yes<br>Directness: yes<br>No crossings: flexible<br>Signage: flexible | Car congestion, mobility, and accessibility problems.<br><br>Pollution and health in recent years. | Adherence to the standards provided by CROW, most notably with regards to width, path quality and directness. Novel strategies to overcome the high cost of crossings. |
| **LAP Cluster**<br>Width: flexible<br>Path Quality: flexible<br>Directness: flexible<br>No crossings: No<br>Signage: flexible | Road safety problems.<br><br>Pollution, health and accessibility in recent years. | Flexibility with bicycle highway standards due to low cycling volumes. Without national help, the no-crossings standard is deemed unfeasible. |

### 4.2.2. Compatibility and Change Agency

When comparing HI and HAP provinces, it seems as though both share the same discursive setting, thus the same problem structure factors applying to them. However, it is the compatibility of bicycle highways that may explain the struggle in implementation of HAP provinces. As seen in Table 6, the spatial compatibility of HI provinces was rather high: the spatial distribution of their settlements is mostly optimal (on a 5 to 20 km distance between each other), and neither the geography of their region nor the presence of already existing cycling infrastructure were a barrier to implementation. The compatibility of the policy with HI provinces was also high: integrated cycling programs within wider mobility programs featuring

formal procedures of interaction for BH projects, high perceived cycling volumes (often setting a minimum bar of 2000 cyclists/day to build a BH project), and e-bike trends only adding to the appeal of implementing such infrastructure (Table 7). From a spatial policy perspective, these factors position HI provinces as bodies with little resistance to adopting and implementing the concept.

On the other hand, Low Implementation provinces (the combination of HAP and LAP provinces) showed lower levels of compatibility. Principally, their spatial distribution was not as optimal, with longer distances across settlements or little space left between them (Utrecht). The presence of cycling infrastructure often meant calibrating the ambition to an upgrade of the existing cycling path (adding 1 meter of width), and geography could play a part in the form of recurring climatic events (wind in Friesland) or uneven terrain (hills in Limburg). The compatibility as a policy featured lower cycling volumes, especially in rural areas of provinces, and relatively new cycling programs or none at all. Thus, Low Implementation provinces showed higher amounts of resistance to adopting this type of infrastructure.

However, within LI provinces, there is a distinction in the change agency between HAP and LAP provinces. With regards to the spatial compatibility, HAP prioritized connections with the big cities or among settlements with high commuting traffic despite the distance, in certain cases leveraging the market demands: "*…the economic boards of the (industrial) campuses said 'we need an ambition network for cycling'. So we have to offer our working people a good infrastructure*" (Interviewee 5). In other instances, the initiative to create a cycling program by the provincial actor ultimately enabled bicycle highways to increase in integration within the wider mobility policy (Candel & Biesbroek, 2016).

**TABLE 6. COMPARATIVE TABLE OF 'SPATIAL COMPATIBILITY' INDICATORS.**

| | **PERCEIVED SPATIAL DISTRIBUTION** | **PRESENCE OF CYCLING INFRA** | **GEOGRAPHY** | **PHYSICAL BARRIERS** |
|---|---|---|---|---|
| **HI Cluster** | Optimal distance between cities / towns (5-20 km) | A positive option in planning phase | Not a factor | Moderate barrier, financial tools |
| **HAP Cluster** | Prioritizing connections with big cities (higher commuting volumes) | A positive option in planning phase | Not a factor<br>E-bike as positive reinforcement | Big barrier, novel ways of overcoming |
| **LAP Cluster** | Not optimal, long distances between cities / towns (+30km) | Main target: upgrading them (width and quality) | Wind as cycling detractor | Big barrier |

Because of the emphasis of transitioning the mobility paradigm of the daily urban system, HAP provinces overlook cycling volumes and see bicycle highways as infrastructural interventions; Overijssel argues there are "*quite a lot of townships with 30,000 to 40,000…*

*pretty spread over the province. If we (prioritize cycling volumes)… then you would only spend your money in the big cities*" (Interviewee 7), although they acknowledge connections either start or end in big settlements. On the other hand, the electric bike is mostly seen as a mitigator of spatial comptability issues, with provinces emphasizing on changing behaviour through a series of stimulant and communication programs (e-bike tryout programs, bottom-up cycling foundations).

LAP provinces, despite the similar BH compatibility to HAP provinces, did not show a proactive outlook on the factors at hand. The main strategies employed were those of financial resource appeals: were there to be more financing, compatibility barriers could be mitigated. Their cycling policy was recently updated, but no signs of creating a formal program for bicycle highways.

The spatial compatibility factor of 'Physical Barriers' has been left out of the discussion because it revealed certain patterns that better fit Section 4.5. All provinces shared the perception of physical barriers being a key factor challenging BH implementation, with financial issues being a principal mediator.

TABLE 7. COMPARATIVE TABLE OF 'POLICY COMPATIBILITY' INDICATORS.

| | INCLUSION IN MOBIILTY PROGRAM | CYCLING VOLUMES | E-BIKE RISE |
|---|---|---|---|
| **HI Cluster** | Yes, lasting and integrated programs | Prioritizing projects with higher volumes (min. 2000 per day) | Not a principal factor, although positive outlook |
| **HAP Cluster** | Program creation 2015, rapid institutionalization of BH implementation | Often disregarded, infrastructure as intervention to increase cycling | Positive factor, allows to plan longer routes previously considered not feasible by bike |
| **LAP Cluster** | No formal program, incidental agreements with municipalities | Low, prioritizing routes with higher volumes or safety issues. | Positive factor, allows to plan longer routes previously considered not feasible by bike |

## 4.3. Navigating Different Political Venues

The political feasibility of bicycle highways revealed to have two sides: the decision-maker governmental side, and the civil society aspect. Generally speaking, the decision-maker side showed high levels of acceptance, but there were mismatches between the ambitions and the budgets allocated to them. The civil society side presented a more complex setting: citizens showed a higher involvement and power level than the theory led to believe. This can be explained through the shift towards a public value management governance style within The Netherlands (Stoker, 2006). The main issues revolved around opposition to the concept, the Not-In-My-Back-Yard (NIMBY) effect and problems of space acquisition.

### 4.3.1. The Governmental Venue

High Implementation provinces showed a favorable political setting, with no big political debates surrounding the implementation of bicycle highways. With regards to the governmental sphere, Gelderland's manager adds "W*ho's against bicycles? No one is. So it's a very kind and nice thing to work on*" (Interwiewee 3). Despite the majorly right-wing car-oriented political spheres, HI provinces presented a favorable attitude towards the implementation of bicycle highways. This is due to two main reasons: 1) the successful coupling and integration of bicycle highways with wider energy transition and car congestion policies and 2) exploiting political venues of realizing tangible achievements, as provincial deputies "*wants something concrete, something he can put his finger on*" (Interviewee 6).

High Acceleration Phase provinces also showed a favorable political setting. The main factors affecting this ambition for bicycle highways can be attributed to 1) diffusion of a maturing promising innovation (Rogers, 2003), 2) the increasing car congestion problems and 3) the will to find environmental and climate-friendly mobility solutions (related to the development of the Dutch *Omgevingsvisie*). The first point is more of a phenomenon concerning the diffusion of innovations, and as early adopters (HI provinces) successfully implemented the first bicycle highways, provinces with similar problems showed interest in adopting the innovation too. The second and third point involve a strategic change agency of cycling policy actors: these played a role in taking politicians by the hand and framing cycling as a solution to their urgent problems, taking advantage of the political window of opportunity to get funding for cycling policy and infrastructure. Another political window of opportunity was the formalization of cycling infrastructure in the provincial *Omgevingsvisie* (Environmental and Spatial Planning Strategy): "*I really worked to get (cycling mobility) in that vision, that it emphasized that for mobility we work on safe, space-saving mobility*" (Interviewee 9).

Low Acceleration Phase provinces had too a favorable political setting, with only recently deciding to invest in bicycle highways. For this cluster of provinces, the main reason was identified as a desire to follow the trend and not lag behind in comparison to other provinces. Again, this phenomenon is explained through Rogers' (2003) diffusion of innovations, as LAP provinces adopt the innovation after a mass adoption and successful results of bicycle highways in other provinces. Interprovincial communication and knowledge transfer through interprovincial projects were key in developing the will to invest in such infrastructure: *"…the last years we have also been designing a few bicycle highways, and it started in 2015 with the bicycle highway between Groningen and Assen… that was the beginning of us thinking about bicycle highways"* (Interviewee 1). Unlike HAP provinces, however, these provinces lack a substantial urgency in their implementation, thus giving strong signals that the implementation of their plans will be rather slow in the coming years.

TABLE 8. COMPARATIVE TABLE WITH A LIST OF STRATEGIES USED IN DIFFERENT POLITICAL VENUES.

| IMPLEMENTATION CLUSTER | GOVERNMENTAL VENUE | PUBLIC RESISTANCE |
|---|---|---|
| **High Implementation Cluster** | Appeal to political achievements<br>Pair cycling solutions to car problems | Communicating the concept<br>Linkage with citizens<br>Financial mediation<br>Nomenclature change |
| **HAP Cluster** | Proximity with politicians<br>Pair cycling solutions to car problems<br>Political windows of opportunity<br>Developing ideas | Communicating the concept<br>Spatial adaptivity<br>Financial mediation<br>Linkage with citizens<br>Openness with citizens<br>Nomenclature change |
| **LAP Cluster** | Appeal to political achievements | Nomenclature change<br>Ambition calibration |

### 4.3.2. The Civil Society Venue

Navigating the civil society venue proved more complicated than initially thought by provinces. To a greater or lesser extent, all provinces have experienced setbacks and resistance from the public. As mentioned before, three main elements are pointed out throughout the interviews: resistance to the name, NIMBY effect and space acquisition problems. The first point is a factor that englobes the general population regarding the name of 'bicycle highways' and the idea it carries:

> *"…it's a signal we get a lot from the project managers in municipalities, that a lot of resistance by citizens is caused by this name and the image they have due to this name*" (Interviewee 6).

> "*A barrier is more and more participation. A lot of people get more and more against the cycle highways"* (Interviewee 4).

High Implementation provinces showed prominently the concern over this growing resistance to the concept, being those provinces with the highest experience with actual implementation. This public opposition mainly stems from the mindset that bicycle highways carry the same negative attributes of car highways (noise, safety, busy route, physical barrier, etc.). Thus, the power of wording proved to be a key factor in the development of public opposition. Thus, a combination of re-framing and knowledge transfer across provinces led to the change of name from '*fietssnelweg*' (bicycle highway) to two variants: '*snelfietsroutes*' (fast cycling routes) and '*doorfietsroutes*' (direct cycle routes). The first term, however, still faces some resistance due to the word "fast" still being present in it. A third strategy used by LAP provinces is the cancelation of the name, going back to calling them bicycle paths yet holding the attributes of bicycle highways.

The second and third points are more deeply intertwined, and mainly concern local people directly or closely affected by the bicycle highway project. The NIMBY effect is a

phenomenon seen across many infrastructural and urban design changes (Dear, 1992), and with a growing voice power of the public, it can become a substantial hinderer of bicycle highway implementation. Space acquisition problems often suppose a NIMBY effect with the added difficulty of the jurisdictional power of the property owner. These challenges were prominent too among HI provinces, as they have gathered much experience with implementation, but were also shared among LI provinces. The most recurrent strategies were 1) convincing affected public discursively (framing benefits, communicating the concept), 2) reaching an agreement through financial compensations or 3) adapting the route to go through less controversial areas (Table 8).

*"…there's a lot of resistance within a town because of what the framing of a bicycle highway means to them: that the village will be cut into two, will be split up by the cycling highway. So, the message, the framing of such a cycling highway is relevant"* (Interviewee 8).

## 4.4. Balancing Leadership and Cooperation

The development of bicycle highways in The Netherlands turned out to be a complex cooperative and communicative task. The development of bicycle highway projects can be generally divided into four sections: ambition creation, feasibility studies, planning phase and implementation phase. Because the land ownership of BH projects belongs to the municipalities, the implementation is always left to municipalities, but the prior phases are not so clear. This jurisdictional arrangement of BH projects places municipalities as crucial actors in the development of BH projects, and their proactivity shows an influence in the implementation rate. Additionally, the distribution of roles between both governmental bodies has been a process left to provinces to figure out, and different clusters show different levels of provincial direction.

HI provinces showed a moderate provincial direction; this resulted from the combination of a relatively formalized role division and, more importantly, a political climate of very ambitious and proactive municipalities. HI provinces present a high degree of network-oriented culture of cooperation and mediation between municipalities. Their strategies revolve are targeted towards problem-avoidance, adaptivity and brokering between political interests of municipalities.

HAP provinces showed a high provincial direction, acting in many instances as a change agent. The main reason is the lack of municipal proactivity and the halting of projects due to low municipal cooperation. The pattern is of a realization that without a provincial lead, implementation will remain low: "*It's becoming more and more a role for the province to lead such a team… And we want to take the lead in the first phases*" (Interviewee 5); "*And then we hoped that these municipalities (would implement) … After a year nothing happened. So, I thought we as a province, it's a small province, we need to take the lead in realizing these highways*" (Interviewee 9). Provided municipalities could not carry the projects, HAP provinces

focus on kickstarting and leading the project, always with the consent and agreed ambition of municipalities. They serve as knowledge and human capacity support, since municipalities often lack the staff to lead the project alone.

LAP provinces also showed a high provincial direction. They took the lead in designing ambitions, consulting municipalities, and studying the feasibility of the ambitions. However, despite this direction, the lack of financial and human capacity in municipalities is a big barrier towards implementing BH projects. Thus, the appeal to bigger provincial financial support is very present: "*I suggested we have to invest more money as a province… Is it possible for us to make an investment of 75%? Or probably 100%? So, we pay it, because it's our ambition. And that is something the main politicians will discuss…"* (Interviewee 3).

From the analysis concerning the 'interaction rules' indicators, these seven strategies were identified as main tools to overcome the complexity of kickstarting BH project ambitions. Table 9 depicts which strategies were used by which cluster:

- Financial support: provinces may decide to contribute additional money in cases where a municipality might not have the means. Especially in cross-municipal projects, an additional incidental investment can help the project move into implementation.
- Knowledge support: due to the knowledge aggregation of several BH projects, provinces can contribute with experience and knowledge on how to plan a bicycle highway in the most effective and efficient manner.
- Building coalitions: due to their organizational power, provincial cycling managers can build coalitions of actors with interests and knowledge in BH projects, in order to support or help convince municipal actors (Huitema, 2011). These coalitions can be members of the cycling union, national government, other municipalities, private consultancies, market parties, etc.
- Bridging between parties: the province can act as an overarching bridge between parties that are not used to cooperate with each other. The more municipalities are involved, the more the provincial figure helps in providing the big picture of the regional scale.
- Leading the project: in the absence of clear ambition and direction from the municipalities, taking the lead is the way to ensure BH projects see implementation. After a provincial kickstart, municipalities may then join the momentum and regain the proactiveness.
- Navigating power imbalances: avoiding the trap of ambition ownership, provinces must let municipalities be the ones with the initial ambition. This way, provinces ensure a municipal cooperation not only financially, but also from a willingness to move forward with the ambition.
- Segment division: in settings of very long and complex routes, segmenting the route into smaller projects can help in reducing complexity and increase in adaptivity. Working with one municipality at a time may prove beneficial, especially in instances of low provincial capacity. Risks lie in that the complete ambition may lay unfinished for years, and its implementation may be slower.

- Reducing ownership dependency: because of the jurisdictional context of The Netherlands, provinces may look to positioning parts of or entire BH projects along the land they own (typically the provincial road network). This solves issues of cooperation with municipalities, drastically reducing governance complexity.

TABLE 9. COMPARATIVE TABLE OF STRATEGIES USED TO OVERCOME 'INTERACTION RULES'.

| | HI provinces | HAP provinces | LAP provinces |
|---|---|---|---|
| **Financial Support** | Yes | No | Partially |
| **Knowledge Support** | Yes | Yes | No |
| **Building Coalitions** | Yes | Yes | No |
| **Bridging between Parties** | Yes | Yes | Yes |
| **Leading the Project** | No | Yes | Yes |
| **Navigating power imbalances** | Yes | Yes | No |
| **Segment Division** | Partially | Yes | Yes |
| **Reducing Ownership Dependency** | No | Yes | No |

## 4.5. Adapting to the Financial Setting

The financial setting differed between HI provinces and LI provinces. While the former showed little concern over financial capacity, the latter presented financial capacity as a main bottleneck to achieving ambitions. From the analysis, this issue can be attributed to three main barriers: 1) the cost underestimation by politicians, 2) the capacity of municipalities, and 3) the high costs of crossing physical barriers. The first two points show a difference between Implementation clusters; the third point is a common denominator across all provinces, and the differences lie in the strategies used, thus presented separately.

HI provinces showed low levels of concern with regards to financial capacity. They successfully coupled arguments of bicycle highways with the urgent problems of their provinces, leading to sums of money that allowed a good level of financial capacity. The proximity with the national government also helped in securing subsidies and incidental financial support where provincial money was lacking. Additionally, the aggregation of knowledge over many BH projects has adjusted politicians' financial expectations for bicycle highways. The capacity and ambition of municipalities played an important role too, as they are a key financial contributor along the province: "*Of course, they have (ambition). I can say that of 50 municipalities, all want to be a bike city of the year. They really want (to implement BH)*". This is also supported by the moderate relationship between the number of 50K+ cities per province and the Weighted Implementation Rate of provinces (Figure 11). As provinces have more cities, the speed at which BH are implemented grows, the financial distribution of projects being a factor.

TABLE 10. COMPARATIVE TABLE OF THE FINANCIAL CONTRIBUTION TO BH PROJECTS BY CLUSTER.

| | HI Cluster | HAP Cluster | LAP Cluster |
|---|---|---|---|
| **Financial contribution to BH project (in %)** | 60-90 % | 50-75% | 50% |

LI provinces showed a more diverse range of financial capacity. On a general note, politicians showed a disconnect between their ambitions regarding bicycle highway implementation and the budgets allocated to them. This requires communicating well the concept, establishing a frame of expectations: "… *(the deputy) asked me one day 'Can it be ready after six months?'. And I really had to explain to him how it works, that it's maybe even more difficult than a (car) highway*…" (Interviewee 9). Municipal capacity tended to be a barrier, especially among the rural municipalities with little finances and little sense of need for a bicycle highway. Additionally, the financial contribution did not play in their favor, as the provincial support declines as Implementation Rate declines (Table 10). Identifying this disparity in financial contribution was a first step towards pushing a higher provincial contribution, appealing to ambition accountability: "*I suggested we have to invest more money as a province… Is it possible for us to make an investment of 75%? Or probably 100%? So, we pay it because it's our ambition. And that is something the main politicians will discuss…*" (Interviewee 3). Additionally, because municipal ambition often remained high, the low availability of BH project subsidy can act as a competition spark for municipalities to find the finances needed to receive the provincial support.

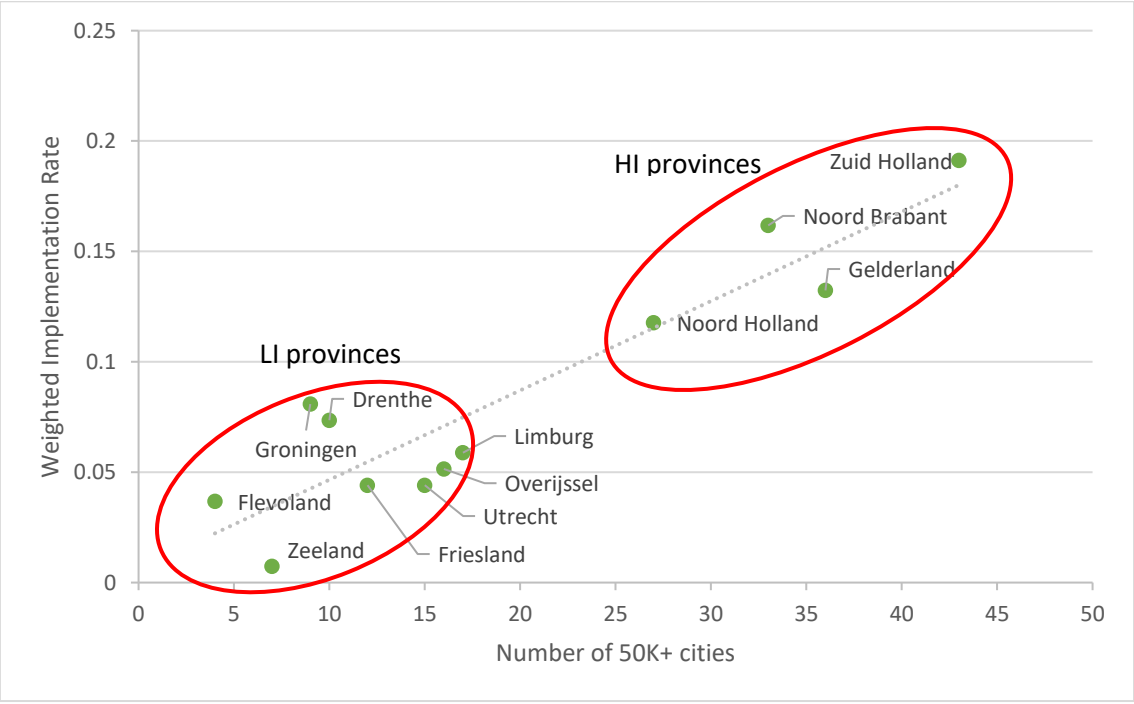



FIGURE 11. SCATTER PLOT OF THE WIR AGAINST THE NUMBER OF 50K+ CITIES PER PROVINCE.

### 4.5.1. Overcoming Physical Barriers

Physical barriers deserve their own section because they are a common negative challenge for all provinces. While they are perceived by all as a key barrier to implementation, the strategies to overcome them vary among implementation clusters. In The Netherlands, physical barriers are mainly water bodies (canals, rivers), other mobility infrastructure (car highways, provincial roads, etc.) and densely populated areas. On one hand, crossing water bodies and other mobility infrastructure suppose a substantial financial investment in the form of a bridge or a tunnel, often way more than provinces can handle. On the other hand, crossing densely populated areas is costly and brings along issues of space and public resistance.

From the analysis of interviews, these six strategies were mainly used by the different clusters. Table 11 depicts which strategies were used by which cluster:

- Infrastructural window of opportunity: pairing the implementation of a bicycle highway crossing with the renovation/construction of infrastructure that has higher priority within the provincial or national agenda's (usually car or railway infrastructure). Although these crossings are very expensive for cycling standards, they become a reasonable investment compared to the expenses of these other infrastructure builds.
- Spatial adaptivity: in the presence of high public resistance, or lack of financial resources, adapting the route can serve as a way of saving costs without hindering the quality and standards too much. The main compromise is usually with directness (avoiding densely populated areas) and the no-crossings standard.
- Intelligent Transport Systems: the use of ITS in cycling can help in solving many safety problems and reduce the costs of building infrastructure. Smart crossings and real-time volume tracking can be solutions towards creating effective crossings without the need of bridges or tunnels.
- Homophily with National Government: showing the higher tiers of government how bicycle highways are also a matter of their concern can help in securing subsidies and management support. *"…Rijkswaterstaat has problems themselves with the number of cars on the highways and needs solutions for that… And Rijkswaterstaat has many assets with cycling routes on it… So, they have a great role in the solution"* (Interviewee 9).
- Financial mediation: this strategy especially relates to crossing densely populated areas. Particularly HI provinces, which have the financial resources, are able to buy the necessary space to achieve a direct bicycle highway.
- Openness and linkage with public: this measure relates especially with crossing densely populated areas. Taking the time and the effort to establish an open communication with the nearby communities to the BH projects can help establish psychological links and reduce resistance (Lunenburg, 2010). Engaging in cooperative activities empowers the communities, who take ownership of the BH project and may stop seeing it as an alien change.

TABLE 11. COMPARATIVE LIST OF STRATEGIES TO OVERCOME 'PHYSICAL BARRIERS'.

| | HI provinces | HAP provinces | LAP provinces |
|---|---|---|---|
| **Infra Window of Opportunity** | yes | partially | no |
| **Spatial Adaptivity** | yes | yes | yes |
| **Intelligent Transport Systems** | no | yes | no |
| **Homophily with National Government** | partially | yes | no |
| **Financial Mediation** | yes | partially | partially |
| **Openness and linkage with public** | yes | no | no |

# 5. Conclusions

This thesis aimed at understanding how provincial actors contribute to the implementation of bicycle highway ambitions in The Netherlands. The country revealed a variety of implementation rates across different provinces: provinces with a high implementation rate (HI provinces), provinces entering a high acceleration phase of implementation (HAP provinces), and provinces in a low acceleration phase (LAP provinces). The subquestions aimed at identifying which factors influenced the rate of bicycle highway implementation and which strategies did provinces employ in order to overcome or leverage these factors. The findings regarding these subquestions have been integrated into the following points:

1) A favorable outlook on the perceived attributes of bicycle highways is a key influencer in kickstarting a smooth and steady implementation. Coupling bicycle highways to urgent mobility and cross-policy problems, a spatially compatible setting, and shaping the political feasibility to frame win-win scenarios and tangible political achievements are key ingredients in a setting of early adoption, but also translatable to any other adoption stage setting.
2) The rules of the institutional system can suppose barrier to implementation, such as provincial capacity, lack of BH formalizations or a weak cycling culture. A strong change agency revealed the possibility of institutionalizing bicycle highways to a level in which they become compatible with the institutional system. Exploiting opportunities and chances to formalize the concept into programs, agendas or structural budgets is another combination of overcoming this factor.
3) Communication Effects become a useful tool when dealing with a context of kickstarted momentum. Within the governance unit that is The Netherlands, the concept of bicycle highways has diffused across provinces, even sparking the effect of not wanting to lag behind the innovation trend. In a context of early adoption, building coalitions with strategic partners and change agents can also bring about a higher implementation rate.
4) Interaction and Governance Rules suppose a process barrier during planning, especially with regards to public resistance and a lack of municipal cooperation. This factor may vary depending on the political context in which bicycle highways may want to be implemented. Keeping an adaptive attitude, an open communication with relevant stakeholders and providing institutional support where necessary proved to be optimal mitigators.
5) Change Agency is a mediator of multiple factors, and provincial actors can play an active role in changing the perceptions of attributes and reshaping the institutional barriers to making bicycle highways more compatible. As the perceived attributes and the institutional system become more favorable, change agency becomes less relevant in content and navigating the complexity of the ambition-to-implementation process.

## 5.1. Contributions to Academy and Society

Bicycle highways are a relatively novel concept that is increasingly gathering attraction. The marketing of its own name has sparked a diffusion to countries with all sorts of cycling culture (Agarwal et al., 2020; Grigoropoulos et al., 2021). The potential to be paired with new cycling technologies and innovations as a viable and sustainable solution to mid-distance travel brings new ideas to mobility policy makers across the world. However, its innovativeness can also bring skepticism and resistance from governance sides (Gironés et al., 2020). Thus, it is crucial for a transfer of knowledge to happen with regards to the governance and implementation arrangements.

From this research, a set of strategic tools employed by provincial cycling policy managers to implement bicycle highways in The Netherlands was gathered. Because infrastructure implementation is very contextual, the contributions listed have an abstract and generic component, with the aim to be translatable to other governance contexts (Huitema, 2011). The main findings were the following:

1) Transition Management Thinking
2) Building and Managing Coalitions
3) Navigating political venues
4) Developing Institutions

These strategies reflect the methods and procedures followed in a championing country with a high level of cycling culture (Pucher & Buehler, 2008). In general terms, they are meant to further knowledge on the infrastructural implementation of innovations, on ways that have shown to facilitate their path towards implementations in the public governance realm. The findings are mainly targeted at public actors that have access to these political arenas and organization power to push their implementation, but any change agent can draw their own conclusions from these findings and adapt them to follow a specific strategy.

From an academic side, this research had two aims: 1) to expand on a novel line of research of high-end cycling infrastructural innovations, especially on the governance side, and 2) to contribute the line of research suggested by Gironés et al. (2020), of carrying out comparative studies on the topic of policy entrepreneurship and policy innovations. The first goal was achieved, providing a new line of policy and governance-oriented research to cycling infrastructural innovations, in particular bicycle highways. The second goal followed in premise, although in execution deviated towards a primary focus of internal public actors (that is policymakers within the policy arena). It did present that change agency is a key element in moving forward infrastructural policy innovations towards implementation.

Two lines of future research have been thought out from the findings of this thesis. On the one hand, research could have a bigger focus on bicycle highway projects in the form of systematic qualitative comparative analyses (QCA), in order to identify specific governance arrangements that determine their implementation. On the other hand, this research delved into a country in which bicycle highways are only moderately disruptive in nature; an explorative research into the strategies of policy entrepreneurs in less cycling-compatible

countries could reveal more aggressive methods and novel tools to ensure a smooth implementation.

## 5.2. Limitations and Reflection

This thesis was a big journey of consolidation in my studies as a spatial planner. It offered the possibility to explore many areas of infrastructure planning, policy innovation and governance that were brushed upon during courses and small assignments. However, the gigantic individual task of carrying out this level of knowledge gathering, analysis and interpretation – for the third time – was not exempt of missteps, errors, and contingencies. I would even add that this thesis proved the biggest challenge of all. In the following paragraphs the reasons as to why that is are explored and developed.

First of all, the methodological limitations are to be discussed. The choice to do a qualitative comparative research was optimal in concept and supported by previously published literature. However, the execution could have been better. The decision to pick The Netherlands as a case study and compare the implementation of bicycle highways in each province, proved harder than initially thought. Every province had a rich context, with its own history and relationship with bicycle highways, and the dependent variable resulted in an overly complicated array of methods and inferential argumentation in order to group them into comparable units of analysis. In hindsight, a comparative analysis between just two provinces, and gathering interview data from a larger number of public actors per province, could have revealed just as much information for the purpose of this study.

This also leads to the choice of unit of analysis. Although this was rather difficult to know without performing this prior research, bicycle highway projects revealed to have many more actors involved, in particular municipalities, that could reveal more operational information. An even better choice of analysis could have been projects themselves, although the strategic change agency perspective would have been lost. Also, reaching the right contacts for the interviews proved rather tricky, and an earlier contact establishment could have granted the interviews with the 4 missing provinces for richer data. This lack of data collection was mitigated with the interview of an external point of view by the national manager of the Fietsersbond.

Another methodological point of reflection was the overly strategic focus of this thesis, which resulted in some sections being on the vague side. Because of trying to englobe all possible variables and factors, the interviews resulted overly complicated with topics that provincial actors often did not understand (the Dutch-English communication problems did not help either). Also personally, I had never dealt with such a strategic and theory-focused thesis or assignment and proved a big learning curve. Although a lot has been learned from this journey, a topic closer to my traditional methodological choices could have been healthier.

This relates well with the mental limitations that COVID-19 restrictions supposed. The spring semester was a big setback in my mental health and well-being, which was not expected. Paired with the mental stress of performing an online internship in a completely Dutch environment (Rijkswaterstaat), left me in a position of mentally procrastinating the thesis. For obvious reasons, that was not optimal, and resulted in a summer gladly enjoyed between the library and the desk. Nonetheless, here is the thesis document, and I am glad to have completed this assignment, for academic, professional, and personal reasons.

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# 7. Appendices

## 7.1. Appendix A – List of Interviewees

Interviewee 1
Sjoerd Bijleveld. *Mobility policymaker.* Province of Drenthe.
Online personal interview. June 29th, 2021.

Interviewee 2.
Wim Bot. *National policy advisor/lobbyist for cycling.* Fietserbond (Dutch Cycling Union).
Online personal interview. July 8th, 2021.

Interviewee 3
Hendrik Jellema. Traffic engineer. Province of Friesland.
Online personal interview. June 23rd, 2021.

Interviewee 4
Anita Stienstra. Cycling team coordinator. Province of Gelderland.
Online personal interview. June 22nd, 2021.

Interviewee 5
Rina Engelen. *Mobility policymaker.* Province of Limburg.
Online personal interview. June 17th, 2021.

Interviewee 6
Roger Heijltjes. *Cycling program leader.* Province of Noord Brabant.
Online personal interview. June 30th, 2021.

Interviewee 7
Else Tutert. *Cycling policy director.* Province of Overijssel.
Online dual interview. July 8th, 2021.

Interviewee 8
Hanno van Klinken. *Cycling projects director.* Province of Overijssel.
Online dual interview. July 8th, 2021.

Interviewee 9
Gwen Boon. *Cycling program manager.* Province of Utrecht.
Online personal interview. July 1st, 2021.

Interviewee 10
Ron van Noortwijk. Cycling policymaker.
Online personal interview. July 8th, 2021.

The transcripts for all the interviews can be found in the following shared drive:
https://drive.google.com/drive/u/3/folders/0ADP12Xjfjq3oUk9PVA

## 7.2. Appendix B – Presentation Email to Interviewees

Dear .....,

I am a master's student of Infrastructure Planning at Rijksuniversiteit Groningen and also an intern at RWS under Rick Lindeman. I am conducting a thesis on the adoption of bicycle highways (from ambition to implementation), focusing on the perspectives and strategies of provincial actors. Therefore, if you agree, I would like to interview you as a representative of ..... in the field of bicycle highways.

The interview would be online, should last no more than 1 hour, and all information would be used for academic purposes only.

- Would (time and date) be a possibility?

You may also **propose a preferred date and time**, and I can adapt. Any day and time before (date) could work.

Looking forward to your reply,

Dennis Martinez-Moro

## 7.3. Appendix C – Interview Guide Master's Thesis

*Abbreviation → BH: Bicycle Highways*

*This research aims at understanding the institutional configurations that lead to successful BH adoption. It is mainly interested in the process of bringing agenda ambitions into implemented projects, from the perspective of the province. The province is chosen because they are the government body in charge of their implementation.*

*This research is focused on two findings: 1) factors that influence adoption of BH (either positively or negatively), and 2) strategies used by provincial team to deal with these factors. For every section of this interview, I would like to find out which indicators are perceived as influential, then try to understand how the province dealt with them (i.e., which strategies were implemented).*

**Before recording:**

- Informal introduction from both ends
- Explanation of research
- Ask for recording permission

**When recording, introduction of interviewee:**

- What is your role within the province? A bit of introduction.
- What is your relation to bicycle highway development?

**Establishing overview of perceived rate of adoption:**

- When and how does the concept of BH first enter the province?
- What is the general overview of BH adoption? Is there an optimistic outlook towards the future? How did it evolve during the years?
- How fast do you perceive BH have been implemented? (fast progress, slow progress, etc.)
- At what stage of BH adoption do you see the province being? (Is the network near completion, more ambitions need to be added, etc.)

**Innovation Decision:**

- How did the province decide to implement BH? (own initiative, municipality-driven, inspiration from other provinces, etc.)

**Attributes of BH (discourse):**

- What is the definition of a BH? Are there standards for what a BH entails?
- How do these attributes affect the adoption? How has the concept convinced decision-makers?
- How do you perceive BH as the provincial cycling mobility team? What problems does it solve?
- How compatible are BH with the current mobility system? How do decision makers see that?
- Has this perception changed over the years? How has it evolved?

- What strategies has the province taken to direct the framing of BH?
- How has the political setting of the province affected the adoption of BH? Is it a partisan policy?
- What is the general outlook of bicycle highways by decision makers?
- What are the main difficulties that provincial politicians see with regards to adoption BH?
- How has the province team overcome those difficulties?

**External Effects (context/resources):**

- Cycling use:
    - How did cycling use affect the adoption of the first few BH?
    - How has it affected since? Does cycling use affect implementation of BH?
    - How has the province used cycling use and cycling innovations to push for implementation?
    - How has the e-bike affected the importance of implementing BH?
    - How has the province used cycling use data to further BH ambitions?
- Physical aspects:
    - How does the geography of the province affect BH adoption?
    - How does the presence of already existing cycling paths affect BH adoption?
    - How did the province overcome these challenges?

**Rules and Structure (rules of the game):**

- Formal:
    - How does cycling policy of the province affect BH adoption?
    - Which actors are involved in the process of BH adoption?
    - What are the formal roles of these actors? Who has what power?
    - How does this organization of actors affect the adoption of BH?
    - What strategies have been used to bring BH into formal ambitions?
    - What strategies are used to bring ambitions into implementation?
- Informal:
    - What is the willingness of actors to implement BH?
    - What are the working methods of the actors involved? Are there actors less interested than others?
    - What barriers in the process of implementation have you come across?
    - What strategies have you used to overcome these?

**Interaction Effects (discourse/resources):**

- Knowledge:
    - How does the implementation of pilot/first BH affect the wider adoption?
    - How does communication across provinces affect the adoption of BH? Does it serve as legitimacy? As inspiration? (Tour de Force, Fiets Filevrij, etc.)
    - How does the implementation of BH in other countries or international regions affect the adoption?
    - What strategies are followed to leverage these?
- Financing:
    - How are BH projects financed?

- How have national subsidies/programs affected BH implementation?
- What barriers do financial aspects present?
- Which strategies does the province use to overcome these?

**Change Agency (actors):**

- How would you see yourself/the provincial cycling team as being a force for change in relation to BH?
- How do municipal actors affect the implementation of BH? Does their optimism result in faster implementation?
- How do traffic regions (if applicable) affect the implementation of BH?
- Are there any particular individuals or organizations that have pushed for BH implementation in your province? Lobby groups, national organizations, private consultancies, etc.?
- As a provincial team, how do you overcome or leverage these actors in order to convince decision makers?

**Into the future:**

- What would you see as necessary to further bicycle highway in coming years?
- How would you see RWS playing a role in BH implementation/management?
- Are there any other specific points you would want to share?
- What advice would you give to early adopters?

## 7.4. Appendix D – Letter of Consent

***Consent to take part in Research***

I _____ voluntarily agree to participate in this research study.

I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.

I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.

I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.

I agree to my interview being audio recorded.

I understand that all information I provide for this study will be treated confidentially.

I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.

I understand that disguised extracts from my interview may be quoted in a final report.

I understand that a transcript of my interview in which all identifying information has been removed will be retained for the period of this research project.

I understand that under freedom of information legalisation I am entitled to access the information I have provided at any time while it is in storage as specified above.

I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

**Researcher:** Dennis Martinez-Moro d.martinez.moro@student.rug.nl

**Supervisor:** Dr. Stefan Verweij s.verweij@rug.nl

*Signature of research participant*

_____

*Signature of researcher*

I believe the participant is giving informed consent to participate in this study

_____