

Master's Thesis – Master Sustainable Business and Innovation

**Overcoming barriers to urban Nature-Based Solutions uptake:  
a multiple case study of new residential building projects  
in the Netherlands**

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## Abstract

The introduction section elaborated on the emerging concept of NBS as a promising approach to address urban sustainability issues. However, the uptake of urban NBS has been limited, as various project-level barriers to its implementation need to be overcome. The barriers and the strategies used to overcome them are found to be context-sensitive, stressing the relevance of taking a context-specific approach. This study has sought to fill a gap in literature by researching how barriers to urban NBS uptake are overcome in Dutch new residential building projects, a national context of particular interest given the country's objective of accelerating urban development.

The theory section provided insight into the types of urban NBS interventions commonly implemented in the research scope (categorised into three scale-levels), the eleven barrier categories at play in the geographical scope of the Netherlands, and four themes of strategies that can be used to overcome barriers to urban NBS uptake.

The methodology section described the research design in detail. It elaborated on the five cases that were sampled, data collection through 14 semi-structured interviews with key stakeholders involved in the cases, and the process of data analysis.

The results section revealed that nine of the eleven barriers identified in literature, were perceived to hamper urban NBS uptake in the specific scope of Dutch new residential building projects. Subsequently, twelve distinct strategies were presented that had proven successful in overcoming barriers to urban NBS uptake in the cases studied.

Next, the discussion section addressed how the findings filled two knowledge gaps. First, the deeper understanding that is gained into the frequency with which certain barriers were perceived in the scope. In doing so, the study allowed for a prediction on the extent to which barriers are expected to play a role in other new residential building projects aiming to implement urban NBS interventions. Second, insight was provided into how strategies relate to types of urban NBS interventions at the house-, street-, and neighbourhood-level. Last, the role of context-sensitivity was touched upon.

Finally, the conclusion section concisely answered the main research question by emphasizing which strategies can be deployed to overcome the most dominant barriers perceived in Dutch new residential building projects.

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# 1. Introduction

## 1.1 Problem statement

More than two-thirds of the world population is expected to live in cities by 2050 (UN, 2019). As a result, 230 billion square metres of new construction will be built over the next 40 years – “adding the equivalent of Paris to the planet *every single week*” (UN Environment and International Energy Agency, 2017, p.2). The global trend of urbanisation is responsible for large scale conversion of natural land into urban areas and is part of the anthropogenic development that accelerates biodiversity loss (Seto et al., 2011). At the same time, urban areas experience considerable direct effects of climate change (Kabisch et al., 2017). Cities face challenges dealing with climate change impacts ranging from increases in extreme weather events (e.g. floods and droughts) to localised effects such as the urban heat island<sup>2</sup> (McCarthy et al., 2010; Forzieri et al., 2016). Ever more frequently, sustainable urban development is mentioned as a key global societal challenge (European Commission, 2016; Kabisch et al., 2017). It is essential to make cities an integral part of the solution in biodiversity restoration and climate change adaptation and mitigation processes.

Recently, discourses in the field of urban sustainability transitions have focused on the emerging concept of nature-based solutions (NBS) as a promising approach to address urban sustainability issues. The concept can be broadly defined as “actions which are inspired by, supported by or copied from nature” (European Commission, 2015, p.4) and “advocates a vision of developing cities with, rather than at the expense of, nature” (Dorst, 2021, p.13). Urban areas offer numerous opportunities for the implementation of NBS in the form of various interventions, such as ponds to store water; green roofs to limit heat stress; vegetation to intercept stormwater; establishing urban pocket parks<sup>3</sup> to improve the area's micro-climate; creating pollinator-friendly domestic gardens; and integrating nesting boxes for birds. Next to its potential to provide ecological benefits, urban NBS are recognised for generating social and economic co-benefits (Raymond et al., 2017). These benefits can range from enhanced social cohesion to increased property value. Thus, integrating NBS interventions into urban development practices simultaneously contributes to climate change adaptation and mitigation, biodiversity restoration, human wellbeing and other sectoral ambitions, thereby supporting sustainable development (Naumann & Davis, 2020; Seddon et al., 2021).

Despite its promise, to date, the uptake of urban NBS interventions has been limited (Xie et al., 2020). The notion of uptake is used to refer to the implementation of urban NBS interventions in the built environment (cf. Dorst, 2021). Recent studies have identified various project-level barriers to NBS uptake (e.g. Sarabi et al., 2019; van der Jagt et al., 2020). Project-level barriers are the challenges, obstacles, constraints or hurdles that impede urban NBS uptake (cf. Eisenack et al., 2014) (from here on in this report simply referred to as ‘barriers’). Examples of such barriers are organisations lacking the necessary ecological knowledge (Haaster-de Winter et al., 2020; Dijkshoorn-Dekker et al., 2020) or development and construction companies experiencing financial bottlenecks in establishing a viable business case (Mommers, 2021). For urban development to contribute to biodiversity restoration and climate change

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<sup>2</sup> A city that is significantly warmer than its surrounding rural areas.

<sup>3</sup> Small public green spaces.

adaptation and mitigation, it is crucial to overcome barriers to urban NBS uptake. To achieve this, strategies can be deployed, i.e. the concrete actions that either prevent barriers from emerging or that help actors to deal with them (cf. Eisenack et al., 2014). Here, the concept of actors entails the key stakeholders involved in the development and realisation of urban development projects, including, but not limited to, different government levels, architects, landscape architects and development companies (Dorst, 2021).

## 1.2 Aim and research question

The literature stresses that both the barriers and the strategies used to overcome them are context-sensitive (Sarabi et al., 2020; van der Jagt et al., 2020; Dorst, 2021). Firstly, the barriers can vary between countries, for instance, due to differences in governmental regulations and policies (van der Jagt et al., 2020). Secondly, strategies are likely to relate more to some specific types of NBS interventions than to others. For example, applying a certification scheme is found to be more relevant for NBS interventions attached to buildings than for larger-scale NBS interventions such as establishing lakes or canals (van der Jagt et al., 2020). It is therefore important to move beyond ‘silver bullet’-type approaches towards more context-specific responses (Dorst, 2021).

A context that is of particular interest for overcoming barriers to urban NBS uptake are new residential building projects in the Netherlands. Due to a persisting housing shortage, the country has formulated national ambitions to accelerate urban development (Rijksoverheid, 2018). The large demand for new residential building projects presents a significant opportunity to support urban NBS uptake. Besides, new residential building projects are generally developed on greenfield sites whereby both the buildings and the public spaces are constructed. By implementing urban NBS interventions on and around buildings, an important coupling can be established. For instance, integrating bird nesting boxes in houses is more effective if the surrounding environment offers a variety of food and green shelters for birds to quickly flee to in case of danger (Vogelbescherming Nederland, 2014). Having a greenfield site at disposal also means few obdurate man-made physical infrastructures stand in the way of development (Dorst et al., 2021). This may greatly benefit the implementation of urban NBS interventions as the development can be designed from scratch, as opposed to having to transform the pre-existing built environment.

Previous studies that provide a deeper understanding into strategies to overcome barriers in the context of new residential building projects in the Netherlands are lacking. Therefore, this paper has set out to fill a gap in literature by conducting empirical research into this specific context. Hence, the main research question to be answered reads:

HOW ARE BARRIERS TO URBAN NATURE-BASED SOLUTIONS UPTAKE OVERCOME  
IN NEW RESIDENTIAL BUILDING PROJECTS IN THE NETHERLANDS?

The research scope is twofold, as the country-context of ‘the Netherlands’ and the context of type of NBS interventions integrated within ‘new residential building projects’ need to be considered. Concerning the barriers which are found to depend on geographical contexts, the majority of previous research into barriers to urban NBS uptake has been conducted in international contexts (e.g. Kabisch et al., 2016; Kiss et al., 2019), though some studies are

demarcated to the Netherlands to account for national-level differences (as will be elaborated on in Section 2.2). However, most studies provide overviews or lists of barriers, rather than also providing insight into the frequency to which they are perceived. Frequency is often used to help predict potential barriers (Sarabi et al., 2019). Lacking insights into the frequency with which identified barriers are perceived in the context of Dutch new residential building projects presents a knowledge gap in literature. A first sub-question (SQ1) is formulated to guide the empirical study in this regard: to what extent are the identified barriers to urban NBS uptake in the Netherlands, perceived in the context of Dutch new residential building projects?

Concerning the strategies which are found to depend on the types of urban NBS interventions implemented, previous studies propose abstract strategies but rarely provide insight into which strategy can be applied to overcome barriers related to what types of urban NBS interventions implemented (see Section 2.3). New residential building projects may lend themselves better to the implementation of (a mixture of) certain types of NBS interventions. For instance, integrating bird nesting bricks into houses, planting trees along roadside verges, and creating pocket parks, rather than constructing wetlands or canals. Due to the application of certain NBS interventions, strategies in this scope may differ from projects in which other types of urban NBS intervention are applied. Lacking insights into which strategies can be deployed to overcome perceived barriers relate to which interventions present another knowledge gap in literature. A second sub-question (SQ2) is formulated to guide the empirical study in this regard: how do the strategies used to overcome barriers to urban NBS uptake, relate to types of urban NBS interventions implemented in the context of new residential building projects?

### 1.3 Scientific and practical relevance

This study contributes relevant scientific knowledge to the growing body of literature on fostering urban NBS uptake. First, it answers calls for context-specific responses by conducting empirical research in the specific context of Dutch new residential building projects. Its findings add to theory by reflecting on the role that context-sensitivity has played in formulating actions to overcome barriers to urban NBS uptake in this specific context. Second, the study is of scientific relevance because it provides a better understanding of the frequency with which barriers are perceived in the context of Dutch new residential building projects. A knowledge gap exists in this regard, thus the insight into the extent to which certain barriers hamper urban NBS uptake in this context adds to theory. Third, a scientific contribution is made by clarifying on how strategies relate to different types of urban NBS interventions – a distinction lacking in previous studies relevant to the research scope. In doing so it fills a knowledge gap while providing insight into relevant strategies for overcoming barriers in the context of Dutch new residential building projects.

Presenting strategies that have proven successful in overcoming barriers within this scope is also of practical relevance for stimulating the Dutch urban sustainability transition. Given that Dutch national ambitions aim to accelerate housing development, but the uptake of urban NBS interventions has been limited so far, strategies to overcome barriers in the short term may be considered highly desirable. The findings may inform improved policy-making and serve as best practices for urban development practitioners for integrating urban NBS interventions in their projects.



## 2. Theoretical background

The starting point of this study takes into account the context-specificity of barriers and the strategies used to overcome them as stressed in literature. Therefore, this theoretical framework serves as a guide to demarcate literature relevant to the research scope. Firstly, Section 2.1 illustrates the types of urban NBS interventions that are commonly implemented in new residential building projects to sketch the ‘context’ the research talks about. Secondly, Section 2.2 provides an overview of the different types of barriers at play in the geographical scope of the Netherlands. Thirdly, Section 2.3 elaborates on previous literature looking into strategies that can be pursued to address barriers.

### 2.1 Urban NBS interventions

The ability of urban NBS interventions to provide multiple benefits simultaneously, is considered one of its key characteristics (Dorst et al., 2019). Going beyond their aim to combat biodiversity loss and the effects of climate change, NBS can provide social and economic co-benefits. For example, including a variety of green elements can help regulate the microclimate, clean the air and reduce noise from traffic at the same time, while providing places for recreation with exposure to nature (C/O CITY, 2020). Planting trees along roadsides and walkways increases carbon sequestration, but also provides shade on sunny days (C/O CITY, 2020). A careful choice of plants, insect and bird feeders as well as proximity between green spaces can provide good habitats for pollinating insects and birds that disperse seeds (C/O CITY, 2020), while offering the possibility for residents to experience nature in their everyday lives – creating a much-needed closer connection with nature (Bulkeley, 2020). Furthermore, choosing to integrate NBS interventions into urban development projects holds the promise of being a cost-effective approach (Dorst, 2021). The costs of creating and maintaining NBS become an embedded part of a larger business case of ‘sustainable urban living’, captured through real estate value and economic growth (Toxopeus, 2020).

However, urban NBS interventions should not be regarded as a panacea to address all challenges (WWAP, 2018; Colléony & Shwartz, 2019). Urban greening may result in ‘green gentrification’ when neighbourhood improvements lead to rising property values, social exclusion and displacement (Scott et al., 2016). This might lead to segregation in the accessibility of urban green spaces between people from different socio-economic backgrounds.

Urban areas each have their own particular set of issues related to biodiversity restoration and climate change adaptation and mitigation. Tackling those socio-environmental challenges through NBS interventions comes in all shapes and sizes, there is no one-size-fits-all solution (Bulkeley, 2020). Still, certain types of NBS interventions are more prominent in urban contexts than others. The Urban Nature Atlas database constructed by Almassy et al. (2018) provides a categorization of types of urban NBS interventions (see Appendix A). Across European cities, the largest share of NBS interventions appear to fall into the categories of parks and semi-natural green areas, green features connected to grey infrastructure, and blue areas. To a lesser extent, urban NBS interventions are implemented in the form of allotments and community gardens, external building greens, green areas for water management, derelict areas,

and green indoor areas. The prominence of certain green features may be explained by the fact that they have traditionally been part of urban areas, and they are only recently termed as urban NBS to reflect their multifunctional character. For example, urban nature in the form of parks has been applied in cities for a longer time, while the use of green roofs and facades constitute more recent innovations.

Considering that new residential building projects entail the construction of both the houses and the surrounding public area (more on this in Section 3), this research has distinguished between urban NBS interventions at three scales: the house-, street-, and neighbourhood-level. Table 1 illustrates how NBS interventions identified by [Almassy et al. \(2018\)](#) may fit in this overview. This categorisation has allowed for insight in, and a comparison between, the type and extent of urban NBS interventions implemented in the new residential building projects analysed in the study.

*Table 1.* Urban NBS interventions on different scale levels relevant for new residential building projects

<b>Scale levels</b>	<b>Types of urban NBS interventions</b> (based on <a href="#">Almassy et al. (2018)</a> )
<u>House</u> <i>Concerns urban NBS interventions attached to buildings, or implemented in the adjacent private gardens.</i>	<ul style="list-style-type: none"> <li>▪ Indoor vertical greeneries</li> <li>▪ Balcony green</li> <li>▪ Green roofs, walls or facades</li> <li>▪ House gardens</li> <li>▪ Other</li> </ul>
<u>Street</u> <i>Concerns urban NBS interventions integrated in and around street profiles.</i>	<ul style="list-style-type: none"> <li>▪ Alley and street trees, hedges, and greens</li> <li>▪ Green parking lots</li> <li>▪ Other</li> </ul>
<u>Neighbourhood</u> <i>Concerns the remaining urban NBS interventions in the public area.</i>	<ul style="list-style-type: none"> <li>▪ Pocket parks</li> <li>▪ Neighbourhood green spaces</li> <li>▪ Green corridor</li> <li>▪ Green playground</li> <li>▪ Rain gardens</li> <li>▪ Riverbank greens</li> <li>▪ Pond</li> <li>▪ Sustainable urban drainage systems, swales or filter strips</li> <li>▪ Allotments or community gardens</li> <li>▪ Other</li> </ul>

## 2.2 Barriers to urban NBS uptake

Five recently published papers have explored barriers in the geographical context of the Netherlands, from which a total of 32 barriers were identified (see Appendix B). Several studies indicated barriers in a similar category, for instance [van der Jagt et al. \(2020\)](#), [Dorst \(2021\)](#) and [Mommers et al. \(2021\)](#) all highlighting the lacking evidence of NBS performance in some form. Given that the same applies to most of the other identified barriers, they can therefore be grouped in certain ‘barriers categories’. In its turn, the categories show overlap, e.g. barriers related to evidence of NBS performance, NBS development and organizational capacities all deriving from lacking knowledge. Figure 1 proposes a thematic overview in which the 32 sub-barriers can be aggregated to 11 barrier categories (in the figure summed up in bullet points)

and subsequently in four corresponding themes (knowledge; policy; economic; and engagement barriers).

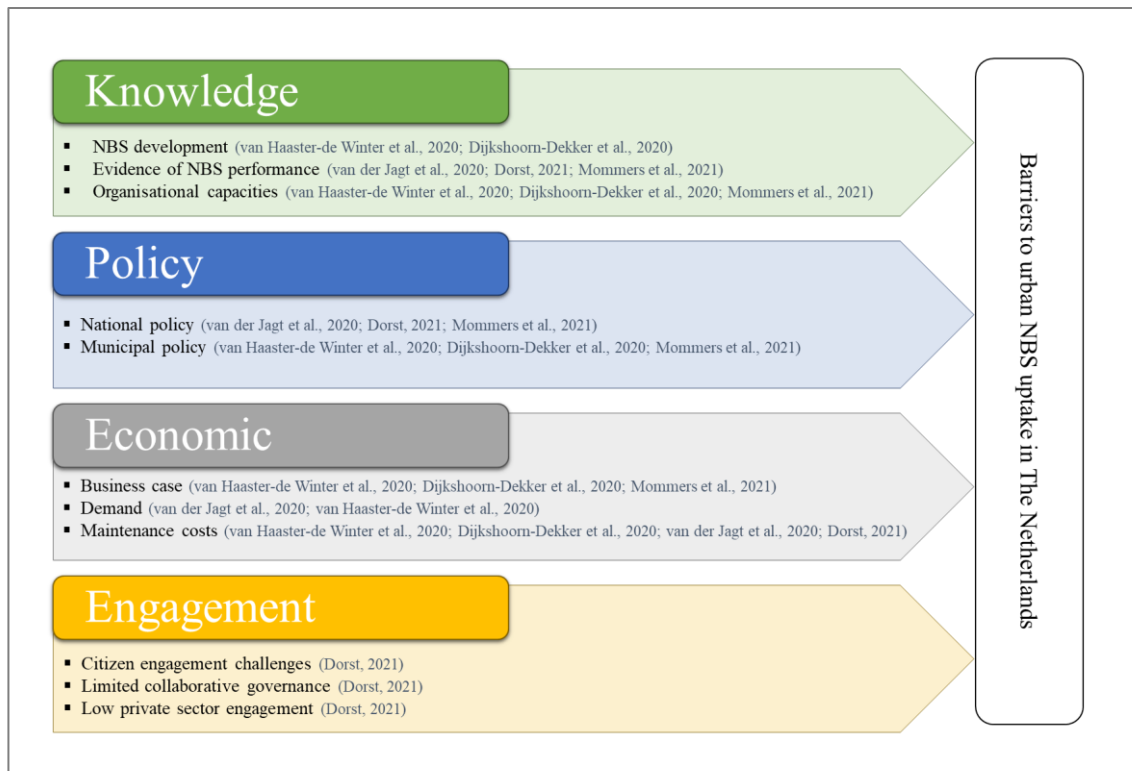


Figure 1. Thematic overview of identified barriers to urban NBS uptake in the Netherlands

### 2.2.1 Knowledge barriers

*NBS development:* urban NBS uptake is hampered by the immaturity of its development. There is limited knowledge about nature-inclusive construction in general (Dijkshoorn-Dekker et al., 2020), the technology and engineering is not advanced enough and the concept is still considered to be in its infancy, resulting in uncertainty for actors (Haaster-de Winter et al., 2020).

*Evidence of NBS performance:* Dorst (2021) has identified several knowledge, awareness and data challenges. Knowledge and knowledge exchange on urban NBS performances are lacking. ‘Grey’ technology and engineering expertise is dominant and hampers the development and use of other types of knowledge (such as from the ecological domain). Actors seem to heavily rely on quantified data and to prefer standardised approaches and assessments (e.g. through certification) in order to achieve economies of scale. Dorst (2021) attributes existing knowledge gaps for NBS to difficulties with employing current knowledge and assessment tools. Too few NBS benefits are included in such tools, leading to an incomplete view of NBS performance. The lack of knowledge about the effectiveness of interventions and lacking evidence on benefits were also found by Mommers et al. (2021) and van der Jagt et al. (2020) respectively.

*Organisational capacities:* other knowledge barriers relate to firm and organisational capacities. Often, the necessary knowledge is missing within organisations (Haaster-de Winter et al., 2020; Dijkshoorn-Dekker et al., 2020). For example, this can regard limited ecological knowledge or limited knowledge about anchoring practices within construction processes

(Mommers et al., 2021). Integrating NBS interventions in urban developments may not align with company's operational processes and often there seems to be little company support (Haaster-de Winter et al., 2020).

### 2.2.2 Policy barriers

*National policy:* barriers to anchoring urban NBS in processes are also found in relation to the integration into national policy (van der Jagt et al., 2020; Mommers, 2021). Where high-priority policy plans exist, actors involved find the step from visions to practical situations difficult – resulting in lacking implementation (Dorst, 2021). Furthermore, urban NBS interventions compete with other sustainability objectives (e.g. renewable energy with the use of photovoltaic panels on roofs). Such goals appear to be more firmly anchored in national policy documents, which often results in NBS being given a lower priority (Mommers, 2021).

*Municipal policy:* complicated regulations and procedures exist at the municipal-level (Haaster-de Winter et al., 2020). The frameworks in place are found to be strict and established landscaping guidelines for public areas leave little room for the implementation of urban NBS interventions (Dijkshoorn-Dekker et al., 2020). Also, a lot of time and money is spent in the early stages of development, whereby local policies (e.g. relating to the Nature Conservation Act) have to be identified and consultations with relevant decentralized governments have to be held (Mommers, 2021).

### 2.2.3 Economic barriers

*Business case:* developers and construction companies experience financial bottlenecks in establishing a viable business case (Mommers, 2021). A lot of uncertainty exists around affordability, risks, and returns (Dijkshoorn-Dekker et al., 2020; Haaster-de Winter et al., 2020). Financial preconditions may come at the expense of the implementation of certain green elements, making revenue models and financial frameworks uncertain (Dijkshoorn-Dekker et al., 2020). Dijkshoorn-Dekker et al. (2020) also indicate that there are ongoing discussions about which actor(s) will bear the responsibility for maintenance of certain urban NBS interventions and possible additional costs related to this. Furthermore, working with NBS may be viewed as unnecessary to maintain or expand a company's market position (Haaster-de Winter et al., 2020).

*Demand:* limited awareness appears to exist about sustainability challenges putting at risk both assets (investments) and liabilities (exposure to damage costs). Therefore, demand in investment portfolios seems to be lacking (van der Jagt et al., 2020). Real estate actors doubt consumers' willingness to pay and nature-inclusive projects are still seen as a 'luxury' for specific target groups (Dijkshoorn-Dekker et al., 2020).

*Maintenance costs:* after the realisation of projects in which urban NBS interventions are integrated, maintenance and management problems of the greenery are faced (Haaster-de Winter et al., 2020). There is a great deal of uncertainty about possible additional costs (Dijkshoorn-Dekker et al., 2020). Both van der Jagt et al. (2020) and Dorst (2021) emphasize the role of limited municipal capacity to engage with urban NBS implementation and management in this regard.

#### 2.2.4 Engagement barriers

*Citizen engagement challenges:* Despite citizens being generally engaged, some exhibit ‘NIMBYism’ – i.e. “‘not in my backyard’: objectives are considered important as long as they do not interfere with citizens’ daily lives” (Dorst, 2021, p.129). There is a tendency to prioritise aesthetics, comfort and low costs. This phenomenon holds true for some NBS interventions more than others: for instance, a resident may have higher appreciation for a nearby pocket-park than the permeable pavement in the street. Due to limited awareness of climate risks, citizens do not always see the ‘bigger picture’ (Dorst, 2021).

*Limited collaborative governance:* in the Netherlands, stakeholders find it difficult to ‘think out of the box’ and look beyond their tasks and responsibilities (Dorst, 2021). A complex stakeholder landscape and silos in project management and (decentral) governmental organisations exist. Collaboration and the coordination of funding and activities between different stakeholders (public and private) and across disciplines is challenging and lacking.

*Low private sector engagement:* given that urban NBS interventions tend to generate most benefits over a longer period of time and most private sector actors are oriented towards economic growth, they are often found less willing to engage (Dorst, 2021).

To conclude, the previous sections have described the barriers that have emerged from the literature and that are considered relevant to hampering urban NBS uptake in the geographical context of the Netherlands. It is important to note that the barrier categories and synthesising themes are interrelated. To illustrate, low private sector engagement may be partly due to economic uncertainties; and organisations lacking the appropriate ecological knowledge needed to work with NBS may be the result of, or contribute to, silo-mentalities and limited collaborative governance.

Previous studies do not provide insight into the frequency with which barriers may appear in the context of Dutch new residential building projects. Therefore this research addresses this knowledge gap by studying the extent to which barriers to urban NBS uptake, as identified in Figure 1, are perceived in the context of Dutch new residential building projects (SQ1).

### 2.3 Strategies to overcome barriers to urban NBS uptake

Only a fraction of studies have focussed efforts on pinpointing the strategies to overcome barriers to urban NBS uptake. Reviewing this body of literature, 13 strategies could be derived (see Appendix C). Similar to Section 2.2, overlap was identified and thus a synthesised overview was created classifying the strategies into four themes (see Figure 2). For example, Kabisch et al. (2016), Egusquiza et al. (2019), and Dijkshoorn-Dekker et al. (2020) all presenting collaborative governance strategies in one form or another to overcome barriers to urban NBS uptake.



Figure 2. *Thematic overview of identified strategies to overcome barriers to urban NBS uptake*

### 2.3.1 Learning strategies

Actors working on nature-inclusive building projects can benefit from knowledge obtained in the realisation of past projects (Dijkshoorn-Dekker et al., 2020; Kabisch et al., 2016). By exploiting existing tacit and expert knowledge in time, e.g. made accessible via knowledge platforms or stewardship communities, actors can be made aware of the benefits and risks of working with urban NBS (Kabisch et al., 2016). Besides, tapping into this knowledge can enable organisations to bring their current methods and operations more in line with nature-inclusive construction (van Haaster-de Winter et al., 2020).

### 2.3.2 Showcasing strategies

Van Haaster-de Winter et al. (2020) stress that emphasising the advantages of urban NBS and demonstrating the yields for both society and the company, can help actors in facilitating the implementation of NBS interventions. Dijkshoorn-Dekker et al. (2020) also underscore the strategy of raising awareness of the value that urban NBS interventions have to offer.

### 2.3.3 Collaborative governance strategies

A crucial strategy for success is the timely engagement of committed stakeholders, as well as involved actors pursuing a shared nature-inclusive ambition (Dijkshoorn-Dekker et al., 2020). To overcome barriers to urban NBS uptake, actors should also be open to innovative ideas and, together, come up with new solutions by thinking creatively outside the existing frameworks (Dijkshoorn-Dekker et al., 2020). Such forms of collective action arrangements can address a significant number of barriers, especially if the governance models are collaborative, multisector, polycentric and adaptive (Egusquiza et al., 2019). The strategy of establishing and



practicing collaborative governance approaches is also elaborated on by Kabisch et al. (2016). Deliberately renouncing grey infrastructural solutions, removing administrative burdens and providing incentives, allows for partnerships between local authorities, businesses and civil society organisations to emerge (Kabisch et al., 2016). Actors actively seeking governance arrangements can foster multi-stakeholder involvement and citizens' engagement, leveraging both public and private funding of NBS in cities (Egusquiza et al., 2019).

#### 2.3.4 Financial strategies

Actors should be willing to bear risks, which means recognising in advance that unforeseen costs and investments may occur (Dijkshoorn-Dekker et al., 2020). Another strategy described by Dijkshoorn-Dekker et al. (2020) in the economic theme regards demonstrating that consumer demand for nature-inclusive building projects exists. Past projects indicate that 'green' sells and actors should aim to create and communicate more such narratives to inspire others.

To conclude, the above sections elaborated on the main themes of strategies identified by literature to overcome barriers to urban NBS uptake. Similar to Section 2.2, it is important to note that the strategies are interrelated. For instance, Kabisch et al. (2016) highlighted the importance of actors sharing the knowledge they gained through experiences of successful projects, empowering them to act as 'ambassadors' to promote NBS. This action also touches upon the theme of collaborative governance as the authors envision the ambassadors to also engage in a science-community advocacy for NBS by making benefits and risks communicable to citizens and politicians alike.

The previous studies fall short in providing insight into how strategies relate to types of urban NBS interventions. The findings are aggregated from broader results across a variety of project types. To illustrate, Kabisch et al. (2016) studied 'NBS implementation' in general, and subsequently presented two main opportunities for facilitating action to urban NBS uptake. Egusquiza et al. (2019) studied the suitability of governance models for 'NBS projects' varying in design, location, scale and levels of management intensity etc. Here, the authors only stressed that the involvement of different actors can help decide the appropriateness of NBS interventions that will require governance models. Van Haaster-de Winter et al. (2020) collected data from companies operating in a variety of property types such as utility-construction, residential construction, retail, but also offices. Lastly, the majority of the cases which Dijkshoorn-Dekker et al. (2020) examined included transformations to high rise residential towers with little or no public space, implicating that the types of urban NBS interventions mainly remain limited to the house-level.

Literature stresses the need to consider the types of urban NBS interventions in order to provide recommendations. The strategies that emerged from literature, as displayed in Figure 2, may not (all) be relevant to the scope of new residential building projects. As elaborate on in Section 2.1, specific types of urban NBS interventions at the house-, street-, and neighbourhood-level, are suitable for implementation in this context. Therefore this research addresses this knowledge gap by studying how the strategies used to overcome barriers to urban NBS uptake, relate to the types of urban NBS interventions implemented in the context of new residential building projects (SQ2).

### 3. Methodology

#### 3.1 Research design

The study has taken a *qualitative* approach by adopting a *multiple case study design*. This strategy involved an in-depth empirical investigation of the phenomenon of overcoming barriers to urban NBS uptake within its real-life context (Yin, 2017). Exploring multiple cases has enabled the researcher to analyse the data both within each situation and across situations, allowing for an understanding in differences and similarities between cases (Bryman, 2012; Yin, 2017). This also provided insight in the role of context-specificity of barriers and strategies. The unit of analysis (i.e., the cases in the research scope) concern nature-inclusive new residential building projects in the Netherlands that meet the criterion set out in Section 3.1.1.

Taking the theoretical framework as a starting point, this study is principally *deductive*. Nonetheless, it leaves room for barriers and strategies that were not previously described by literature to emerge during data collection. To arrive at an answer to the main research question, the research steps followed the main elements of the process of social research as described by Bryman (2012) (see Figure 3).

Table 2. Research question and sub-questions

<b>RQ:</b>	HOW ARE BARRIERS TO URBAN NATURE-BASED SOLUTIONS UPTAKE OVERCOME IN NEW RESIDENTIAL BUILDING PROJECTS IN THE NETHERLANDS?
<b>SQ1:</b>	TO WHAT EXTENT ARE THE IDENTIFIED BARRIERS TO URBAN NBS UPTAKE IN THE NETHERLANDS, PERCEIVED IN THE CONTEXT OF DUTCH NEW RESIDENTIAL BUILDING PROJECTS?
<b>SQ2:</b>	HOW DO THE STRATEGIES USED TO OVERCOME BARRIERS TO URBAN NBS UPTAKE, RELATE TO TYPES OF URBAN NBS INTERVENTIONS IMPLEMENTED IN THE CONTEXT OF NEW RESIDENTIAL BUILDING PROJECTS?

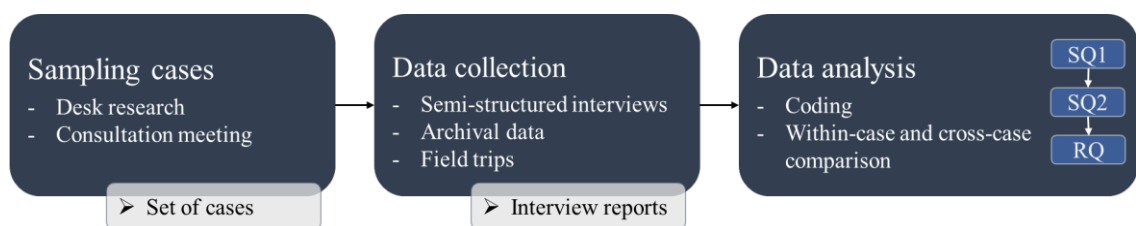


Figure 3. Research steps with deployed methods and deliverables (based on Bryman (2012))

##### 3.1.1 Sampling cases

The research deployed a *generic purposive sampling* strategy to select cases of new residential building projects in the Netherlands. This means that cases have been selected in a strategic way, so that those sampled were relevant to the posed research question (Bryman, 2012). For this, case selection criteria were formed a priori (see Table 3).

To start with, *desk research* has been conducted to delineate an initial sample of residential urban development projects that have implemented NBS interventions. This was done through consulting research projects such as the Urban Nature Atlas database,



development firm company websites, news articles, and Dutch knowledge network websites such as KANbouwen, Bouwnatuurinclusief.nl and Checklist Groen Bouwen etc. At first, this resulted in 18 cases. Subsequently, in-depth desk research into this sample was carried out to obtain more project details related to the criteria for case selection.

One such criterion, in line with the research question, was the realisation of a case within the geographical context of the Netherlands. Similarly, the second criterion concerned the project type, namely a new residential building project. A third requirement related to the successful uptake of urban NBS interventions at the house-, street-, and neighbourhood level. New residential building projects are characterized by types of urban NBS interventions at these scales (drawing on Section 2.1), and their presence in cases is essential for understanding how strategies relate to the types of interventions in this context. Despite prevailing barriers to urban NBS uptake, various new residential projects with successful implementation of multiple urban NBS interventions exist in the scope of the Netherlands. By studying these nature-inclusive projects, lessons can be learned about the strategies used to overcome barriers and thereby result in the desired outcome (Kabisch et al., 2016; Cohen-Shacham et al., 2016). A last criterion regarded the project being ‘active’, meaning appropriate cases were in a development phase where urban development plans were as good as completely established and construction was either nearly starting, had recently started, or was almost finished. Aside from the fact that the construction process of new residential developments to be delivered is deemed lengthy (CPB, 2019), external factors such as national (financial) crises have delayed projects even further, making it difficult to set a hard time-frame. As long as the project is ongoing, it is probable that barriers perceived by actors involved in the projects’ realisation are recent and thereby more relevant compared to multiple past projects being studied. In this case, barriers are more likely to be outdated and the findings less relevant to currently running projects or ones in the near future. Based on the four compiled criteria, the number of cases was reduced to 7.

Consequently, a *consultation meeting* was held with the ‘expert panel’, consisting of two employees from BirdLife Netherlands (see Appendix D). This research was done in collaboration with this organisation as the findings of the study may contribute to supporting urban NBS uptake, which is in line with BirdLife’s vision to protect a rich diversity of birds and nature (Vogelbescherming Nederland, n.d.). With their comprehensive (ecological) knowledge about nature-based urban development in the Netherlands, they acted as sparring partners. The aforementioned consultation meeting allowed for reflection on the characteristics of each case, which were subsequently considered to fit the criteria of Table 3.

The research aimed to contact at least one actor from each case to verify whether the cases met the criteria (such as the involved private development firm or municipality). In addition to the expert panel’s assistance in contacting relevant actors, the researcher approached organisations in a conventional manner (e.g. generic company emails). For one potential case, the researcher was unable to reach the involved actors, and in another, the scale of urban NBS interventions implemented proved insufficient (no urban NBS interventions at the house-level). The five remaining cases were selected to be studied, which was a number expected to be feasible taking into account time and resources available for this study. This number of cases has generated sufficient data to allow for cross-case comparison, while not losing detail and allowing for an in-depth understanding per case.

Table 3. Case selection criteria

Aspect	Case criteria
Geographical context	<i>The Netherlands</i>
Project type	<i>New residential building projects</i>
NBS	<i>Successful uptake of urban NBS interventions at the house-, street-, and neighbourhood-level</i>
Time-frame	<i>Active project</i>

### 3.1.2 Data collection

After establishing the set of cases, it was essential to create a comprehensive overview of the barriers perceived by actors and the strategies deployed to overcome them. Data has been collected through a series of *semi-structured interviews*, for which an interview guide was drafted (see Appendix E). This document consisted of a list of specific topics to be covered in order to ensure cross-case comparability, but also allowed for a great deal of room in how to reply during interviews (Bryman, 2012).

The interviewees were sampled in accordance with the definition of ‘actors’ used in this research (as mentioned in Section 1.1). Key stakeholders involved in the development and realisation of the cases mainly included commissioning parties, involved municipalities, private development firms, or (landscaping) architects. Important to note is that a commissioning party may, in fact, be made up of one or more of the actors mentioned above. From this sample of interviewees, empirical data could be collected about the barriers and strategies within the real-life context of the projects.

Starting the interview, the researcher introduced the topic of the study and the research aim. Subsequently, every interviewee was asked to define their understanding of urban NBS interventions and a nature-inclusive residential building project. When this did not match the conceptualisation used in this study, the researcher provided clarification. Furthermore, background information about project details, the role of the involved organization in the project and that of the interviewee were retrieved. Next, the interview focused on grasping a comprehensive understanding of barriers at play in the project. The researcher asked open-ended questions about what barriers to urban NBS uptake the interviewee perceived in the project. Accordingly, interviewees were asked what strategies were used to overcome certain barriers. During the interviews, the researcher used the thematic overviews of barriers and strategies from Sections 2.2 and 2.3 as guidance, as this helped to put the data in perspective.

The research conducted an average of three interviews per case to gain an in-depth understanding of the barriers to urban NBS uptake perceived in Dutch new residential building projects (SQ1) and the strategies used, relating to the types of urban NBS interventions implemented (SQ2). This resulted in a total of 14 interviews (see Appendix F). All interviews were recorded, for which the researcher requested permission. Furthermore, the names of all interviewees were anonymised throughout the thesis report. For each interview a summarizing *interview report* was composed. The interview report was then shared with the appropriate interviewee, who was asked if it constituted a factually accurate representation of the interview. Provided comments were incorporated and interview reports were corrected accordingly. Relevant *archival data* provided by the interviewees to serve as background information were also included for data analysis. In addition, two *field trips* were carried out. These informal

visits provided the researcher with the opportunity to observe urban NBS interventions ‘in action’ and contributed to the researcher's experience of the study subject.

### 3.1.3 Data analysis

Each interview report was *coded* using NVivo 12 Pro, a qualitative data analysis computer software package. The thematic overview of barriers (see Figure 1) served as the basis for the coding scheme. The coding process resulted in a total of 209 codes, each of which was allocated to one or several of the 32 sub-barriers, falling under 11 barrier categories and four central themes (clarification of the coding scheme can be found in Appendix G). Per interview report, statements of interviewees relating to their perception of a barriers and/or the used strategy to overcome a particular barrier, were assigned a corresponding code. To illustrate: an interviewee could state that the choice of certain nature-inclusive greenery to be applied in the public area was rejected by the municipal maintenance department, as it did not comply with existing municipal guidelines in place. This statement was found to relate to the sub-barrier of ‘strict municipal regulations’, which is placed under the barrier category of ‘municipal policy’. In its turn, this falls under the central theme of the overarching ‘policy’ barrier.

In this research, the notion of barriers being ‘perceived’ refers to the barriers that actors experienced or identified as problematic when aiming to implement urban NBS interventions (cf. Eisenack et al., 2014). This concept is important given that certain barriers can be valued differently by different actors, i.e. “judged as being problematic by one actor and viewed as beneficial by others” (Eisenack et al., 2014, p. 868). It is beyond the scope of this study to explore such positive connotations to predefined barriers, though the discussion section will shed some light on this (see Section 6). In line with the research question, this focus of this study is to gain insight into the barriers that *are* perceived. While both positive and negative effects of subjects may occur in the same case, an interviewee describing the perception of a barrier hamper urban NBS uptake in the project, will be regarded as a barrier being present.

The codes containing statements related strategies to overcoming a perceived barrier were analysed to gain insight into the strategies used and their relationship to specific types of urban NBS interventions. In addition to analysing the data within each case, the differences and similarities between the cases were explored. Any overlap was identified, resulting in the identification of 12 distinct strategies. Subsequently, these defined strategies were compared to the four themes of strategies identified by previous studies (see Figure 2 in Section 2.3). It should be noted that coding the data and analysing the findings entailed a reiterative process, in which the researcher continuously interpreted and made sense of the data (Bryman, 2012).

## 3.2 Reliability, validity and ethical considerations

To add breadth and depth to data collection, the research has deployed desk research, a consultation meeting, use of archival data, field trips, and interviews. Relying on multiple sources of evidence has assisted in bringing a richness of data together through *triangulation* and has contributed to the validity of the research (Yin, 2017).

The fact that this study adheres to calls from the literature for a context-specific approach affects the degree to which findings can be generalised (*external validity*). When the research findings reflect the context-sensitive character of overcoming barriers to urban NBS uptake, they may be difficult to generalise to different contexts on the one hand, but transferable

to the similar context of Dutch new residential building projects on the other hand. Section 6.1.3 will further elaborate on this. Unlike external validity, *internal validity* often does not present a problem in qualitative research (Bryman, 2012). By crystallising concepts in the theoretical framework, the researcher was able to ensure a high degree of congruence between concepts and observations, as evidenced by the internal coherence of research findings.

*External reliability* is often considered a difficult criterion to meet in qualitative research, since it is impossible to ‘freeze’ a social setting to make it replicable (Bryman, 2012). This also applies to this study, given that barriers may be resolved over time, or new ones may emerge. Despite the research’s limited ability to ensure replicability, a strategy was introduced to approach the requirements of external reliability. By rigorously reporting all steps taken during the research process, the research aimed to provide scholars with the opportunity to reproduce the research design to analyse the subject matter. Including explicit details of the research process has also helped strengthen the *internal reliability*. The researcher was aware of possible researcher bias that might threaten internal reliability and has, at all times, strived for objectivity and transparency. The drafted interview guide was helpful in this regard as it ensured consistency in the interview questions.

## 4. Case descriptions

Table 4 shows the project details of the five selected cases in summary. On each scale level, the cases show overlap in the types of urban NBS interventions integrated. For instance, all projects have integrated bird nesting boxes in buildings (house-level) and alley and street trees, hedges, and greens (street-level). Besides, the majority of cases paid attention to urban NBS interventions in the gardens of houses (house-level), green parking lots (street-level), and sustainable urban drainage systems, swales or filter strips (neighbourhood-level). More background information on the integration of urban NBS interventions and other project details per case are provided in the sections below.

Table 4. Summarizing case overview

Case	Urban development characteristics	Integrated types of NBS interventions
(1) <b>Tuinbuurt Vrijlandt</b> Rotterdam	Approximately 7 ha. and 290 homes: mixture of social housing, private rental sector and private owner-occupied property.	<ul style="list-style-type: none"> <li>▪ House level: <i>house gardens; green roofs; other.</i></li> <li>▪ Street-level: <i>alley and street trees, hedges, and greens; green parking lots</i></li> <li>▪ Neighbourhood-level: <i>riverbank greens; pond; sustainable urban drainage systems; other.</i></li> </ul>
(2) <b>Wickevoort</b> Haarlemmermeer	Approximately 56 ha. and 700 homes: mixture of social housing, private rental sector and private owner-occupied property.	<ul style="list-style-type: none"> <li>▪ House level: <i>house gardens; other.</i></li> <li>▪ Street-level: <i>alley and street trees, hedges, and greens; green parking lots; other.</i></li> <li>▪ Neighbourhood-level: <i>Neighbourhood green spaces; allotments or community gardens; other.</i></li> </ul>
(3) <b>Kerckebosch</b> Zeist	Approximately 46,5 ha. and 1000 homes: mixture of social housing, private rental sector and private owner-occupied property.	<ul style="list-style-type: none"> <li>▪ House level: <i>other.</i></li> <li>▪ Street-level: <i>alley and street trees, hedges, and greens; green parking lots; other.</i></li> <li>▪ Neighbourhood-level: <i>neighbourhood green spaces; green playground; sustainable urban drainage systems, swales or filter strips</i></li> </ul>
(4) <b>Westergouwe</b> Gouda	Approximately 200 ha. and 4000 homes: broad mixture ranging from owner-occupied houses and apartments to private building plots.	<ul style="list-style-type: none"> <li>▪ House level: <i>house gardens; green walls or facades; other.</i></li> <li>▪ Street-level: <i>alley and street trees, hedges, and greens; green parking lots.</i></li> <li>▪ Neighbourhood-level: <i>green corridor; sustainable urban drainage systems, swales or filter strips; other.</i></li> </ul>
(5) <b>Erasmusveld Midden</b> Den Haag	Approximately 6,8 ha. and 370 homes: mixture of social housing, private rental sector and private owner-occupied property.	<ul style="list-style-type: none"> <li>▪ House level: <i>green roofs; balcony green; other</i></li> <li>▪ Street-level: <i>alley and street trees, hedges, and greens; other.</i></li> <li>▪ Neighbourhood-level: <i>green corridor; riverbank greens; pond; sustainable urban drainage systems, swales or filter strips.</i></li> </ul>

### 4.1 Case 1: Tuinbuurt Vrijlandt

The first case is located in the district Smeetsland Noord in the city of Rotterdam. Tuinbuurt Vrijlandt is a new residential building project of around 290 homes. The development consists of a mixture of social housing, private rental sector and private owner-occupied property. The amount of houses to be realised and with its 7 hectares, it is one of the two smaller cases this study investigated. In Figure 4 some impressions are provided.

The project is commissioned by the Municipality of Rotterdam and local housing corporation Havensteder. The private development firm Ballast Nedam Development



was selected to design and construct the residential development (year 2018). For this, the actor sought collaboration with the landscape architecture and urban planning company Karres en Brands.

For a new residential building project to be realised in this area, the commissioning parties set several requirements. Even though the integration of urban NBS was not an explicit part of this, two other core themes were deemed important starting points in the projects' contribution to a nature-inclusive environment. Firstly, urban development had to safeguard water management in the area (as part of a requirement from the Regional Public Water Authority). This involved implementing various interventions to guarantee climate adaptivity. Secondly, the neighbourhood had to be designed according to a garden village typology ('tuinstad' in Dutch). In this light, increased space for greenery, large and deep gardens, and mature hedges etc. were demanded.

Construction of the first phase started in the year 2021, and the urban NBS interventions from Table 5 are known to be integrated in the project.

Table 5. Urban NBS interventions implemented in case 1

Scale levels	Types of urban NBS interventions
House	<ul style="list-style-type: none"> <li>▪ <b>House gardens:</b> hedges planted on property lines between houses and adjacent to inner courtyards; constructed gates between private gardens and public areas will be overgrown with greenery.</li> <li>▪ <b>Green roofs, walls or facades:</b> on all garden sheds.</li> <li>▪ <b>Other:</b> free rain barrel for every ground level home; integration of bird nesting boxes in houses.</li> </ul>
Street	<ul style="list-style-type: none"> <li>▪ <b>Alley and street trees, hedges, and greens:</b> planting of mixed tree species and underplanting</li> <li>▪ <b>Green parking lots:</b> partly permeable pavement</li> </ul>
Neighbourhood	<ul style="list-style-type: none"> <li>▪ <b>Riverbank greens:</b> nature-friendly banks</li> <li>▪ <b>Pond:</b> established pond</li> <li>▪ <b>Sustainable urban drainage systems, swales or filter strips:</b> bioswale</li> <li>▪ <b>Other:</b> possibly a stork post will be added</li> </ul>

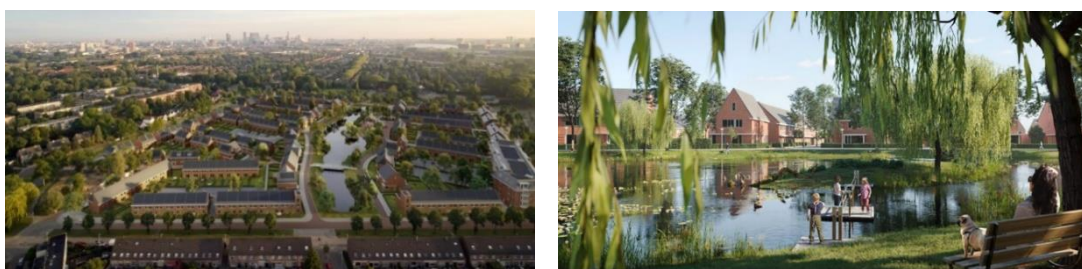


Figure 4. Impressions of case 1: Project Tuinbuurt Vrijlandt (Ballast Nedam Development, n.d.)

## 4.2 Case 2: Wickevoort

The second case is located in Cruquius near Haarlem, in the municipality of Haarlemmermeer. Project Wickevoort covers about 56 hectares and around 700 homes are developed, containing a mixture of social housing, private rental and private property. An impression is showed in Figure 5.

The project is commissioned by SEIN in collaboration with AM. The latter actor is the private development firm responsible for the design and construction of the residential

development (from the year 2013 onwards). LANDLAB is the responsible landscape architectural organisation, and in addition the Municipality of Haarlemmermeer is involved in the project.

As commissioning party SEIN outlined several requirements to the new urban development. Similar to case 1, urban NBS were not an explicit part of the tender request. But, again, two other key themes contributed to the projects’ focus on a nature-inclusive environment. The relevant Regional Public Water Authority included a criterion to ensure a water body was integrated into the development plans (e.g. in the form of a pond), and the project had to realise an estate design style ('landgoed' in Dutch).

Construction of the first phase started in the year 2021, and the urban NBS interventions showed in Table 6 are known to be integrated in the project:

Table 6. Urban NBS interventions implemented in case 2

Scale levels	Types of urban NBS interventions
Building	<ul style="list-style-type: none"> <li>▪ <b>House gardens:</b> mature hedges of mixed species planted on property lines</li> <li>▪ <b>Other:</b> integration of bird nesting boxes in houses</li> </ul>
Street	<ul style="list-style-type: none"> <li>▪ <b>Alley and street trees, hedges, and greens:</b> narrowed street profiles designed to allow for more green space in verges;</li> <li>▪ <b>Green parking lots:</b> partly permeable pavement</li> <li>▪ <b>Other:</b> 'holes' designed in the wall demarcating the districts’ property line to allow mammal movement</li> </ul>
Neighbourhood	<ul style="list-style-type: none"> <li>▪ <b>Neighbourhood green spaces:</b> choice of plant species with high biodiversity value</li> <li>▪ <b>Allotments or community gardens:</b> establishment of neighbourhood farm</li> <li>▪ <b>Other:</b> retaining as much trees as possible, with special attention to safeguarding monumental old ones; planting extra trees, taking into account the basic principle that every new tree must have an added value (e.g. bloom for the insects/birds, bear fruit as production for the urban farmer etc.)</li> </ul>



Figure 5. Impressions of case 2: Project Wickevoort (Haarlems Dagblad, 2019; AM, n.d.)

### 4.3 Case 3: Kerckebosch

Case number three concerns project Kerckebosch near the city of Zeist. Within this development around 1000 are realised, covering 46,5 hectares. Similar to previous projects, a mixture of social housing, private rental sector and private owner-occupied property is present. Figure 6 has provided an impression of the case.

This development is commissioned by the Wijkontwikkelingsmaatschappij (abbreviated to WOM), which regards a collaboration between the local social housing

corporation Woongoed Zeist and the Municipality of Zeist. At the start of urban planning the ambition was set to realise a 'special neighbourhood', focusing on conserving and strengthening the existing natural area. The (landscape) architecture and urban planning firm wUrck has been closely involved in developing this residential building project. Implemented urban NBS interventions in the project are summed up in the table below.

Table 7. Urban NBS interventions implemented in case 3

Scale levels	Types of urban NBS interventions
Building	<ul style="list-style-type: none"> <li>▪ <b>Other:</b> integration of boxes, openings and roof overhangs etc. in houses providing opportunities for birds to nest</li> </ul>
Street	<ul style="list-style-type: none"> <li>▪ <b>Alley and street trees, hedges, and greens:</b> preservation of existing greenery, and planting extra trees, shrubs etc. with selection of native planting and sowing seeds composed of a special heathland mixture</li> <li>▪ <b>Green parking lots:</b> retaining structures of lowered parking spaces consist of a compressed peat wall where greenery can grow; permeable pavement</li> <li>▪ <b>Other:</b> partly dead hedges applied as fences</li> </ul>
Neighbourhood	<ul style="list-style-type: none"> <li>▪ <b>Neighbourhood green spaces:</b> landscape has been opened up and nature has been brought in, intermediate public green area has been designed as native heathland nature; preservation of existing greenery, and planting extra trees, shrubs etc. with selection of native planting and sowing seeds composed of a special heathland mixture</li> <li>▪ <b>Green playground:</b> established green playground</li> <li>▪ <b>Sustainable urban drainage systems, swales or filter strips:</b> bioswale</li> </ul>



Figure 6. Impressions of case 3: Project Kerckebosch (Kerckebosch Zeist, 2018; Evergreen Zeist, 2020)

#### 4.4 Case 4: Westergouwe

The fourth case, project Westergouwe, is located near Gouda. Compared to the other cases, it is by far the largest project in size. Its total development covers approximately 200 hectares and consists of around 4000 homes, ranging from owner-occupied houses and flats, to building plots. Figure 7 gives an impression of the project.

The Municipality of Gouda and the VOF Westergouwe serve as the commissioning parties in this project. The VOF Westergouwe is a collaboration between VolkerWessels Vastgoed and Heijmans Vastgoed. The parties involved KuiperCompagnons, a firm specialised in spatial planning and architecture, for the design and construction of the residential development.

Even though creating green public spaces was part of the initial urban development plans by the Municipality of Gouda, the plan was later refined and choices were made to preserve an existing drinking water pipe running through the area. This changed urban design plans and increased the amount of green space, as well as the inclusion of a tender requirement to establish a natural area adjacent to the project site (serving as nature preservation and



recreational space). Similar to case 1 and 2, water also played an important role in this project. Taking into account breakthrough scenarios of the close by IJssel River, sections of the project had be able to function as buffers for water retention, as well as constructing houses to act as retaining structures to break possible waves (right hand side of the first picture in Figure 7). Despite the project plan including aforementioned points, initial plans made by the commissioning parties paid little attention to the integration of urban NBS. It was only after first project phases were realised, the concept of nature-inclusive construction practices gradually emerged. Table 8 shows urban NBS interventions known to be realised in further development of the project.

Table 8. Urban NBS interventions implemented in case 4

Scale levels	Types of urban NBS interventions
Building	<ul style="list-style-type: none"> <li>▪ <b>House gardens:</b> mixed types of hedges with high biodiversity value on property lines</li> <li>▪ <b>Green roofs, walls or facades:</b> steel wires attached to houses to support growing of climbing plants</li> <li>▪ <b>Other:</b> integration of bird nesting boxes in houses</li> </ul>
Street	<ul style="list-style-type: none"> <li>▪ <b>Alley and street trees, hedges, and greens:</b> flower and herb mixtures for sowing the verges; variety of species of trees and underplanting.</li> <li>▪ <b>Green parking lots:</b> permeable pavement</li> </ul>
Neighbourhood	<ul style="list-style-type: none"> <li>▪ <b>Green corridor:</b> Green-blue zone for the purposes of nature conservation, water buffering and recreation</li> <li>▪ <b>Sustainable urban drainage systems, swales or filter strips:</b> bioswale</li> <li>▪ <b>Other:</b> bats nesting/resting boxes implemented in the public area</li> </ul>



Figure 7. Impressions of case 4: Project Westergouwe (Gemeente Gouda, n.d.; Projectbureau Westergouwe, n.d )

#### 4.5 Case 5: Erasmusveld Midden

The final case study regards an urban development in the city of The Hague. As part of a larger development in the area, project Erasmusveld Midden is realised. Mixing both social housing, private rental sector and private owner-occupied property, around 370 homes are build covering 6,8 hectares. Figure 8 has provided impressions.

The project is commissioned by the Ontwikkelingscombinatie Wateringse Veld (abbreviated tot OCWV). This party consists of both the Municipality of The Hague and BPD. As private development firm, BPD designs and constructs the residential development.

From the start, the ambition was set for the project to be part of the most sustainable neighbourhood in The Hague. Its starting point was to create as little private land as possible,

and as much public area as possible (18% higher compared to the municipality average), so that greenery and social meeting places could be established. In later more concrete urban planning stages, part of this ambition was translated into the implementation of urban NBS as a key objective. Integrated interventions regard the ones summed up in the table below.

Table 9. Urban NBS interventions implemented in case 5

Scale levels	Types of urban NBS interventions
Building	<ul style="list-style-type: none"> <li>▪ <b>Green roofs, walls or facades:</b> green roofs</li> <li>▪ <b>Balcony green:</b> greenery/plant boxes on balconies and galleries</li> <li>▪ <b>Other:</b> integration of bird nesting boxes in houses</li> </ul>
Street	<ul style="list-style-type: none"> <li>▪ <b>Alley and street trees, hedges, and greens:</b> planting extra trees and plants, choice for native types</li> <li>▪ <b>Other:</b> permeable pavement</li> </ul>
Neighbourhood	<ul style="list-style-type: none"> <li>▪ <b>Green corridor:</b> green corridor supporting a migration route for bats; safeguarding of two important green zones (west to east connecting to an existing ecological ribbon, and north to south connecting greenery to all houses in the project)</li> <li>▪ <b>Riverbank greens:</b> nature-friendly banks</li> <li>▪ <b>Pond:</b> established pond</li> <li>▪ <b>Sustainable urban drainage systems, swales or filter strips:</b> bioswale</li> </ul>



Figure 8. Impressions of case 5: Project Erasmusveld Midden (Architectenweb BV, 2017; Gebiedsontwikkeling.nu., 2019).

## 5. Results

This chapter describes the results of the study in two sections. First, the results of the empirical research into perceived barriers to urban NBS uptake in the context of Dutch new residential buildings projects are presented (SQ1). The extent to which certain barriers are perceived is also elaborated on in this regard. Second, the strategies used to overcome barriers in cases are identified (SQ2). Here, the relationship between strategies and the types of urban NBS interventions is also addressed.

### 5.1 Perceived barriers to urban NBS uptake

Section 2.2 outlined the barriers that were expected to hamper urban NBS uptake in projects within the geographical scope of the Netherlands. A total of 32 sub-barriers were combined into 11 barrier categories covering four themes. Figures 9 and 10 present which of these identified barriers were perceived in the cases studied in this research. Furthermore, the sections following the figures contextualise these findings.

The first figure depicts the number and type of barriers perceived in each case. This number varied per project, although not significantly. Three barriers were perceived in case 1, five barriers were perceived in case 2, and a total of seven barriers were perceived in cases 3, 4, and 5. Except for case 1, where no statements were made about engagement barriers, all other cases perceived barriers across all barrier themes.

The second figure illustrates the number of cases (out of five) to which a specific barrier was perceived. Certain barriers to urban NBS uptake appear to be more frequently perceived in Dutch new residential building projects than others. In particular, the barriers *municipal policy*, *organisational capacities*, the *business case*, *maintenance costs*, and *citizen engagement challenges* were perceived to hamper urban NBS uptake in the projects. Interestingly, no statements were made indicating *demand* or *low private sector engagement* being barriers at play in any of the cases.

It is important to note that the number of cases that perceived a certain barrier, does not necessarily equal its influence or impact in terms of hampering urban NBS uptake. This will be addressed further in the discussion (see Section 6.1).

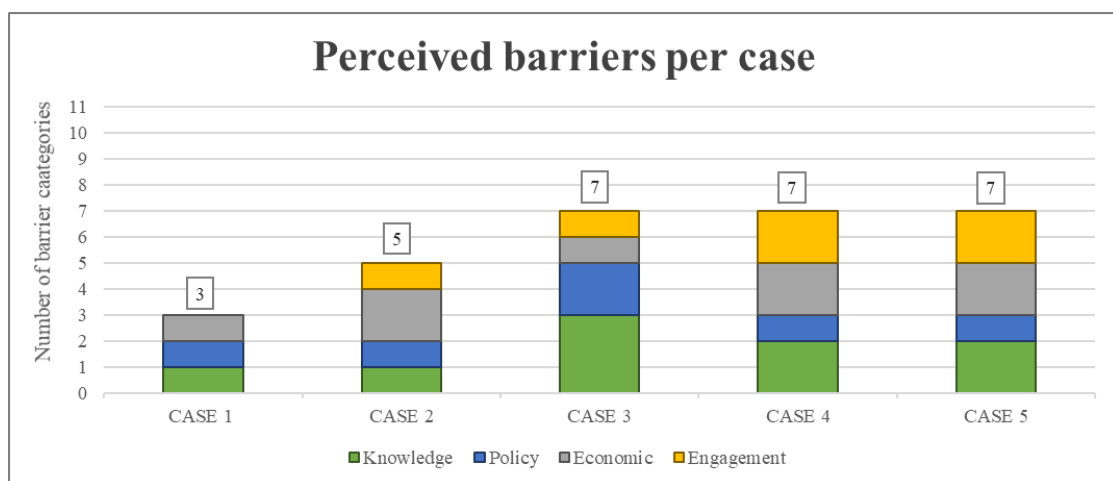


Figure 9. Overview of the number of barriers categories perceived per case, grouped per theme.

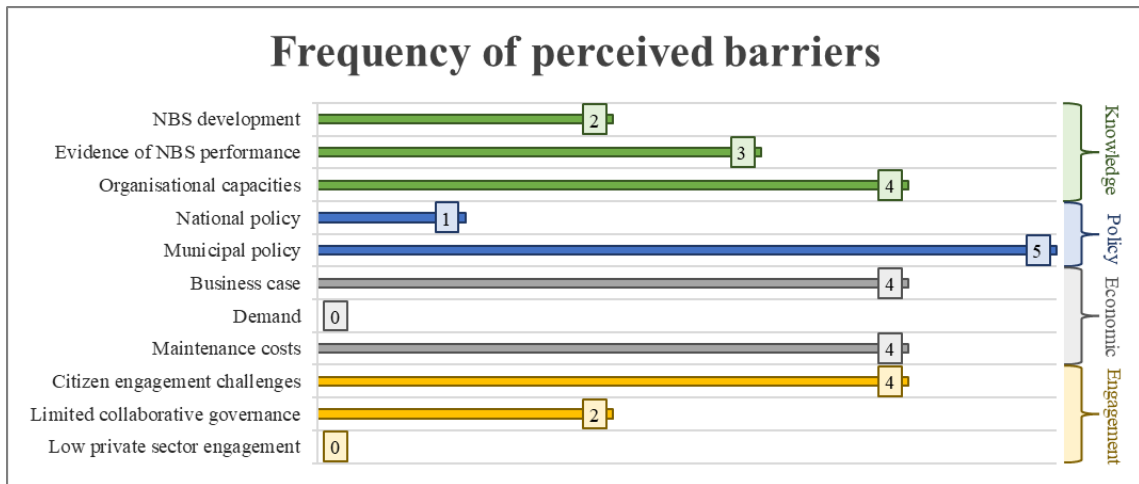


Figure 10. Overview of the number of cases perceiving a barrier category, grouped per theme.

### 5.1.1 Knowledge

Every project perceived at least one knowledge-related barrier, though most case perceived several. In two cases, the barrier of *NBS development* was perceived, and in three cases, the barrier of *evidence of NBS performance* was perceived. In the majority of cases *organisational capacities* were perceived to hamper urban NBS uptake.

In terms of the latter, several interviewees emphasized the unfamiliarity of involved actors and parties with NBS to be a barrier. In case 3 an interviewee highlighted the conventional way of working by urban developers, reflecting in the initial design of street profiles with dominant space for grey infrastructure (Int. #8). Also in the initial set-up of case 4 conventional urban development practices were prevalent. This showed, for example, in the space for, and selection of, greenery by landscaping architects. Limited prior knowledge and experience also played a role in the involved development firms in case 4 and case 5, often resulting in resistance. An interviewee from case 4 clarified on this by pointing out the false assumptions that regularly seem to exist among fellow developers within the company about the difficulty and expenses of integrating urban NBS interventions (Int. #10). Likewise, interviewees from both case 3 and 4 made statements about the desired integration of NBS interventions in their projects not aligning with the standardized way of working of the municipal maintenance departments involved (Int. #7; Int. #8; Int. #10).

Concerning the barrier of *evidence of NBS performance*, the municipal project manager interviewed from case 5 struggled to proof social benefits of applying NBS because no calculations methods were included during the planning process. In the same case, as well as in case 4, involved actors struggled with the municipal maintenance department's reluctance to accept certain NBS interventions, arguing there was only organisational support to work with 'proven' practices.

With regard to the barrier of *NBS development*, an interviewee from case 1 indicated that the used design method had likely hampered the application of some interventions (Int. #2). The chosen architectural style was considered unsuitable for the implementation of urban NBS interventions such as green façades, walls or roofs attached to the houses. Little knowledge seemed to exist about nature-inclusive alternatives that would still comply with the design typology. Also an interviewee from case 1 emphasised the potential of biomimicry in sustainable urban development and the project, but its immature stage of development (Int. #2).



### 5.1.2 Policy

All of the cases perceived *municipal policy* to be a barrier to urban NBS uptake in their projects. Only in one case did an interviewee mention *national policy* exerting hampering effects.

Current *municipal policy* is found to often prioritize other ambitions and objectives over NBS. For example, an interviewee from case 2 pointed out that, in some instances, space for parking was considered more important than greenery and also in case 1 actors stressed the importance of parking spaces at the expense of green space (Int. #6; Int. #2; Int. #3). An interviewee from case 5 highlighted the continuous struggle that existed in the project regarding land-use choices (Int. #13). Actors found that several interests clashed, such as the demand for urban densification, energy efficiency and urban greening. The interviewee stated sometimes feeling ‘forced’ to make certain choices that did not benefit space for greenery, also due to external factors such as societal developments and the ruling local political administration. More than anything, interviewees within all the cases explicitly mentioned municipal policy containing requirements for the design of public space to be a restrictive factor for the uptake of urban NBS interventions (all interviewees except for Int. #11 and Int. #14). Hampering criteria from this handbook manifested itself in different ways, e.g. strict rules regarding underground cables and pipes making it more difficult to plant larger order trees (case 1); standardised planting distances between trees in street profiles that prohibit the desired quantity of trees to be implemented (case 2); and requirements for the width of the roads leading to discussions when more narrow street profiles are desired (case 4 and 5). The handbook for managing the public area is focused on convenient maintenance for the municipal maintenance department, and rejects interventions that are expected to be of a labour-intensive character. Even though the content of the policy framework varies between municipalities, it is generally found to be old-fashioned and unfunctional in the light of implementing urban NBS interventions in the public area. Actors can feel the need to ‘discard’ the preconditions when establishing design principles for nature-inclusive projects (Int. #9).

The barrier of *national policy* was perceived to a much lesser extent. An interviewee from case 3 shared an experience from the project in which the national Building Decree (‘Bouwbesluit’ in Dutch) demanded a grey infrastructural solution, while a NBS intervention existed as an excellent alternative (Int. #7).

### 5.1.3 Economic

In terms of economic barriers, both a lacking *business case* and high *maintenance costs* were perceived in four cases each. None of the interviewees made statements indicating that lacking *demand* was a barrier at play in any of the cases.

With regard to the *business case*, interviewees shared their expectations about the costs of NBS interventions not sufficiently translating into increased sales prices (case 1 and case 4). “*The birds are not going to pay for the tree*”, as an interviewee from case 1 stated (Int. #3). Furthermore, an interviewee from case 5 emphasized that, with other sustainability aspects like energy efficiency with solar panels etc., added value is more visible (Int. #14). In addition, actors from case 1, 3 and 4 experienced that the integration of NBS interventions prolonged the already lengthy development process (Int. #1; Int. #7; Int. #10).

The barrier of *maintenance costs* seemed to be closely related to the municipal handbook as elaborated on in the policy theme. The municipal maintenance department often rejected

proposed urban NBS interventions because they deviated from their known standards and previous experiences with their management was lacking. Due to uncertainty in maintenance-intensiveness and thereby costs, the municipal departments were often found reluctant to make adjustments in working methods as they were already working with limited budgets (Int. #5; Int. #15). Previous rounds of national budget cuts have affected municipal maintenance departments' resources, meaning they have been working with declined, or at best remained constant, budgets for many years (Int. #8). In addition, municipal budget cuts also regularly decide to cut back on management of public areas, making it difficult to secure the maintenance of 'deviating' greenery in the long term (Int. #5). On top of that municipal maintenance departments seem to prioritize budget spending to guarantee safety and tidiness, sometimes coming at the expense of opportunities for NBS interventions. As in all cases developers constructed the public area and have to hand it over to the municipal organisation after realisation, they are bound to comply with their requirements. A concrete example of this is the municipal maintenance department opposing the implementation of permeable pavement in case 2, 3, 4 and 5. This intervention was not in line with the traditional way of working and extra costs for its maintenance were expected. The maintenance departments seem to prefer the use of traditional materials such as 'clinker' paving instead, as these are also kept in stock and are thereby easier to replace.

#### 5.1.4 Engagement

Interviewees within four cases made statements about *citizen engagement challenges* and only in two cases *limited collaborative governance* was deemed to hamper urban NBS uptake in the projects. None of the interviewees indicated *low private sector engagement* to exert hampering effects in their project.

The majority of cases experienced barriers related to *citizen engagement challenges*. Examples are residents having negative experiences with living in a natural environment, complaining about the 'weeds' in the permeable pavement in parking lots or in verges and asking them to be mowed; the presence of ticks in tall grass; oak processionary caterpillars in the trees; hay fever complaints; and 'leaking' trees on cars parked underneath them (case 3, Int. #7). Possible complaints from residents about this last-mentioned point were also discussed in case 5 (Int. # 12). There also seem to be negative expectations among actors about the engagement of citizens, which appear to be based on presumptions rather than previous project experiences. Developers may fill in that residents do not want bird nesting boxes and would stuff them shut (case 4, Int. #10); that residents do not want a large tree in their garden as they would experience too much maintenance from it (case 2, Int. #6); or that the use of permeable pavement for the paths leading to the entrance of the houses would lead to objections from residents, because it may cause inconvenience, especially after rain (case 5, Int. #12).

Interviewees from two cases perceived *limited collaborative governance* to be a barrier in the project, in the form of silo-mentalities to be specific. In case 5, an interviewee experienced insufficient integral thinking due to the municipal organisation having made a separation between the departments urban development and maintenance (Int. #13). This leads to both units mainly thinking from their own discipline, subsequently resulting in internal discussions. Furthermore, case 4 experienced that, despite development plans being tested by both the urban development department and maintenance department, in practice a gap existed (Int. #10).

## 5.2 Deployed strategies to overcome barriers to urban NBS uptake

Section 2.3 described the 12 strategies suggested by previous studies to overcome barriers to urban NBS uptake, which were classified into four themes. Figure 11 depicts how these strategies derived from literature, relate to the distinct strategies identified in the case studies (also a number of 12). Furthermore, this figure shows which strategies were used to overcome which barriers to urban NBS uptake. Section 5.1 revealed that the economic barrier of lacking *demand* and the engagement barrier of *low private sector engagement* were not perceived in any of the cases, and no interviewee statements related to strategies on these subjects were identified, so they have been excluded from the figure.

Except for the barrier of *evidence of NBS performance*, interviewees made statements about specific strategies used to overcome all other barrier categories. Figure 11 shows that strategies may contribute to overcoming multiple barriers at once (learning-by-doing; consulting external experts; awareness-raising actions; agreeing to deviate from the handbook; and alternative maintenance regimes). It can also be seen that for some barriers, several strategies were used simultaneously to overcome them. This applied to the perceived barriers of *organisational capacities* (through learning-by-doing; consulting external experts; and guiding frameworks); *municipal policy* (through political pressure; and agreeing to deviate from the handbook); *maintenance costs* (through the supplementation to maintenance budget; and alternative maintenance regimes); *citizen engagement* (through awareness-raising actions; contractual safeguarding; and target market selection); and *limited collaborative governance* (through awareness-raising actions; consulting external experts; agreeing to deviate from the handbook; and alternative maintenance regimes).

The following sections elaborate on each strategy in the context of the different cases, as well as in the light of the themes of strategies identified in the theoretical framework. Moreover, a final section addresses the strategies in relation to the three scale-levels of urban NBS interventions described in Section 2.1.

### 5.2.1 Learning-by-doing

Overall, this strategy proved helpful in overcoming barriers in *NBS development* and *organisational capacities* in several cases. A recurring statement was “onbekend maakt onbemind” (Int. #7; Int. #10), which can be roughly translated to “unknown makes unloved”. Meaning one can not love and embrace what one is not familiar with, referring to the lack of knowledge about ecological aspects and anchoring of these practices within organisational and construction processes. Both in case 1, 4, and 5 interviewed developers explicitly talked about their openness and willingness to learn, and about seizing opportunities in the project to experiment and gain knowledge (Int. #1; Int. #10; Int. #14). For instance, the development company involved in case 4 experienced that by ‘just doing it’ organizational resistance to work with urban NBS was counteracted. Employees become enthused about the course of action, as they begin to look at the returns in a different way, i.e. realising the added value of NBS to a healthy living environment, and observe that integrating measures proves to be less complicated than expected.

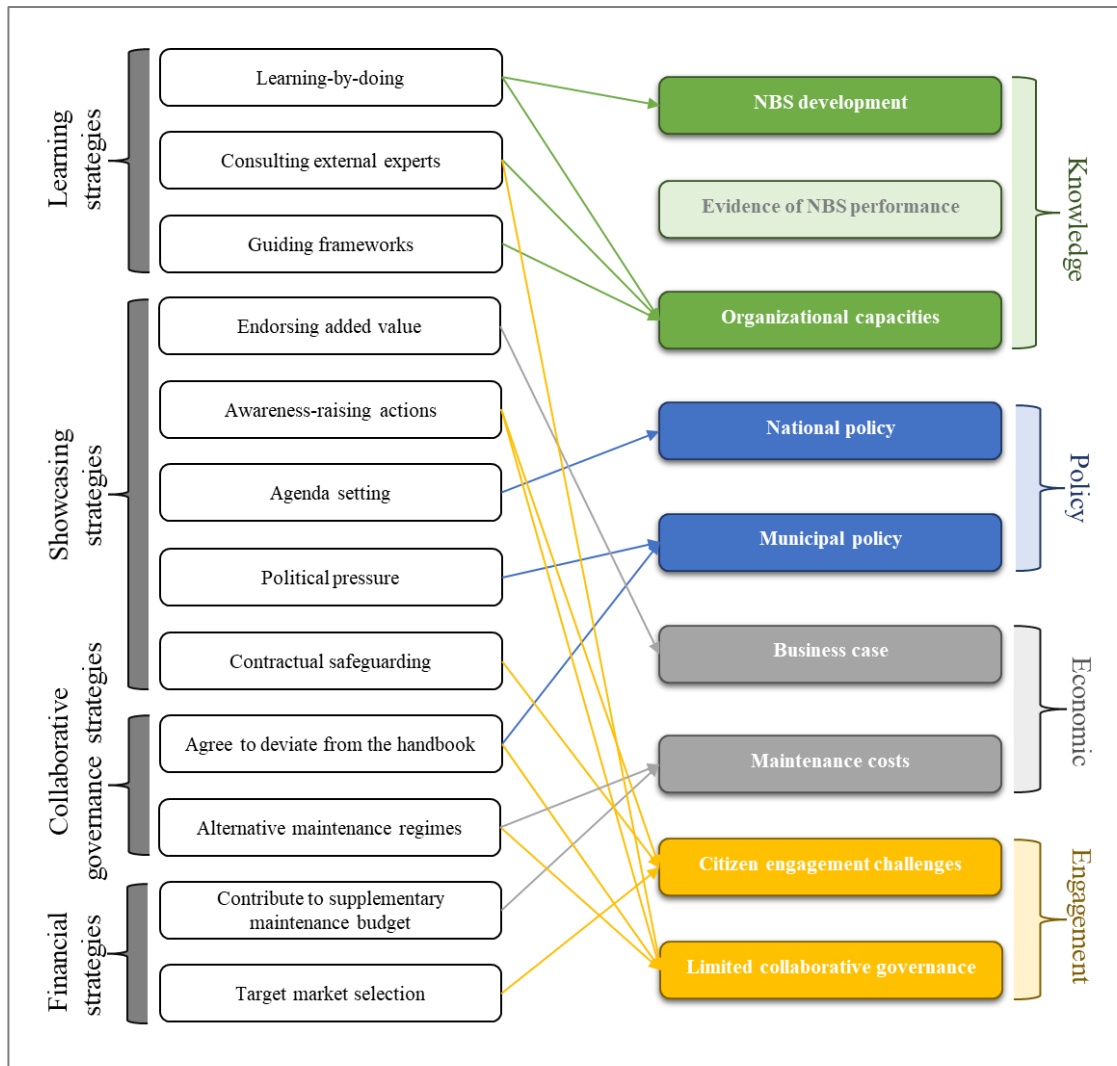


Figure 11. *Strategies to overcome barriers to urban NBS uptake in Dutch new residential building projects*

Even though the developer in case 1 had already required knowledge about urban NBS interventions in a previous project, this actor is making a learning curve in more efficiently fitting the practices into its development process. Actors in case 4 did not foster urban NBS uptake from the start, but rather showed gradual improvements during the development process and learning from previous subdevelopments in the project. Practical examples of learning on the job in this case included the belated recognition that ecologists needed to be involved, which led to plans being retrospectively adjusted to reflect some of the proposals from the ecological addendum (e.g. a higher variety of tree species and richer flower and herb mixtures for underplanting). The strategy is also illustrated by the adjustment the developer made in the way private gardens were delivered to residents. Initially, private gardens were handed over with a sandy surface, which invited residents to apply tiles. In the light of climate adaptation and mitigation and biodiversity, the developer wanted to avoid this and started thinking about how to create conditions for green gardens. From there on it was decided to excavate about 40 cm of the surface, stimulating the use of soil to fill the area as it is currently a cheaper resource than sand.



Other practical examples of the hands-on approach to learning were demonstrated in case 3. Actors concluded that when parking strips were lengthy, cars would drive all over the surface, damaging the permeable pavement. The measure was adapted by constructing no more than three parking spaces in a row, protecting the material. Also during the development of case 3, the retaining structures of lowered parking lots (build up out of BioBlocks) have been modified. Where they used to be sloped, they are now stacked on top of each other providing more stability and making it possible to grow greenery (see Figure 12).

The strategy of learning-by-doing fits within the theme of *learning strategies* as elaborated on in Section 2.3. In case 4 (the largest project in the case sample), actors demonstrated to benefit from knowledge gained in the realisation of the previous sub-development phases. Besides, in case 1 the project enabled the private development company to bring their operational processes more in line with the implementation of urban NBS interventions.



Figure 12. *Learning-by-doing in case 3: adjustment of retaining structure intervention*

### 5.2.2 Consulting external experts

To overcome the knowledge-related barrier of *organisational capacities*, consulting external expert knowledge appeared to be a valuable strategy. This is primarily related to the ecological knowledge needed for nature-inclusive urban development. All cases included external ecologists in their processes, be it in different forms and at different stages. As mentioned earlier, case 4 only started doing this from the second sub-development in the project, compared to case 1, 2, 3 and 5 managing to deploy knowledge at earlier stages. The municipal urban ecologist conducted research on feasible and functional measures in the preliminary stages of case 5. In the phases that followed, the developer aligned choices with this actor. Also in case 3 ecologists were involved. On the one hand by the architect for establishing an ecological vision and design principles for the public space, on the other hand by the developer to answer questions regarding specific animal target groups and policy frameworks related to ecology. In addition, the developer has made the ecologist available to several other private parties involved in the development.

Moreover, both the developers in case 1 and 2 consulted a scientific source (a doctoral dissertation and the Wageningen University & Research respectively) and consulted the NGO BirdLife Netherlands. With regard to this latter action, the strategy also helped in overcoming the barrier of *limited collaborative governance*. The consultation with experts appeared decisive in the realisation of various measures, such as the choice of greenery with special attention to native species in case 3, 4, and 5, or the application of nature-friendly banks for amphibians

and the possible construction of a stork post in case 1. Interestingly, case 3 also had to use the ecologist for the sake of legitimacy. Where societal stakeholders did not consider the contractor a legitimate actor, the same message delivered by an ecologist did get accepted.

The importance of consulting external expert knowledge, especially in relation to ecological aspects at an early stage, was showed by all cases. Exploiting existing expert knowledge is also stressed by the *learning strategies* as elaborated on in Section 2.3, and thus this strategy suits within this theme. Though it also shows overlap with *collaborative governance strategies*, drawing attention to the interrelatedness between strategies.

### 5.2.3 Guiding frameworks

Existing schemes, programs, or frameworks can provide involved parties with guidance as a basis for decisions-making and help in anchoring practices in internal processes. This enables organisations to bring their operational and construction processes more in line with the implementation of urban NBS interventions, and thus relates to the *learning strategies theme*. In case 4, the developer is familiar with the NL Greenlabel methodology, i.e. an integral concept and tool for assessing the sustainability of outdoor space. In case 5, the involved municipality had priorly created a NBS scoring system – a policy direction consisting of a list of urban NBS measures for developers. Although neither project has (yet) formally been assessed or reviewed in accordance with the frameworks, interviewees stressed the importance of such instruments to serve as a guideline and help overcome the barrier of lacking *organizational capacities* (Int. #10; Int. #12; Int. #13).

### 5.2.4 Endorsing added value

This strategy was deployed by actors to overcome the economic barrier of a lacking *business case*. The majority of cases endorsed the added value that urban NBS interventions brought to their urban development projects. Involved actors are convinced that investments translate into higher project quality and there appeared to be sufficient organizational support to back this up. Actors communicated, internally and externally, the unique selling points nature-inclusive projects have to offer. Both interviewees from case 1 and 4 indicated willingness-to-pay of buyers, especially for a good green public area (Int. #1; Int. #10). However, interviewees also emphasised that for this strategy to be successful, it is important that a share of urban NBS interventions are visible in order to facilitate marketing and communication purposes (Int. #1; Int. #10; Int. #14).

Actors deploying this strategy emphasise the advantages of urban NBS interventions and demonstrate its yields for the company – which may partly be observed through the learning-by-doing strategy. These elements seem to relate to the theme of *showcasing strategies* described in Section 2.3.

### 5.2.5 Awareness-raising actions

Several actors have initiated activities to increase environmental awareness in order to overcome *citizen engagement* challenges and *limited collaborative governance*. In particular case 3 had proven to be very committed to this. For instance, by installing projectors at several intersections, which at night display silhouettes of animals living in the area; by using sheep herds to mow, thereby especially enthusing children; by the developer making all residents a

member of the provincial nature reserve area management organisation for one year; and this involved foundation organising informative excursions in nearby areas and recruiting residents as volunteers (Int. #7). In turn, these efforts result in initiatives by residents, such as the creation of a history and nature walk through the neighbourhood, and the installation of a wildlife camera of which the images are also shared (e.g. footage of deer in the ‘backyard’ natural area). Such practices demonstrated the ability of actors to collaborate and think outside the box, thus promoting collaborative governance approaches. Examples of awareness-raising actions from other cases were educational activities by urban farmers (case 2, Int. #6) and the promotion of social cohesion through the community greenhouse (case 1, Int. #2). The majority of involved developing firms have also stimulated residents to green their private gardens in order to contribute to the nature-inclusive neighbourhood (case 1, 2, 3 and 4). In case 2, the developer even created a book with four sample gardens to serve as inspiration. Emphasising the advantages and benefits of implementing urban NBS interventions to society fits with the *showcasing strategies* theme.

### 5.2.6 Agenda setting

Although *national policy* was hardly perceived as a barrier in the cases, various actors were found to act as ambassadors who engaged in policy agenda setting. For example from the public domain, the municipality involved in case 2 indicated having sent a letter to the national government (together with other Dutch municipalities), drawing attention to a green living environment and requesting more national leadership and financial resources to realise this (Int. #5). Actors from the private domain were also raising awareness. The developers involved in case 1 and 4 both signed a manifesto stressing the opportunities for greening urban areas to provide more space to nature (‘Manifest bouwen voor natuur’) (Int. #1; Int. #10). The authors advocate a ‘nature standard’ for new urban developments, requesting the national government to incorporate the implementation of urban NBS interventions in legislation and regulations. Raising awareness of the value that urban NBS have to offer is in line with the *showcasing strategies*.

### 5.2.7 Political pressure

A strategy that had proven helpful in overcoming the barrier of *municipal policy* was identified in case 3. Here it was demonstrated that political pressure from the municipal level facilitated the uptake of urban NBS interventions. Based on the success and reputation of the new residential building project (national awards for district with the best public space and most nature-inclusive neighbourhood), the municipal maintenance department made above-average efforts to meet the choices needed to maintain this prominent position. Whilst this strategy entailed more of an "enforced" mechanism, it overlaps with the theme of *showcasing strategies*.

### 5.2.8 Contractual safeguarding

The strategy of contractual safeguarding also seemed to fit in the theme of *showcasing strategies*. Similarly to the strategy described in the previous section, the advantages of urban NBS were rather ‘imposed’ than ‘emphasised’. Yet this was found necessary to overcome perceived *citizen engagement* barriers. In both case 1 and 2 preservation obligations for greenery were included in a legal document to ensure that residents retained the hedges planted

on property lines (Int. #2; Int. #6). Additionally, case 2 and case 4 prescribed a mandatory maximum percentage of paving in private gardens (Int. #4; Int. #11).

#### 5.2.9 Agree to deviate from the handbook

Early collaboration with the municipal maintenance department had proven helpful in the implementation of NBS interventions in public spaces. The involved developing firm in case 3 has actively engaged in dialogues to overcome *municipal policy* deemed restrictive for the implementation of urban NBS interventions. An interviewee stressed that a developer's dedication to pursuing timely and close collaborations is essential to a project's success in this regard (Int. #7). Although in case 4 this collaboration had been lacking so far, the interviewed developer acknowledged its importance and aims to improve it in current and future project sub-developments (Int. #10). From previous projects, the actor had already experienced the benefits of early collaborative governance with the municipal maintenance department in creating opportunities to deviate from the standard and avoid resistance later on in the process.

Actors found that, in dialogue with the municipality maintenance department, it could be agreed upon to deviate from the standardized municipal handbook. Interviewees in case 1, 2 and 3 highlighted existing room for manoeuvre in the municipal handbook with regard to design principles for the public area (Int. #1; Int. #5; Int. #8). In general, in the aforementioned cases, the presentation of well-reasoned argumentation about the choice for certain interventions could convince the municipal maintenance department to deviate from its restrictive policy that was perceived to hamper urban NBS uptake. For instance, in case 2, the private actors remained firm in their discussions to convince the municipality about a reduced parking norm, a smaller required distance between trees to be planted, and a deviated arrangement to allow the use permeable pavement (Int. #6). Also in case 5 parties succeeded to deviate from the standard by agreeing on a reduced parking norm as well as through the early introduction of paid parking in the area (Int. #12). In case 3, the municipal maintenance department and the developer reached an agreement to pilot the use of permeable pavement (Int. #7). Finally, case 1 managed to deviate from prescribed municipal policy for the planting of trees by installing two-sided root barriers to protect underground cables and pipes (Int. #1).

The strategy required willingness and persistence on the part of private actors and the municipal maintenance department to advocate for NBS interventions, as well as their ability to come to feasible arrangements in partnership. The strategy of actors actively seeking such governance arrangements to move away from grey infrastructure solutions is related to the theme of *collaborative governance strategies*.

#### 5.2.10 Alternative maintenance regimes

A strategy used to overcome the barriers of *limited collaborative governance* and *maintenance costs* is that of alternative maintenance regimes. As is common for certain types of residences such as flats, an association of owners (in the Netherlands known as a 'VVE') may be responsible for maintenance related to the building. In case 2, 3 and 5 it has been arranged in such a way that this entity also (partly) takes care of the surrounding greenery in the public area (Int. #6; Int. #7; Int. #14). This means residents themselves are responsible for management, which may be outsourced. This alternative maintenance regime has, for example, enabled the realisation of a wadi in case 3. Another creative approach is the inclusion of third parties, such



as an urban farm on the property in case 2 (see Figure 13). This allowed for the cultivation of vegetables and a large number of fruit-bearing trees and shrubs between the homes, creating a win-win situation in which the farmer gets to keep the harvest and sell it to in a local grocery store. Furthermore, case 3 managed to set up a partnership with a provincial nature reserve area management organisation (Het Utrechts Landschap). Through this solution, the project its heather landscape in the public area was preserved.

By deploying this strategy, actors showed their ability to come up with innovative solutions to overcome a perceived barrier. Seeking coordination of activities between different stakeholders (public and private) across disciplines allowed for multi-stakeholder partnerships to emerge, thereby relating to the theme of *collaborative governance strategies*.



Figure 13. *Alternative maintenance regimes: collaboration with urban farmers (case 2) (De Wickevoorter Stadsboeren, 2021) and nature preservation organization safeguarding the heather landscape (case 3) (Kerckebosch Zeist, n.d.)*

#### 5.2.11 Contribute to supplementary maintenance budget

When private parties and the municipal maintenance department fail to agree on a deviating arrangement for the implementation of a contested urban NBS intervention in the public area (see Section 5.2.9), its implementation can still be realised by supplementing the municipal maintenance department its budget (Int. #1; Int. #4). In fact, private development firms in case 1, 2 and 5 stated that, in advance, budget was already generated to cover any possible additional costs (Int. #1; Int. #4; Int. #14). In practice this strategy proved useful to overcome the barrier of *maintenance costs* perceived in case 2, where a financial contribution was made to the involved municipality to realise the urban NBS intervention of permeable pavement (Int. #4). The strategy of actors being prepared to free up budget fits into the theme of *financial strategies* as elaborated on in Section 2.3.3.

#### 5.2.12 Target market selection

Developers from case 1, 2 and 5 explicitly mention the strategy of target market selection to overcome the barrier of *citizen engagement*. This meant positioning the project in such a way that it appealed to a group of people that is environmentally aware and/or have affinity with living in a more natural area. In line with this approach, the developer from case 2 asked possible future residents to fill in a motivation form when registering. The strategy of actors committed to creating and communicating narratives about nature-inclusive projects that demonstrate that implementing urban NBS interventions sells, aligns with the theme of *financial strategies*.

### 5.2.13 Strategies in relation to types of urban NBS interventions

The findings provide insight into how strategies to overcome barriers to urban NBS uptake relate to certain types of interventions. Figure 14 reflects on the applicability of the strategies used in the context of new residential building projects in light of their urban NBS interventions at the scale-levels defined in Section 2.1.

The majority of the strategies were found to be applied to overcome barrier in relation to urban NBS interventions at all scale-levels (learning-by-doing; consulting external experts; guiding frameworks; endorsing added value; awareness-raising actions; agenda setting; and target market selection). A smaller fraction of strategies were deployed by actors to overcome barriers in relation to urban NBS interventions at the street-, and neighbourhood level specifically (political pressure; agree to deviate from the handbook; alternative maintenance regimes; and contribute to supplementary maintenance budget). Only the strategy of contractual safeguarding was used to overcome barriers to urban NBS interventions solely at the house-level.

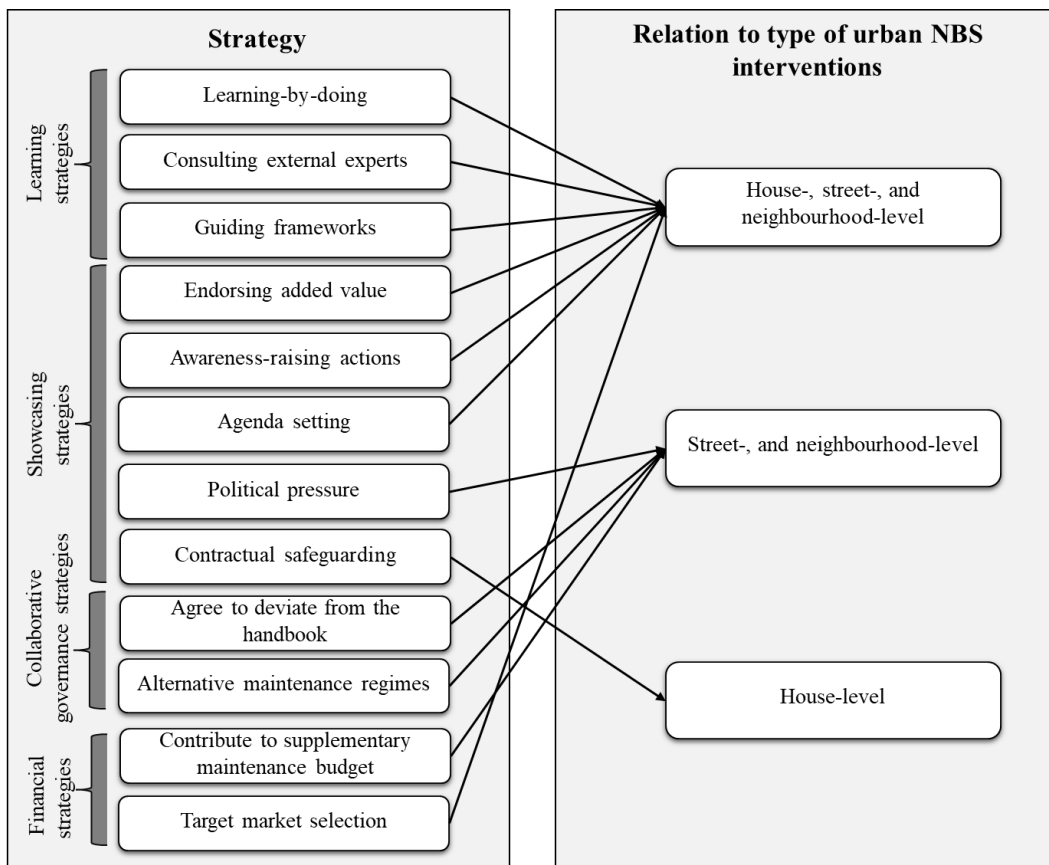


Figure 14. Relationship between strategies and types of urban NBS interventions

## 6. Discussion

The research problem addressed by this study was to fill the existing gap in literature on strategies to overcome barriers to urban NBS uptake in the context of new residential building projects in the Netherlands. The results indicate that, various knowledge, policy, economic, and engagement barriers hampered the implementation of urban NBS interventions in this specific context. However, actors involved in the realisation of new residential building projects also deployed several strategies to overcome perceived barriers. Section 6.1 reflects on these findings in the light of the theoretical framework and discusses the implications for theory and practice. Section 6.2 clarifies on the limitations of this research. The recommendations for further research are included throughout the discussion sections.

### 6.1 Reflection and implications

#### 6.1.1 Barriers to urban NBS uptake

Concerning the first sub-question, the results validate that actors implementing urban NBS interventions in projects within the geographical scope of the Netherlands perceive most of the barriers identified in previous studies by van der Jagt et al. (2020); van Haaster-de Winter et al. (2020); Dijkshoorn-Dekker et al. (2020); Dorst (2021); and Mommers et al. (2021). On the one hand, this finding supports existing literature as it suggests that further research in Dutch contexts will likely reveal a similar list of barriers. The literature may be saturated in this regard. On the other hand, this challenges existing literature by debating the role of context-specificity of barriers. Section 6.1.3 will further elaborate on the implications of this result.

Whereas previous studies lacked insight into the extent to which barriers appear in the specific context of Dutch new residential building projects, the results from this study extend current theoretical insights by adding to literature empirical findings on the frequency of which barriers were prevalent in this scope. The results suggest that the barriers *organisational capacities*, the *business case*, *maintenance costs*, and *citizen engagement challenges* are frequently perceived in the cases. However, the findings revealed that the barrier of *municipal policy* most dominantly hampered urban NBS uptake in new residential building projects in the Netherlands. To overcome this barrier, actors mainly deployed the collaborative governance strategy of ‘agreeing to deviating from the handbook’. Even though this strategy proved successful in overcoming the barrier at the project-level, the strategy fails to address the root cause of the barrier, which is the actual content of such municipal handbooks. If municipal policy remains the same and actors do not deploy any strategies to overcome this barrier, the barrier is likely to persist and resurface within projects aiming to implement urban NBS interventions at the street-, and neighbourhood-level. Public spaces will most likely continue to be designed according to standardised principles which do not appear to be conducive to urban NBS. Thus, the municipal policy barrier can be considered highly influential in terms of its hampering effects on urban NBS uptake. Future research can build on these findings and examine which aspects of municipal handbooks create the most hampering effects to the implementation of urban NBS interventions. A similar line of reasoning applies to the other frequently perceived barriers of *organisational capacities*, the *business case*, *maintenance costs*, and *citizen engagement challenges*. In exploring the underlying structural conditions that

constitute these barriers on a project-level, further research can for example draw on findings from Dorst (2021).

Thus, despite the fact that frequency does not necessarily equal impact in terms of hampering effects on urban NBS uptake, the frequency with which a particular barrier is perceived can serve as a prediction for future projects. As such, actors aiming to stimulate the uptake of urban NBS interventions can focus efforts on overcoming most urgent barriers.

Although the types of barriers perceived in the specific context of new residential building projects are generally in line with the existing literature, some findings differed from the barriers identified by previous studies. Interviewee statements related to perceiving the barriers of *demand* and *low private sector engagement* remained absent. A possible explanation for this may be the delineation of the case sample. From this, it can be inferred that all the private parties involved intentionally participated in the project developments, contradicting the idea of low private sector involvement. A similar line of thought can explain the absence of the economic barrier of lacking *demand*, as actors have deliberately chosen to realise a project with urban NBS interventions within their portfolios. Also, it should be considered that the interviewee sample influenced the identification of perceived barriers. The limitations section will further elaborate on these aspects (see Section 6.2).

Another possible explanation for the fact that *demand* and *low private sector engagement* were not perceived as barriers in the studied cases, may be that market characteristics have evolved in such a way that these factors no longer hamper urban NBS uptake. Section 3.1.3 briefly mentioned the existence of positive connotations by interviewees. In relation to the barrier of demand several of such statements were identified. For example, an interviewee from case 3 stated that the company rarely runs into any new urban development projects that have not included preconditions related to biodiversity or urban NBS specifically (Int. #9). Also, developers experienced benefits in terms of saleability (Int. #9) and the development firm in case 1 mentioned how nature-inclusive projects fit within its project portfolio by contributing to organisational objectives in line with the UN Sustainable Development Goals (Int. #1). Further research could clarify how such positive perceptions of predefined barriers relate to their hampering impacts and influences, and when these positive effects may outweigh the negative ones.

Lastly, statements about strategies to overcome the perceived barrier of lacking *evidence of NBS performance* were completely absent during all interviews, even though it was perceived to hamper urban NBS uptake in three out of the five cases. In spite of the fact that no strategies were deployed to overcome this barrier, the cases managed to implement a multitude of urban NBS interventions. This suggests that, at least in these cases, this barrier was not decisive in preventing urban NBS uptake.

### 6.1.2 Strategies to overcome barriers to urban NBS uptake

Concerning the second sub-question, the results indicate overlap between the empirical findings and the strategies described in previous studies by Kabisch et al. (2016); Egusquiza et al. (2019); van Haaster-de Winter et al. (2020); and Dijkshoorn-Dekker et al. (2020). This study thereby supports that such general strategies are relevant and applicable to overcome barriers to urban NBS uptake in the more specific context of new residential building projects.



Unlike literature, which remained rather abstract in defining strategies, this research provided a deeper understanding of practical strategies also considering which actor can deploy which strategy to overcome which specific barrier. It has done so by contextualising the strategies with real-life background information from cases tailored to a specific scope, and clarifying which strategies are suitable to which barriers (see Figure 11). The findings thereby enable actors involved in the development and realisation of new residential building projects in the Netherlands, to overcome perceived project-level barriers in the short term. To exemplify: may an actor developing a new residential building project run into the knowledge barrier of limited capacities, strategies described by previous studies would suggest exploiting existing knowledge (Kabisch et al., 2016; Dijkshoorn-Dekker et al., 2020). Based on this study, actors could now be more specifically informed that experts can be consulted for ecological knowledge specifically, guiding frameworks can be used such as NL Greenlabel or municipal scoring systems, or that just by learning-by-doing the barrier could be overcome.

Moreover, the research has filled a knowledge gap concerning the relationship between strategies and the types of urban NBS interventions they are applicable to. Drawing on Figure 14, the findings suggest that most strategies could generally be applied to overcome barriers in relation to urban NBS interventions at all scale-levels. Several strategies were found to only be deployed in relation to urban NBS interventions at the street-, and neighbourhood level because they were used to overcome the barriers of municipal policy and maintenance costs which were only relevant to the implementation of urban NBS interventions in the public area. Interestingly, the strategy of guiding frameworks was found to apply to interventions at all scale levels, whereas van der Jagt et al. (2020) had stressed such schemes to be primarily relevant for NBS interventions at the house-level. These findings have implications for the aspect of context-specificity, as will be further discussed in Section 6.1.3.

It is also interesting to explore how a strategy used to overcome a certain barrier, may also be adopted to overcome others. To illustrate, an increased use of guiding frameworks for integrating urban NBS in urban development practices, has the potential to contribute significantly to a sector-wide standardised approach and assessment for *evidence of NBS performance* (which actors seem to prefer (Dorst, 2021)). Exploring possible multifunctional uses of strategies presents an avenue for further research.

The findings also suggest that particular strategies may be more appropriate for use by particular actors. Strategies that seem to be primarily applied by private development firms in the cases regard learning-by-doing; endorsing added value; contribute to supplementary maintenance budget; target market selection; and contractual safeguarding. Another strategy deployed by a single actor was that of exerting political pressure, by an involved municipality. Some strategies appeared suitable for various actors, such as consulting external experts, guiding frameworks and agenda setting being used by involved municipalities, private development firms as well as (landscaping) architecture and urban planning companies. Other strategies seemed to lend itself better for deployment by a collaboration between various actors. For instance agreeing to deviate from the handbook which required project development managers and municipal staff to work together. Other examples are the establishment of alternative maintenance regimes and awareness-raising actions for which private development firms have to seek co-operation with societal actors such as citizens and/or third parties.

A final remark concerns that, next to interviewees describing strategies related to the barriers perceived specifically within the project in which they were involved, statements were also found to draw from previous project experiences in which they aimed to implement urban NBS interventions. It is therefore important to consider that in the cases the strategies may have been put in place by involved actors at an earliest opportunity, which may have prevented barriers from arising at the project-level in the first place. The limitations section will elaborate on this further (see Section 6.2).

As touched upon in Section 5.1, the number of perceived barriers varied per case. Case 1 perceived a relatively low number of barriers (three), especially compared to cases 3, 4 and 5 (seven). Moreover, it was the only project in which an engagement barrier did not seem to be prevalent. The characteristics of the projects (type of urban development and integrated NBS interventions) did not seem to differ much from other cases, actually quite some overlap was found with case 5. What appeared to stand out in case 1 were the numerous strategies applied (nine) in proportion to the number of barriers perceived (three). The findings in Section 5.2 showed that various strategies were already put in practice in preliminary stages by actors in case 1, such as consulting external experts to fill the knowledge gap, but also awareness-raising actions, target market selection and contractual safeguarding with regard to the theme of engagement barrier. To illustrate how this differed from the other projects: in case 2, 3, 4 and 5, virtually all deployed strategies focused on overcoming barriers that were already perceived in the projects. This shows the majority of actors in these cases adopting a reactive approach rather than a proactive one. The only exceptions are actors from case 2 and case 4 putting effort into agenda-setting, despite the fact that *national policy* did not appear to exert hampering effects on urban NBS uptake in these studied cases specifically.

### 6.1.3 Context-sensitivity

The starting point of this study was to account for the context-specificity of barriers and the strategies used to overcome them as emphasized in the literature. However, the identified barriers for the broad national context of the Netherlands appeared to be largely consistent with the barriers identified in the specific context of various Dutch new residential building projects. Thus, the barriers perceived in this scope did not turn out to be as context-specific as was suggested. Further research is needed to examine whether the same applies to other contexts in the Netherlands.

Similarly, the strategies identified from broad context with varying types of interventions, appeared show overlap with the strategies identified in the specific context of new residential building projects. Thus, also the used strategies did not turn out to be as context-specific as was emphasised by literature. Further research could explore to what extent the strategies identified by this research, could also be used in other contexts. It is interesting to study this in terms of the both the geographical scope and project types. For example, are the strategies generalisable to e.g. overcoming barriers in new residential building projects in Germany, or in developments of business parks in the Netherlands.

## 6.2 Limitations

It is important to consider the main limitations of this study. First, the selected sample of the five new residential building projects can be discussed. The researcher aimed for transparency

by drawing up case selection criteria, but the choice of cases was influenced by the availability of information through desk research, and the attitude of the approached actors towards participating in the research. Should the case study protocol be repeated, other cases may be considered more suitable. Furthermore, by limiting the case sample to projects that successfully implemented urban NBS interventions may have excluded the perception of barriers. Actors involved in ‘unsuccessful’ nature-inclusive projects – those that attempted but failed to integrate urban NBS interventions – may have perceived barriers that were not present in the cases studied. This was beyond the scope of this research, but it is suggested for future research to evaluate such other cases as well.

The case sample affects the generalisability of study results. Future studies could explore the applicability of the findings in differing contexts to better understand its implications. This is relevant for both different types of nature-inclusive projects within the Netherlands (e.g. business parks, commercial centres, and community initiatives that may differ in applied types of NBS interventions), as for new residential projects in other geographical contexts (e.g. other European cities to which different policies apply).

Second, the sample of interviewees had a significant influence on the collected data. Aimed at including relevant parties, but also looking from different perspectives, the research mainly involved municipalities, private development firms, and landscape architecture and urban planning companies. However, conducting more interviews with stakeholders such as involved ecologists, third party contracting firms, housing corporations, NGOs or civil society actors etc. would provide a more comprehensive reflection of the stakeholder landscape.

Third, possibly researcher's bias exists in the process of data collection and interpretation of results. Interviewer's expectations or opinions may have interfered with the objectivity of the interview questions and analysis – which entails the primary data source in this qualitative study. Since all interviews were conducted in the Dutch language, certain nuances may be lost in the translation of the data into this written report.

## 7. Conclusion

To arrive at an answer to the main research question, two sub-questions were drafted. This section answers each question in summary.

### **SQ1: To what extent are the identified barriers to urban NBS uptake in the Netherlands, perceived in the context of Dutch new residential building projects?**

Actors involved in the development and realisation of Dutch new residential building projects perceive the majority of barriers as identified by previous studies for the geographical scope of the Netherlands. The empirical findings from the multiple case study revealed that – except for lacking demand and low private sector engagement – all identified barriers were perceived to hamper urban NBS uptake by at least one case in the context of new residential building projects.

This study did, however, reveal that certain barriers were perceived more frequently than others. This enables prediction of the barriers that should be considered for future projects in a similar context. Actors implementing urban NBS interventions in Dutch new residential building projects are expected to perceive hampering effects from municipal policy, in particular a restrictive municipal handbook. In addition, limited organisational capacities to work with NBS, a lacking business case, issues with (expected) maintenance costs, and citizen engagement challenges are expected to be dominant barriers to urban NBS uptake.

### **SQ2: How do the strategies used to overcome barriers to urban NBS uptake, relate to types of urban NBS interventions implemented in the context of new residential building projects?**

The research identified that actors involved in the cases pursued 12 distinct strategies to overcome the perceived barriers in Dutch new residential building projects. Although these strategies relate to the four themes of strategies derived from literature from broader contexts, the strategies presented in this study are more concrete rather than abstract. Moreover, drawing from the empirical findings, the research linked each strategy to a particular barrier, providing insight into the relationships between them.

Furthermore, the relationship between strategies and types of urban NBS interventions was clarified. Most strategies appeared to be applicable to overcoming barriers at all scale-levels, though some used in relation to more specific types of urban NBS interventions. The strategy of contractual safeguarding was used to overcome citizen engagement challenges concerning NBS interventions at the house-level. Strategies deployed to overcome restrictive municipal policy or expected higher maintenance costs were only found relevant with regard to the street-, and neighbourhood level.

### **RQ: How are barriers to urban nature-based solutions uptake overcome in new residential building projects in the Netherlands?**

The previous sub-questions revealed the frequency with which barriers were perceived in the specific context of Dutch new residential building projects, how strategies were used to overcome them, and how they relate to the types of urban NBS interventions implemented. The findings show that involved municipalities, private development firms, and (landscaping)

architects actors make use of learning-, showcasing-, collaborative governance-, and financial-strategies to overcome knowledge-, policy-, economic-, and engagement-related barriers to urban NBS uptake.

The findings from this study can help actors overcome barriers in the context of new residential building projects in the Netherlands. To illustrate: municipal policy is considered the most frequently perceived barrier to the implementation of urban NBS interventions at the street- and neighbourhood-level. According to the cases studied, this barrier can be overcome if the involved municipality and the private development firm agree to deviate from the municipal handbook in collaboration.

The research presented strategies in such a way that they can serve as best practices for actors working on projects in similar contexts now or in the near future. The researcher recommends actors to learn from the past cases studied by being aware of the dominant barriers and deploying the strategies proven successful in the cases as early as possible. In this regard, Figure 11 may serve as guidance for overcoming barriers to urban NBS uptake in the specific scope of new residential building projects in the Netherlands. However, as the results of the research challenge context-specificity, the findings may also be suited for use by actors who perceive similar barriers when implementing urban NBS interventions in different geographical contexts (e.g. other European cities) or in different type of projects in which urban NBS interventions are implemented at the house-, street-, or neighbourhood scale levels (e.g. designing the public area of a business park).

While overcoming barriers to urban NBS uptake provides a short-term solution to fostering the implementation of urban NBS interventions, a barrier's root causes need to be addressed before it can be resolved. This research has revealed the most prevalent barriers in new residential building projects, allowing policy-makers, for example, to focus their efforts on addressing the most urgent barriers. Whereas current efforts to overcome barriers in, for example, the policy theme are currently more focused on national policy (e.g. the public-private manifesto or the resolution by political parties calling for national legislation), the findings of this study point to the importance of addressing municipal policy.

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## Appendix A – The Urban Nature Atlas database

Categorization of types of urban NBS interventions based on Almassy et al. (2018):

Categories	Types of NBS interventions
<b>Parks and semi-natural green areas</b>	<ul style="list-style-type: none"> <li>▪ Large urban park or forest</li> <li>▪ Pocket parks/neighbourhood green spaces</li> <li>▪ Botanical garden</li> <li>▪ Green corridor</li> <li>▪ Other</li> </ul>
<b>Urban green space connected to grey infrastructure</b>	<ul style="list-style-type: none"> <li>▪ Alley and street trees/hedges/greens</li> <li>▪ Railroad bank and tracks</li> <li>▪ House gardens</li> <li>▪ Green playground/school grounds</li> <li>▪ Institutional green space</li> <li>▪ Green parking lots</li> <li>▪ Riverbank greens</li> <li>▪ Other</li> </ul>
<b>Blue areas</b>	<ul style="list-style-type: none"> <li>▪ Lake/pond</li> <li>▪ River/stream/canal/estuary</li> <li>▪ Delta</li> <li>▪ Sea coast</li> <li>▪ Wetland/bog/fen/marsh</li> <li>▪ Other</li> </ul>
<b>Allotments and community gardens</b>	<ul style="list-style-type: none"> <li>▪ Allotments</li> <li>▪ Community gardens</li> <li>▪ Horticulture</li> <li>▪ Other</li> </ul>
<b>External building greens</b>	<ul style="list-style-type: none"> <li>▪ Green roofs</li> <li>▪ Green walls or facades</li> <li>▪ Balcony green</li> <li>▪ Other</li> </ul>
<b>Green areas for water management</b>	<ul style="list-style-type: none"> <li>▪ Rain gardens</li> <li>▪ Swales/filter strips</li> <li>▪ Sustainable urban drainage systems</li> <li>▪ Other</li> </ul>
<b>Derelict areas</b>	<ul style="list-style-type: none"> <li>▪ Abandoned and derelict spaces with growth of wilderness or green features</li> <li>▪ Other</li> </ul>
<b>Green indoor areas</b>	<ul style="list-style-type: none"> <li>▪ Indoor vertical greeneries (walls and ceilings)</li> <li>▪ Atrium</li> <li>▪ Other</li> </ul>

## Appendix B – Overview of identified barriers to urban NBS uptake in the Netherlands

Complete overview of identified barriers to urban NBS uptake in the Netherlands:

Paper	Identified barriers
van der Jagt et al. (2020)	<ol style="list-style-type: none"> <li>1. Lacking integration into high-priority policy plans</li> <li>2. Lacking ‘hard’ evidence on NBS benefits</li> <li>3. Perceived high maintenance costs</li> <li>4. Lacking demand in investment portfolios</li> </ol>
van Haaster-de Winter et al. (2020)	<ol style="list-style-type: none"> <li>5. It is still in its infancy, it is too uncertain for me</li> <li>6. The technology/technique is underdeveloped</li> <li>7. Not in line with company operational processes</li> <li>8. Limited knowledge within the organisation</li> <li>9. Insufficient company support</li> <li>10. Complicated municipal regulations and procedures</li> <li>11. Unacceptable return-risk ratio</li> <li>12. Not necessary to maintain or expand market position</li> <li>13. Low customer/buyer willingness-to-pay</li> <li>14. Greenery maintenance and management problems</li> </ol>
Dijkshoorn-Dekker et al. (2020)	<ol style="list-style-type: none"> <li>15. Uncertainty about affordability and risks</li> <li>16. Uncertainty about revenue models and financial frameworks</li> <li>17. Limited own and general knowledge about nature-inclusive construction</li> <li>18. Strict municipality regulations</li> <li>19. Expectations about (additional) costs of investments and maintenance</li> </ol>
Dorst (2021)	<ol style="list-style-type: none"> <li>20. Silos in policy-making, budgets and development processes</li> <li>21. Knowledge, data and awareness challenges</li> <li>22. Low private sector engagement</li> <li>23. Competition over urban space</li> <li>24. Insufficient policy implementation</li> <li>25. Insufficient public resources for maintenance</li> <li>26. Citizen engagement challenges</li> </ol>
Mommers et al. (2021)	<ol style="list-style-type: none"> <li>27. Limited ecological knowledge</li> <li>28. Insufficient knowledge about effectiveness</li> <li>29. Limited knowledge about anchoring in construction and policy processes</li> <li>30. Lower priority than competing other sustainability policy objectives</li> <li>31. Time and money spend in the preliminary process to consult with (decentral) governments and identify local policy frameworks</li> <li>32. Financial bottlenecks for developing or construction companies</li> </ol>

## Appendix C – Overview of identified strategies to overcome barriers to urban NBS uptake

Complete overview of identified strategies to overcome barriers to urban NBS uptake:

<b>Paper</b>	<b>Identified strategies</b>
Kabisch et al. (2016)	1. Valorising and exploiting existing tacit and expert knowledge 2. Establishing and practicing collaborative governance approaches
Egusquiza et al. (2019)	3. Deploy collaborative, multisector, polycentric and adaptive governance models
van Haaster-de Winter et al. (2020)	4. Emphasising the advantages 5. Demonstrate the yields 6. Spreading knowledge
Dijkshoorn-Dekker et al. (2020)	7. Raising awareness of the value 8. Demonstrate existing consumer demand 9. Share and draw on existing knowledge 10. Pursue a shared ambition 11. Creative thinking to find new solutions 12. Willingness to bear risks 13. Developing a common language



## Appendix D – Expert panel

Two sparring partners from BirdLife Netherlands (Vogelbescherming Nederland):

Name	Job title
Stefan Vreugdenhil	Team manager urban nature
Femke Jochems*	Policy officer urban nature

*\*Former employee*

## Appendix E – Interview guide

Interview guide (in Dutch):

### **Introductie**

*Voor mijn masterscriptie aan de opleiding Sustainable Business & Innovation aan de Universiteit Utrecht voer ik in samenwerking met Vogelbescherming Nederland een onderzoek uit naar natuur-inclusief bouwen. Welke barrières hebben succesvolle natuur-inclusieve projecten ervaren en hoe zijn deze overwonnen? Het doel van het onderzoek is middels best-practices bij te dragen aan de ontwikkeling van natuur-inclusieve nieuwe woningbouwprojecten in Nederland.*

*Middels dit semi-gestructureerde interview doel ik erop informatie te verkrijgen over door u ervaren barrières tijdens de ontwikkeling/realisatie van [project], en inzicht te krijgen in hoe deze door u of in samenwerking met andere partijen zijn overwonnen. Ik zal starten met een aantal vragen omtrent het project en uw rol/die van de organisatie hierin, om vervolgens dieper in te gaan op ervaren barrières en toegepaste strategieën deze te overwinnen.*

*[\*toestemming opnemen interview t.b.v. verslaglegging]*

### **Interviewvragen**

<b><u>Achtergrond – Algemeen</u></b>
1. Wat verstaat u onder natuur-inclusief bouwen?
<b><u>Achtergrond – Project, rol organisatie en geïnterviewde</u></b>
2. Kunt u de project details toelichten? a. Jaartallen/projectfases b. Betrokken partijen (opdrachtgever(s), ontwikkelaar(s), gemeente, architect(en), derden etc.) c. Projecttype (gebiedscontext, aantal en type woningen etc.) d. Toegepaste natuur-inclusieve maatregelen
3. Hoe is [organisatie] betrokken bij [project]?
4. Vanuit welke rol bent u betrokken?
5. Wanneer/sinds welke fase bent u betrokken bij het project? (initiatief, (plan)ontwikkeling, uitvoering etc.)
<b><u>Ervaren barrières</u></b>
6. Welke barrières tot natuur-inclusief bouwen heeft u ervaren/ervaart u binnen [project]?
<b><u>Overwinnen van barrières</u></b>
7. Welke barrières zijn overwonnen?
8. Hoe zijn deze overwonnen? Met behulp van welke strategieën?
<b><u>Afronding</u></b>
9. Wat vindt u dat moet gebeuren om natuur-inclusief bouwen tot de standaard te verheffen?
10. Zijn er nog dingen die niet aan bod kwamen en die u graag nog kwijt zou willen?

*Hartelijk dank voor uw bijdrage aan het onderzoek.*

*\*Terugkoppeling interviewverslag ter akkoord*

*\*Delen onderzoeksresultaten na afronding onderzoek*

## Appendix F – Interviewees

Per case overview of interviewees, related organisation and role:

Case	Interviewee	Organisation	Role in project	Interviewee function
<b>Case 1: Tuinbuurt Vrijlandt</b>	Int. #1	Ballast Nedam Development	Private development firm	Project development manager
	Int. #2	Gemeente Rotterdam	Commissioning party, involved municipality	District developer
	Int. #3	Karres en Brands	Landscape architecture and urban planning company	Urban planner
<b>Case 2: Wickevoort</b>	Int. #4	AM	Private development firm	Project development manager
	Int. #5	Gemeente Haarlemmermeer	Involved municipality	Landscape architect
	Int. #6	LANDLAB landscape architects	Landscape architecture firm	Landscape architect
<b>Case 3: Kerckebosch</b>	Int. #7	Wijkontwikkelings- maatschappij	Commissioning party	Project development manager
	Int. #8	Gemeente Zeist	Commissioning party, involved municipality	Advisor public area management
	Int. #9	wUrck	(landscape) architecture and urban planning firm	Urban planner
<b>Case 4: Westergouwe</b>	Int. #10	VOF Westergouwe (Heijmans Vastgoed)	Commissioning party, private development firm	Project development manager
	Int. #11	KuiperCompagnons	Spatial planning and architecture firm	Urban planner
<b>Case 5: Erasmusveld Midden</b>	Int. #12	Ontwikkelings- combinatie Wateringse Veld	Commissioning party	Project manager
	Int. #13	Gemeente Den Haag	Commissioning party, involved municipality	Project manager
	Int. #14	BPD	Commissioning party, private development firm	Project development manager

# Appendix G – Coding scheme

Schematic overview of coding process including an example:

