

CLIMATE ADAPTATION IN URBAN AREAS

What motivates property owners to implement green infrastructure?



Master Thesis
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Preface

In front of you lies my master thesis 'Climate adaptation in urban areas – What motivates property owners to implement green infrastructure?'. This report describes the research that I performed as the final part of the master Civil Engineering and Management at the University of Twente. The research was done in collaboration with Witteveen+Bos.

In the past few months, I have been working on this research. It was the first time to perform such a large assignment individually. I was able to apply my acquired knowledge and skills, but also learned a lot during the whole process. It was fun and challenging at the same time. In addition, I had the opportunity to experience the practical side of civil engineering at Witteveen+Bos.

I want to thank my graduation committee for their help and feedback during this research. First, I want to thank Joanne for her feedback and support as a daily supervisor. Our biweekly meetings always gave me new insights and offered the right tools to continue with the research. I also want to thank Leentje for sharing her expertise and providing useful feedback when needed. Lastly, I want to thank Donald and Edwin for their feedback from a more practical point of view, and the invitation to participate in the project of Zandvoort Nieuw Noord when possible. I for example got the opportunity to attend an information afternoon for citizens.

I also want to thank the stakeholders for their contribution to this research. First, I want to thank the citizens of Zandvoort Nieuw Noord who participated in the door-to-door interviews. They often spontaneously invited me into their homes, even when they were working from home or having a Friday afternoon drink. Further, I want to thank the employees of the housing corporation for their participation in the interviews. Their interest in the research and flexibility for an appointment created a very pleasant cooperation.

With the completion of this master thesis, my years as a student come to an end. It all started with the bachelor of Biomedical Engineering, but I am happy to have found my real interest and passion in the domain of Civil Engineering. I am grateful to look back on some incredible years as a student in Enschede. Next to my studies, I was able to spend a large part of my spare time participating in several committees and a part-time board. I want to thank everyone who has been part of these amazing years. Finally, I want to thank my friends and family for their trust and support during this period.

I hope you enjoy reading this report en maybe even get inspired to implement green infrastructure in your own private space.

Dian van der Deure
March 2023, Utrecht

Summary

The negative impacts of climate change lead to one of the largest challenges which the world is currently facing. Especially urban areas are vulnerable to the effects of climate change. To deal with these effects, urban areas need to become climate adaptive. One of the measures for climate adaptation is the implementation of green infrastructure. That means more greenery (e.g. trees, shrubs, green roofs) needs to be planted in the urban area. Municipalities have a large responsibility for the implementation of green infrastructure. Within these practices, they are highly dependent on the private sector, because a large part of an urban area is owned by private actors. However, currently, the private sector is insufficiently involved. Municipalities face challenges on how to improve private sector engagement. Therefore, more insights into the motivations of the private sector are needed to know how they can participate or be involved.

In literature, stakeholder participation in climate adaptation (including green infrastructure implementation) is already a topic of discussion. Various studies look into motivations and barriers, and some suggest how private sector involvement can be improved. However, some aspects of this topic are still being undiscussed. First, current research mainly focuses on the private sector or citizens in general and does not distinguish different types of stakeholders. Second, they discuss motivations and drivers only in general terms. The perceived value of climate adaptation remains unclear. This research states that insights into the values of different types of private actors can help to better understand their motivations. Subsequently, these insights can help to better involve them in green infrastructure practices. Therefore, this research focusses on two types of property owners: house owners and housing corporations.

Based on the practical problem and scientific relevance, the research question is: *What types of values motivate house owners and housing corporations to implement green infrastructure in privately owned urban areas?*

Two theoretical concepts are important for this research, green infrastructure and values, which can be combined into a conceptual framework. To start, the definition for green infrastructure is 'a network of natural and semi-natural areas, including both green and blue spaces, in urban areas to deliver multiple values to urban communities'. Green infrastructure is known for its wide variety of benefits, which can be categorised into climate adaptation, environment, health and wellbeing, social, and economic. Further, some potential motivators and demotivators for green infrastructure implementation can be listed, based on previous findings. A motivator can for example be interest in gardening and a demotivator can be financial constraints. Secondly, six different types of values can be distinguished: use value, ecological value, exchange value, economic value, professional value, and social value. Each type of value has a theoretical definition and a working definition. The conceptual framework links the benefits, motivators, and demotivators of green infrastructure to the different value types. This forms the theoretical base for this research.

A neighbourhood in Zandvoort (Netherlands) functions as a case for the data collection. Interviews were performed with house owners and the housing corporation, located in this urban area. These interviews were used to investigate what their (de)motivations are for the implementation of green infrastructure. The main part of the interview consisted of statements about benefits, motivators, and demotivators. Each statement was linked to one of the six value types. Respondents were asked whether the topic of a statement plays a role in their decision to implement green infrastructure in private space. The interviews were recorded, transcribed, and analysed.

In total, 29 house owners were interviewed. 26 of them are interested in green in their garden and 3 are not. The main motivation is based on use value (aesthetic, pleasure/comfort) and for some house owners also use value (health) and ecological value are a motivation. Exchange value, economic value, professional value, and social value do not play a role in the consideration of house owners. Lastly, there are only limited values that influence the demotivation of house owners. One that does play a small role is use value (physical hindrance, time). Additional explanations that were given by the house owners, provided extra insights. For example, it demonstrated their lack of awareness of climate change impacts.

Three employees of the housing corporation participated in the interviews. Green infrastructure is not the main priority for the housing corporation, however, they are working on improvements. A Green team has been created, which investigates potential sustainable projects for the housing corporation. The answers by the three respondents varied for many topics, which made it complex to abstract clear results. Overall, the motivations of the housing corporation are based on use value (aesthetic, pleasure/comfort, health), ecological value and professional value. The latter plays a role in the demotivation as well, together with economic value. Further, use value (physical hindrance, time), exchange value, and social value play no, or a limited role in the decisions on green infrastructure. Lastly, the housing corporation is interested in cooperation with the municipality and renters, because it makes green infrastructure implementation less complex and financially more attractive.

A comparison of the values demonstrates that there are similarities as well as differences between the two types of property owners. One of the surprising insights is the unimportance of economic and social value for house owners. This is in contrast with previous findings and contradicts the current financial support that is provided by several municipalities. Further, a lack of knowledge was observed for the majority of the property owners. This lack of knowledge is (consciously and unconsciously) of large influence on their decisions to (not) implement green infrastructure.

Based on the characteristics of the neighbourhood, the case is comparable with other urban areas in the Netherlands. Further, the interest in green is comparable with the average interest of Dutch citizens, although the respondents of this research were slightly more positive. In the research, only two types of stakeholders are included, while an urban area can include several types of stakeholders. Therefore, it is recommended to include a broad variety of property owners in future studies.

Based on the findings of the case study, municipalities are recommended to involve different types of stakeholders in different ways. The following five recommendations are therefore dedicated to house owners or the housing corporation specifically. First, it is recommended to not have a main focus on financial support for house owners. Third, house owners should be informed about the effects of climate change and possible solutions. Fourth, it is recommended to create social cohesion in order to benefit from its potential positive effect on green infrastructure implementation. Fifth, it is recommended to provide financial support for the housing corporation. Sixth and last, cooperation with the housing corporation should be promoted and enhanced.

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1 Introduction

1.1 Problem context

1.1.1 Climate adaptation

It is commonly known that climate change is one of the largest problems the world is currently facing. The recent report by the IPCC (2022) indicated the urgency of these problems again. The negative impacts of climate change are affecting the climate system, environmental system, and society (EEA, 2017). Considering the effects on the climate and environmental system, a distinction can be made between direct and indirect impacts (da Silva et al., 2012). Direct impacts are for example extreme weather events like heat waves, and indirect impacts happen gradually over time, like an increase in mean annual temperature. These types of impacts are also expected in Europe and some are already noticeable (EEA, 2017).

Especially urban areas are vulnerable to the effects of climate change. An urban area is an area with a high population density and many infrastructure systems. It can be considered as a complex system, composed of different networks (Meerow et al., 2016). Because these networks are interconnected and include closely linked sectors and activities, an urban area is more vulnerable to the effects of climate change (Kim & Lim, 2016). Moreover, urban areas currently face challenges like rapid urbanisation and economic cycles, and climate change is an extra challenge added to that (da Silva et al., 2012). A practical, recent example of climate change impacts and the large consequences for urban areas, is the floods in Limburg (Netherlands) in July 2021 (Van Heeringen et al., 2022).

To limit or prevent the negative effects of climate change, it is important to make urban areas more resilient. Urban resilience is “the ability of an urban system (...) to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity” (Meerow et al., 2016, p.45). Thus, when an urban area is resilient, it can better cope with the effects of climate change. Climate adaptation is an important way to improve urban resilience. As the term suggests, climate adaptation is about adapting or adjusting to the climate and the changes thereof. It is a way to respond to the effects of climate change (EEA, 2013).

Climate adaptation measures can be categorised into three types: grey, soft, and green actions (EEA, 2013). Grey actions focus on engineering and technical solutions, soft actions are about management, policy or legal approaches, and green actions are ecosystem-based solutions that use the services of nature. The climate adaptation measure that is the focus of this research, is a specific type of green adaptation action: green infrastructure. According to the European Environment Agency (2013), green adaptation actions are specified as green infrastructure when it is “integrated into a spatially organised plan” (p.15). The definition of green infrastructure used in this research is as follows: a network of natural and semi-natural areas, including both green and blue spaces, in urban areas to deliver multiple environmental, social and economic values to urban communities (European Commission, 2013; Naumann et al., 2011; Pitman et al., 2015). More detailed information on green infrastructure and its definition will be provided in Section 2.1.

1.1.2 Responsibility of municipalities

Sustainability has been adopted in various policy documents in the past years. The most well-known document is the Paris Climate Agreement in which 196 countries agreed to limit global warming by 1,5 degrees Celsius (UNFCCC, 2015). In the Netherlands, the Dutch government formulated a National Climate Agreement in order to reach these climate goals (Ministerie van EZK, 2019). The document contains agreements with authorities, companies and social organisations in five sectors, of which one is the built environment. The aim of the agreement is to reduce green house gasses, and therefore climate adaptation and green infrastructure are not included. The main focus is on preventing climate change, not dealing with the effects of climate change.

However, adapting to climate change is an important element in other Dutch policies. A program has been set up that aims to prevent damage caused by heat, water, draught, and floods as much as

possible. This program is called the National Delta Programme (Ministerie van IenW et al., 2021). One of the three main themes in this program is spatial adaptation, which includes climate adaptation in urban areas. It is stated that authorities at different levels (local, regional, national, water) together with private parties are responsible. One of the results of the National Delta Programme is a document that presents an approach on how the built environment in the Netherlands can become greener and climate resilient (Ministerie van IenW et al., 2022). In this document, it is stated that the success of climate adaptation is dependent on the implementation at a local level. That means the municipality as a local authority, plays an important role. Also financially, Dutch municipalities have a major task in climate adaptation practices (Raad voor het Openbaar Bestuur, 2021).

So, the municipality is a key player in the climate adaptation strategy, and thus for the implementation of green infrastructure at a local level (urban area). However, these municipalities are highly dependent on the private sector (Klein et al., 2017). The majority of the buildings (and their surroundings) in an urban area is property of the private sector (Mees, 2014). So, a large part of the measures needs to be implemented by companies, residents and social organisations (Raad voor het Openbaar Bestuur, 2021). Moreover, because an urban area is a system that includes a public and private component, both are needed for a transition within the system (Bijsterveldt et al., 2021).

In the Netherlands, there are various actions and initiatives to motivate private actors. For example, there is an event (NK Tegelwippen, 2022) as well as an organisation (Stobbelaar et al., 2021) to promote replacing tiles by greenery. Further, there is an initiative that connects different housing corporations and provides information on ways to implement green infrastructure as a housing corporation (Groene Huisvesters, 2022). Municipalities benefit from these initiatives, and in some cases cooperate or participate in projects. Also, municipalities initiate separate projects to motivate private actors. For example, they provide subsidies (e.g. for the installation of a green roof) in order to make adaptation measures financially more attractive for private actors.

1.2 State of the art

Climate adaptation action and the implementation of green infrastructure are discussed by various scholars. Stakeholder participation is an important element within this topic and is increasingly recognised. The presence of this topic in literature can be illustrated by the 142 papers that are included in a literature review by Ferreira et al. (2020), about stakeholders' engagement in nature-based solutions. Other relevant studies are the work by Dorst et al. (2022) Klein et al. (2018) Wamsler (2016). Dorst et al. (2022) identify barriers for nature-based solutions, which include low private sector engagement and citizen engagement challenges. Klein et al. (2018) studied the role of private sector and citizens in urban climate change adaptation, and Wamsler (2016) focussed on the relation between adaptation by the public sector and private adaptation. A similarity between these studies about stakeholder participation is their focus on urban areas. A difference is the adaptation measures that are included. Most studies include climate adaptation in general, while some focus on, for example, nature-based solutions. Another difference is the type of private actors that are included. This can for example be the private sector in general, or a focus on citizens.

It was observed that the main focus is on the public sector and that the private sector is insufficiently involved in practice (Dorst et al., 2022; Klein et al., 2018). Involvement of the private sector refers to the individual measure that private actors (e.g. citizens, private businesses) take. A lack of involvement of the private sector will lead to fewer climate adaptation actions and thus limits the achievement of climate adaptation goals. Therefore, studies investigate ways to improve private sector involvement in practice. Wamsler (2016) for example lists drivers that can enhance individual adaptation actions, including an increased awareness of climate impacts and financial incentives. Also Ferreira et al. (2020) provide a list of drivers and motivations for stakeholder involvement. Further, Wamsler et al. (2020) state that nature related issues tend to improve engagement more than climate adaptation. These types of motivations suggest that not only climate adaptation can motivate, however, also other aspects. That observation will be further explored in this research.

Studies about the private sector and climate adaptation often refer to drivers and motivations. These drivers and motivations are discussed in general terms. What the perceived value of climate adaptation is for these stakeholders, remains unclear. Insights into these values can help to better understand stakeholders' views and perspectives. Understanding and analysing values is a common concept in the management and organisation literature (Lepak et al., 2007), while in literature about climate adaptation, values are limitedly discussed.

Four studies on climate adaptation that include values in some way, were found. First, Brink and Wamsler (2019) analyse the role of economic, ecological, and social values in citizen engagement for climate adaptation. They link each value to motivational factors (e.g. link between economic value and low cost). However, it is only a small part of the study. Second, Bouman and Steg (2022) consider basic human values as motivation and demotivation for climate adaptation. In that research, the concept of values remains general and no specific value types are formulated. Third, a recent study by ten Brinke et al. (2022) includes public values (exchange value and professional value) in the discussion on climate adaptation by private developers and investors.

To conclude, the involvement of the private sector in climate adaptation practices is lacking behind. Scholars start to investigate how this involvement can be improved. Current studies refer mainly to drivers and motivations of stakeholders, while the perceived value is unknown. Some papers do look into value, however, it is not the main focus. Therefore, this research will further explore the private sector involvement by focusing on values.

1.3 Problem statement

As follows from the problem context, municipalities are key players in the implementation of green infrastructure. In addition, municipalities in the Netherlands committed to create a 'climate resilient and water robust Netherlands' (VNG, 2021), as part of the Dutch Delta Programme Spatial Adaptation (Deltaprogramma, 2022). For these climate adaptation practices, they are highly dependent on the private sector. Unless the various initiatives and projects, it is complex and challenging to involve and motivate the private actors (Baack & Vinke-de Kruijf, 2022; Bijsterveldt et al., 2021; Holstein, 2011; Kreemers et al., 2020). In order to improve participation, it is useful to identify what private actors find important and what can motivate them to implement green infrastructure.

Also in scientific literature, the motivation of private actors is an urgent topic. Various studies discuss the participation of stakeholders in climate adaptation and try to get insights into the motivations of private actors. However, more research is needed to better understand the motivations of private actors. Based on the state of the art, two scientific research gaps can be identified. First, studies about motivations for climate adaptation do not include a perspective on values, while these can provide useful insights. Second, private actors are discussed in a general way and no detailed distinction between different types of actors is made. Authors only distinguish public and private actors, and sometimes citizens. However, it is expected that different actors will have different motivations.

1.4 Research objective and questions

The objective of this research is to provide recommendations for municipalities on how to motivate different types of stakeholders to implement green infrastructure in private space. The focus will be on a specific type of private actors, namely the property owners. A distinction will be made between two different types of property owners: house owners and housing corporations. This research aims to identify the values that motivate these property owners. The underlying aim is to include also private space in urban green infrastructure planning. Implementing green infrastructure in both public and private space will help to achieve climate adaptation goals.

Based on the research objective, the main research question is:

What types of values motivate house owners and housing corporations to implement green infrastructure in privately owned urban areas?

The corresponding sub-research questions are:

- 1) How can values and the motivations for the implementation of green infrastructure from literature, be conceptualized?
- 2) What types of values motivate house owners and housing corporations from the case, to implement green infrastructure, and how do the values of property owners compare?
- 3) Considering the types of values that can motivate house owners and housing corporations, how can the municipalities best motivate and involve these property owners?

1.5 Scope

In this research, the focus is on green infrastructure as a climate adaptation measure, so other measures for climate adaptation are not included. Related to the extreme weather events, only the situation of the Netherlands is considered in this study. The neighbourhood Zandvoort Nieuw Noord, located in Zandvoort (Netherlands), will be used as a case for the data collection. This neighbourhood is part of a project at the consultancy and engineering firm Witteveen+Bos. The project is about implementing more green infrastructure in a neighbourhood in Zandvoort. A large part of the urban area is owned by private actors. More detailed information about the case will be provided in Section 3.2.

Two types of property owners are selected for this research: house owners and housing corporations. These property owners own a major part of an urban area, which is also applicable to the case. All other property owners are excluded. Only green infrastructure measures that are possible at the property of house owners and housing corporations, are considered for this research (more information on specific green infrastructure measures will be given in Section 2.1.1).

1.6 Report structure

This first chapter introduced the topic of this research by discussing the practical and scientific relevance, formulating the research objective, and defining the scope of the study. Chapter 2 will explain and define the theoretical concepts that are relevant to this research: values, green infrastructure, and stakeholder motivations. In addition, a conceptual framework that combines the theoretical concepts will be presented. Chapter 3 will discuss the methodology and includes an introduction to the case. This is followed by an analysis of the case study results in Chapter 4. In Chapter 5, these results will be discussed. Finally, Chapter 6 will present the conclusion for this research and provide recommendations for the municipality. An overview of the key steps in this research is given in Figure 1.

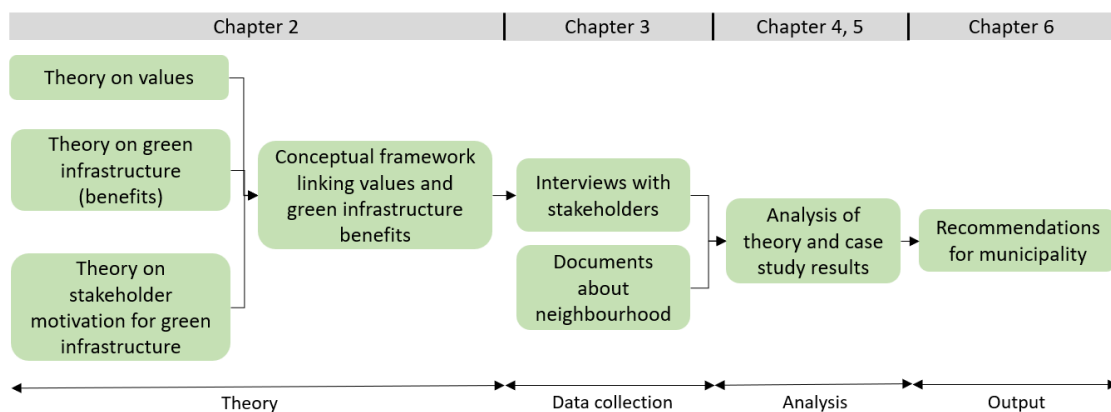


Figure 1 Research overview

2 Theory

2.1 Green infrastructure

2.1.1 What is green infrastructure?

In literature, the concept of green infrastructure is discussed across different disciplines and studied from different perspectives. Examples of perspectives are greenspace planning, urban ecology, and water/stormwater management (Matsler et al., 2021). As a result, there are various definitions for green infrastructure. Also the scale level (local, regional, national and EU) can have an effect on the understanding and definition of green infrastructure (Naumann et al., 2011). A clear definition of green infrastructure is important because it can prevent misunderstandings and problems in the implementation or integration (Matsler et al., 2021).

The definition of green infrastructure for this research is: A network of natural and semi-natural areas, including both green and blue spaces, in urban areas to deliver multiple values to urban communities. This formulation is based on the definition in three different sources (European Commission, 2013; Naumann et al., 2011; Pitman et al., 2015), which are selected for two reasons. First, their definitions are formulated broadly and include several network elements or aims. Second, the sources are a combination of practical and theoretical (scientific) perspectives. The three definitions were split up into elements and combined based on the relevance for this study (Appendix A). That means there is a focus on urban areas and communities and the delivery of values. An urban community refers to all stakeholders that are part of an urban area, including property owners. What types of values are included, will be discussed in Section 2.2. Green infrastructure in this research refers to green infrastructure in urban areas. Therefore, the definition focusses on urban green infrastructure.

In literature (Matsler et al., 2021) as well as practice (Naumann et al., 2011), various terms are used to refer to the concept of green infrastructure. Sometimes these terms have the same meaning, however, also differences can be observed. Examples of alternative terms are green spaces, biological interfaces, ecological hubs, sponge cities, urban forests, or ecological infrastructure (Matsler et al., 2021; Naumann et al., 2011). Another term that is close to the concept of green infrastructure and that is frequently used in literature, is nature-based solutions. Nature-based solutions is often referred to as an umbrella concept that covers, among others, ecosystem services, integrated resource management and green infrastructure (Browder et al., 2019; Dorst et al., 2019). In other words, green infrastructure can be considered as “a subset of nature-based solutions” (Browder et al., 2019. p.15). Further, when comparing green infrastructure and nature-based solutions, only minor differences are observed (Dorst et al., 2019). Therefore, also literature about nature-based solutions will be included in this research.

Numerous types of urban green infrastructure measures can be implemented in public as well as private space. This research focusses on the implementation by house owners and housing corporations. Therefore, only measures that can be implemented by these property owners, will be considered. Table 1 provides an overview of measures that are possible for house owners and housing corporations. Three types of buildings are considered: a house (including or excluding a garden), apartment building, and shared space. The latter is only applicable to housing corporations and can for example be a space between two apartment buildings or a parking lot. Although this is in most cases defined as public space, in some cases it is owned by the housing corporation. For each property type, the most common green infrastructure measures are listed.

Table 1 Green infrastructure measures for house owner and housing corporation

Green infrastructure measure	Type of property	Reference
Green in a garden (grass, regular plants, trees)	House (preferably >60% green surface), shared space (community garden)	(Hansen et al., 2017; Snep & Klosterman, 2021)
Kitchen garden	House, apartment building (balcony), shared space (community garden)	(Snep & Klosterman, 2021)
Plants on a balcony (ivy or plant in pot)	Apartment building	(Hansen et al., 2017; Snep & Klosterman, 2021)
Green roof	House (house or shed), apartment building	(Hansen et al., 2017; Snep & Klosterman, 2021)
'Façade garden': strip of plants in front of the house (part of the sidewalk)	House	(Snep & Klosterman, 2021)
Green façade (ground-based or façade-bound)	Apartment building	(Hansen et al., 2017; Snep & Klosterman, 2021)
Green parking spaces	Shared space	(Snep & Klosterman, 2021)

2.1.2 Benefits and co-benefits

Green infrastructure is known for its wide variety of benefits and co-benefits. Generally, a benefit is the gain that is initially aimed for when implementing green infrastructure and a co-benefit is an additional positive effect (Choi et al., 2021; Demuzere et al., 2014). According to Sharifi (2020), "co-benefits occur when implementing an adaptation (mitigation) measure results in ancillary mitigation (adaptation) gains" (p. 3). For example, a municipality implements green infrastructure for flood defence. These implemented measures at the same time result in a more aesthetic city and health improvement of residents. In this case, flood defence is the initial aim and thus the benefit, while better aesthetics and health are co-benefits. Using the term 'co-benefits' suggests that one benefit is seen as more important and has a higher focus in a project. However, for the basis of this research, all benefits must be considered to be equal. The level of importance for the property owners is currently unknown and will be investigated. Therefore, no distinction will be made between benefits and co-benefits. Only the term 'benefit' will be used from this point forward.

A list of benefits that will be used in this research is created, based on three different sources (Choi et al., 2021; Parker & de Baro, 2019; Pitman et al., 2015) (Table 2). These sources are selected because of the following reasons. To start, Choi et al. (2021), and Parker and de Baro (2019) are selected because both are literature reviews, and therefore cover many scholars about benefits. Further, Pitman et al. (2015) is a valuable additional source since it discusses benefits that were not covered by the other two sources. The benefits are divided into five categories: climate adaptation, environment, health and wellbeing, social, and economic. The categories help to structure the long list of benefits. However, one should keep in mind that there is not only one solution for categorising the benefits. A benefit from one category, can directly or indirectly have an effect that corresponds with another category (Choi et al., 2021). To illustrate, air quality improvement is defined as an environmental benefit, however, this can also have positive effects on health and wellbeing.

Table 2 Benefits of green infrastructure

Benefit	Reference
Climate adaptation	
Flooding protection	(Choi et al., 2021; Pitman et al., 2015)
Water management	(Pitman et al., 2015)
Water scarcity management	(Choi et al., 2021)
Heat stress reduction	(Choi et al., 2021; Pitman et al., 2015)
Evapotranspiration	(Pitman et al., 2015)

Environment	
Water quality improvement	(Choi et al., 2021)
Carbon storage and sequestration	(Choi et al., 2021; Parker & de Baro, 2019)
Air quality improvement	(Choi et al., 2021; Parker & de Baro, 2019; Pitman et al., 2015)
Noise reduction	(Choi et al., 2021; Pitman et al., 2015)
Biodiversity increase	(Parker & de Baro, 2019)
Biodiversity protection	(Pitman et al., 2015)
Habitat opportunities	(Parker & de Baro, 2019)
Ecosystem resilience improvement	(Choi et al., 2021)
Renewable energy opportunities	(Choi et al., 2021)
Erosion control	(Choi et al., 2021)
Food source	(Choi et al., 2021; Parker & de Baro, 2019)
Health and wellbeing	
Mental health improvement	(Parker & de Baro, 2019; Pitman et al., 2015)
Physical health improvement	(Parker & de Baro, 2019; Pitman et al., 2015)
Cognitive recovery improvement	(Parker & de Baro, 2019)
Productivity increase	(Parker & de Baro, 2019)
Stress reduction	(Parker & de Baro, 2019)
UV radiation protection	(Pitman et al., 2015)
Social	
Social cohesion increase	(Parker & de Baro, 2019; Pitman et al., 2015)
Attractiveness and comfort of urban area	(Choi et al., 2021; Pitman et al., 2015)
Improved connection humans with nature	(Pitman et al., 2015)
Reduced crime/safer neighbourhood	(Parker & de Baro, 2019; Pitman et al., 2015)
Environmental education	(Choi et al., 2021)
Environmental justice	(Choi et al., 2021)
Green job opportunities	(Choi et al., 2021)
Economic	
Lower capital cost compared to alternatives	(Parker & de Baro, 2019)
Lower operational cost compared to alternatives	(Choi et al., 2021; Parker & de Baro, 2019)
Energy usage reduction	(Choi et al., 2021; Parker & de Baro, 2019; Pitman et al., 2015)
Increase in life of materials and surfaces	(Pitman et al., 2015)
Better economic vitality of neighbourhoods	(Pitman et al., 2015)
Higher real estate value	(Choi et al., 2021)
Recreation/tourism increase	(Choi et al., 2021)

2.1.3 Motivators and demotivators for the implementation

Although studies on motivations and barriers for climate adaptation do not focus on green infrastructure and values specifically (see Section 1.2), they can provide useful insights for this research. The motivations and barriers in those studies are expected to be somewhat similar to the motivations for the implementation of individual green infrastructure measures. So, it can give a first impression of the potential motivations and barriers that is searched for in this study. In addition, it can serve as an inspiration for the input for the data collection in this research. In total, a combination of five studies was selected, based on the extensiveness and collective variety of motivations and barriers (Baack & Vinke-de Kruijf, 2022; Dorst et al., 2022; Ferreira et al., 2020; ten Brinke et al., 2022; Wamsler, 2016).

A distinction will be made between motivators (things that have a positive effect on the motivation) and demotivators (things that have a negative effect on the motivation). Four of the selected studies present motivators which include societal driving forces, perceived benefits, motivations, and drivers (Baack & Vinke-de Kruijf, 2022; Ferreira et al., 2020; ten Brinke et al., 2022; Wamsler, 2016). Demotivators are listed in three of the five studies, referred to as (societal) barriers, risks, and

challenges (Dorst et al., 2022; Ferreira et al., 2020; Wamsler, 2016). Most of the studies focus on citizens and some look at the private sector. Further, while some studies focus on climate adaptation in general, other studies focus more specifically on nature-based solutions. A complete overview of these studies and their scope is presented in Appendix B.1.

The selected literature is used to create two lists: potential motivators for the implementation of green infrastructure (Appendix B.2, Table 9) and potential demotivators for the implementation of green infrastructure (Appendix B.2, Table 10). Motivators include for example awareness of climate risks, interest in gardening or corporate image enhancement. In addition, 'benefits of nature-based solutions/green infrastructure' are included in the list of motivators, which requires an additional explanation. According to Ferreira et al. (2020), the benefits of nature-based solutions can form a motivation for the implementation (e.g. physical well-being, shade, food provision). All of these benefits listed by Ferreira et al. (2020) correspond with the benefits presented in Table 2. So, in order to prevent overlap between the two tables, the benefits are not individually mentioned here. Examples from the list of demotivators are nuisance from insects, time constraints, and lack of political support.

2.2 Value

In daily life, the term 'value' is used to indicate the worth or importance of something (e.g. product, service) to someone. In scientific literature, the concept of value is applied from different perspectives and several different types of values are distinguished. Here, a distinction is made between public value and private value. Public value refers to a collective benefit, while private value is about an individual benefit (de Bruijn & Dicke, 2006). A more specific definition of public value is given by Kuitert et al. (2019), based on De Bruijn and Dicke (2006): "a reflection of what society believes are important values in the production of certain products or services and whose provision is the responsibility of the government" (p.259). Based on this definition, climate adaptation can be considered as a public value. Climate adaptation namely contributes to a public benefit by creating a safer living environment, and is mostly the responsibility of the national and local authorities. Also the implementation of green infrastructure, as a part of climate adaptation, can create public value. However, green infrastructure implementation also results in private benefits, and can thus create private value as well. To illustrate, health improvement as a result of green infrastructure implementation, offers individual as well as public benefits. The collective health of an urban community improves, having positive effects on society as a whole (public value), and the individual health improves (private value). This research will therefore explore the potential of private and public value creation by implementing green infrastructure.

The creation of value "depends on the relative amount of value that is subjectively realised by a target user (or buyer) who is the focus of value creation" (Lepak et al., 2007, p.182). Values that are created, are thus subjective for different users, which can be an individual, organisation or society. This means that the value creation by climate adaptation measures will be different for different stakeholders in one urban area. For value creation, there should be a willingness by the user to exchange monetary value for the value received (Lepak et al., 2007). Next to the process of value creation, there is the process of value capture. Value capture is about the realisation of value that can be related to both monetary and non-monetary (Bos-de Vos et al., 2016; Bowman & Ambrosini, 2000). Value creation and value capture should be distinguished separately, because the source that creates the value, is not always the one also capturing the value (Lepak et al., 2007). Central in this research, is the value capture by property owners by implementing green infrastructure in privately owned areas. This value can be created by the property owners themselves, as well as by the municipality. The latter is the case when for example subsidies are provided for the property owners.

Values can be categorised into different types. An overview of the value types that will be used in this research, is presented in Table 3. These values are selected based on the relevance for the motivations of property owners. For each value type, a definition based on literature is given. To make the definitions operationalisable for this research, a practical understanding of each definition is formulated. The first two types are use value and exchange value, based on Bowman & Ambrosini

(2000). Bos-de Vos et al. (2016) use these two values as well, and add a third value in order to also study value in a professional service context: 'professional value'. While these first three values are mostly from a financial and organisational point of view, Benington (2005) lists other value types that are about social factors: 'economic value', 'social and cultural value', and 'ecological value'. Within these value types, specific values can be listed, often called a 'value set' (e.g. transparency, efficiency, or functionality) (Jørgensen & Bozeman, 2007; Kuitert et al., 2019; Van Der Wal et al., 2008). Similar to these value sets, Section 2.3 will present a list of topics for each value.

As can be noticed, the definition of use value is broad, especially considering the interpretation for this research. Therefore, use value is split into five categories: aesthetic, pleasure/comfort, physical hindrance, health, and time. These categories are based on the benefits, motivators, and demotivators of green infrastructure. From this point forward, use value will be referred to as 'use value (category)'. For different actors, different value types are important. Also in urban areas, different property owners have different perspectives and interests, resulting in different values. This study will explore what types of values are important to these different property owners, considering the implementation of green infrastructure.

Table 3 Value type definitions

Type of value	Definition	Interpretation for this study
Use value	Specific qualities of the product perceived by the customer in relation to their needs (Bowman & Ambrosini, 2000, p.2)	The qualities and functionalities of the property perceived by the property owner, like looks, comfort and safety. Also required working activities (e.g. gardening) and corresponding time investments are covered by use value.
Ecological value	Adding value to the public realm by reducing public 'bads' like pollution and global warming (Benington, 2005)	Creating a positive effect on the environment and reducing the negative effects on the environment.
Exchange value	The monetary amount realised at a single point in time when the exchange the goods take place (Bowman & Ambrosini, 2000, p.3)	The market value of the property. This is thus about an indirect economic effect.
Economic value	Cost reduction, and improvement of the financial gains like an increase of economic activity (Benington, 2005; Brink & Wamsler, 2019)	Limited costs for implementation of green, and preventing or reducing direct costs related to the property. This is thus about a direct economic effect.
Professional value (business)	Non-monetary aspects like reputation, individual talent, motivation and knowledge development (Bos-de Vos et al., 2016)	Non-monetary aspects that are relevant for businesses: reputation, position towards other businesses, individual talent of employees and knowledge development within the company.
Professional value (house owner)	-	Non-monetary aspects that are relevant for an individual, in this case house owner: impression on neighbours, individual talent, individual knowledge development.
Social value	Contribution to social capital, social cohesion, social relationships, social meaning, individual and community well-being (Benington, 2005; Brink & Wamsler, 2019)	Contribution to cohesion and relationships in the neighbourhood, health of people in general, and the physical appearance of the neighbourhood. (individual health is covered by use value)

2.3 Link green infrastructure and value

In this research, the implementation of green infrastructure is considered as a way to create value for stakeholders in an urban area. Green infrastructure is known for its wide variety of benefits, and each has the potential to create value. This value creation can lead to the decision to implement green infrastructure by property owners. In addition, there are other motivators and demotivators that influence the decision to (not) implement green infrastructure. These motivators and demotivators are based on values. So, knowledge about the values related to the implementation of green infrastructure can help to get insights into what motivates private actors and how they can be involved by the municipality.

To better understand the link between benefits, motivators, demotivators, and values, a conceptual framework is designed (Figure 2). In this framework, all motivators and demotivators is linked to a type of value. Each value type and corresponding definition as presented in Table 3, are used. Also the categorisation of use value is included. The motivators include all benefits (Table 2) as well as other potential motivators for green infrastructure implementation (Table 9). Benefits can be a motivation to implement green infrastructure (Ferreira et al., 2020) and therefore, benefits are considered as a motivator here. The benefits are colour coded based on the benefit category. The demotivators include potential demotivators for green infrastructure implementation (Table 10). However, a link between demotivator and value was not always possible. Therefore, some are left out.

In order to provide a more detailed explanation of the link between (de)motivator and value, some examples will be given. To start, the benefit 'higher estate value' can create exchange value, because it is about an increase in the market value of the property. Therefore, a link between these two can be made. Another example is the motivation of 'financial incentives'. The reasoning behind this motivation is based on economic value since this value is about preventing or reducing direct costs. In some cases, there is a link possible with more than one value. For example, 'energy usage reduction' creates economic value, because the energy savings will lead to lower costs. In addition, reduction in energy use has a positive effect on the environment and thus creates ecological value as well.

The link between value and (de)motivator is complex and not straightforward. As the double link of 'energy usage reduction' in the previous paragraph illustrates, there is not always one clear link. One can argue several direct or indirect effects of a (de)motivator, and come up with different links. This is similar to the categorisation of benefits of green infrastructure, for which there is also not one straightforward 'solution'. Choi et al. (2021) state that "it can be challenging, and even misleading to organise the multiple benefits into fixed categories because almost all benefits can have direct or indirect implications for environmental, social, or economic values simultaneously" (p. 6). However, still, a decision must be made about a categorisation or in this case the correct link. For this framework, these decisions are based on the definitions of the value types and by keeping in mind the perspective of the property owner.

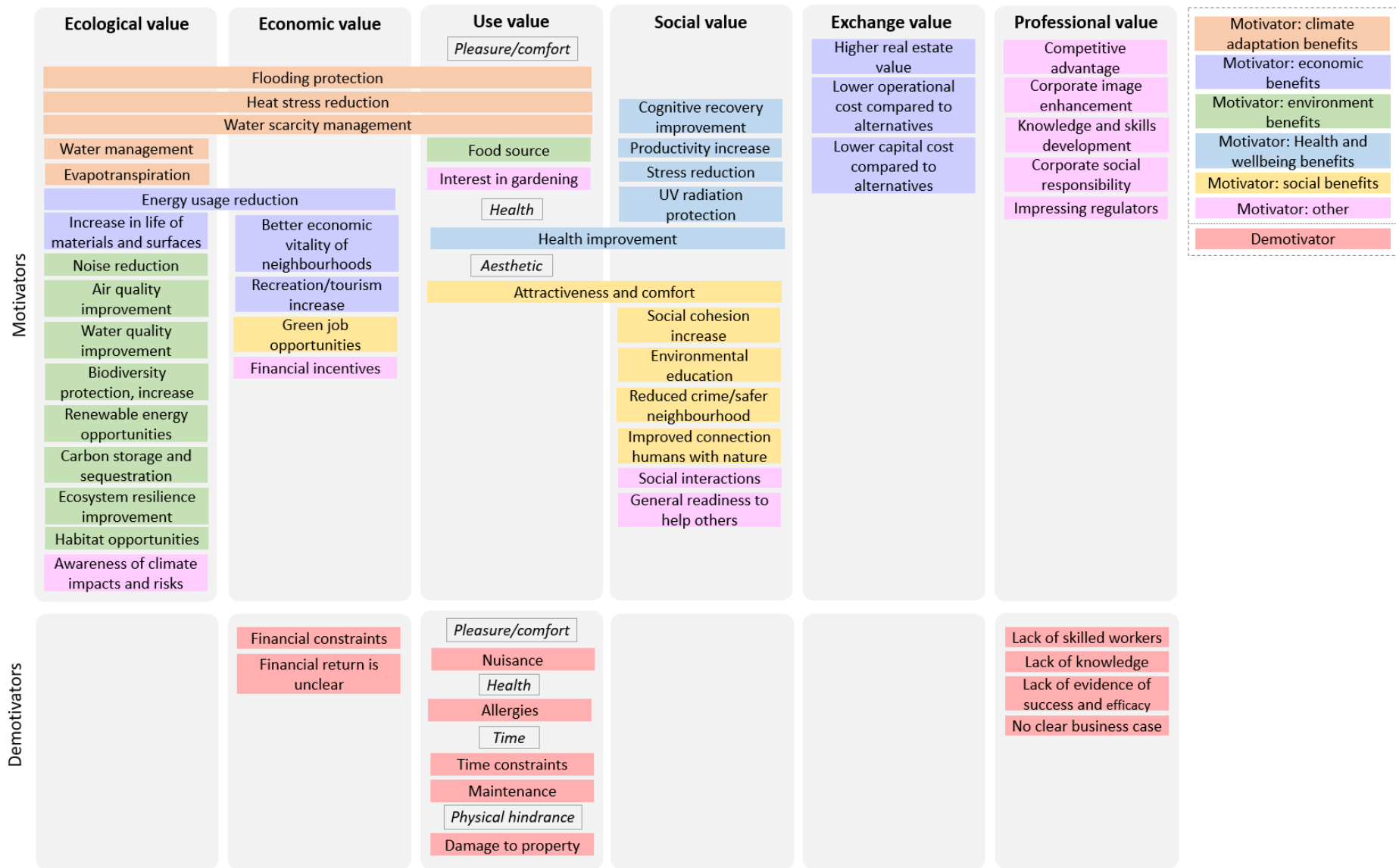


Figure 2 Conceptual framework linking values, benefits, motivators, and demotivators for green infrastructure implementation

3 Methodology

3.1 Strategy and approach

This study is an exploratory case study research. Case study research is typically applied in social sciences and is advantageous when a 'how' or 'why' question is asked about for example something that cannot be controlled by the researcher (Yin, 2009). These elements apply to this research since it will explore how property owners can be motivated and why they make decisions related to the implementation of green infrastructures. These are motivations over which there is no control by the researcher. Also, the case study will help to get insights into practice. Further, a single case study was chosen to be able to study one case more in-depth.

Based on three different selection criteria, the neighbourhood Zandvoort Nieuw Noord (Zandvoort, Netherlands) was selected as the single case study. The selection criteria for the case were as follows. First, the neighbourhood must be demographically representative or similar to other neighbourhoods in the Netherlands. Second, there must be opportunities to improve the amount of greenery in private space. In other words, private space in the neighbourhood is currently relatively grey. Third, the area must have a variety of property owners. These property owners form the unit of analysis in this research. More information about the case of Zandvoort Nieuw Noord will be discussed in the next section.

The data from the case study will be obtained by conducting interviews with property owners. To be able to include all benefits of green infrastructure that can be a motivation, the interview worked with statements. These statements are about different factors that can positively or negatively influence the decision to implement greenery. Using such a pre-defined list of statements in the interview is inspired by the Q methodology (McKeown & Thomas, 1988). Previous research also used Q methodology or statements for studies on motivations for urban green (Guenat et al., 2019) and values (Kuitert et al., 2019). More information about the formulation of statements and how they are used in the interviews, will be given in Section 3.3 and 3.4.

3.2 Introduction of the case

3.2.1 Geographical and demographical context

As mentioned, the neighbourhood Zandvoort Nieuw Noord was selected as a single case. It is located in Zandvoort, a coastal city in the Netherlands with 17.107 inhabitants (Allecijfers.nl, 2022c). With 2.840 inhabitants, Zandvoort Nieuw Noord is the second large neighbourhood in Zandvoort. It can be split into a residential area and a business park (Figure 3). The residential area is chosen to be the focus of this study since this includes a variety of property owners. The following types of property owners can be found here: utility companies, house owners, businesses, associations of owners (Dutch: VVE), a housing corporation, and the municipality (see Appendix C for a map of the ownership situation in more detail). House owners and housing corporations are the property owners participating in this research. The neighbourhood counts 1 housing corporation and approximately 220 house owners (based on the map of property ownership).

Zandvoort Nieuw Noord has the urban structure of a so-called post-war neighbourhood (Gemeente Zandvoort, 2008). This type of urban structure is common in the Netherlands (CBS, 2018). It means, among others, that the majority of the houses have a backyard as well as a front yard. This is the case in Nieuw Noord as well. As a result, the amount of green in the neighbourhood is highly dependent on the design of these gardens (Kluck et al., 2017). Further, these post-war neighbourhoods typically have residents with low incomes (CBS, 2018). In Nieuw Noord, the average income is 22.200, which can be considered to be a low income in the Netherlands (Allecijfers.nl, 2022b). It makes Nieuw Noord comparable with 9,2% of the Dutch neighbourhoods that have an average monthly income of 22.000-24.000 (Allecijfers.nl, 2022a). Only 9,3% of the Dutch neighbourhoods have a lower income. The property ownership of the neighbourhood matches this low income situation: 79% of the property is owned by the housing corporation, which are typically houses for people with a low income

(Allecijfers.nl, 2022b). To compare, an average of 4 out of 10 houses is rental property in the Netherlands (CBS, 2020).

Currently, an urban redesign is being made for Zandvoort Nieuw Noord that includes many green elements. The aim of this urban redevelopment project is to make it more climate resilient for extreme weather events, to create more consistency in appearance, and to improve social cohesion. These aspects are lacking in the current design of the neighbourhood. The project focuses on public space only. However, photos of the gardens, façades and apartment buildings in Zandvoort Nieuw Noord (Appendix D) demonstrate that also private space lacks green.

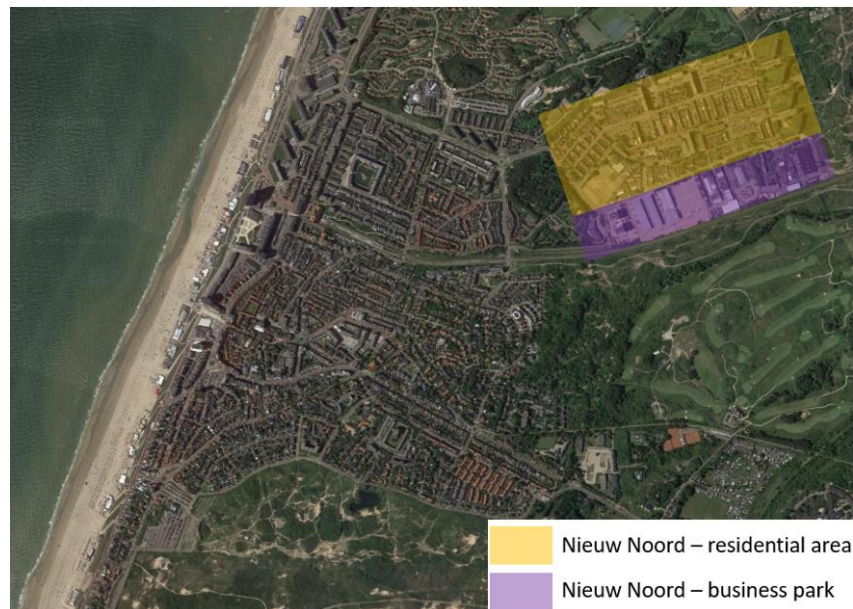


Figure 3 Map of Zandvoort, including neighbourhood Zandvoort Nieuw Noord

3.2.2 Municipality's vision on the living environment

In 2021, the municipality of Zandvoort created a document, called the *omgevingsvisie* (Traudes et al., 2021). The document presents the vision on the living environment of Zandvoort (and Bentveld, a small village next to Zandvoort) until 2040. It can be seen as a strategic policy plan for the design and quality of the living environment. In the vision of the municipality of Zandvoort, there are five main ambitions: economy, society, space, sustainability, and mobility. The document is structured by discussing each of these five ambitions, applied to Zandvoort in general as well as each neighbourhood. Since the ambition of sustainability is relevant to this study, the content for this part of the vision will be discussed in more detail.

The ambition of sustainability is referred to as a 'green and future-proof living environment' and for this ambition, three main elements are described. The first aim is to make Zandvoort more climate resilient by having fewer paved surfaces, and creating more space for green and water. Second, attention is paid to sustainable energy generation and storage. Third, the municipality wants to protect nature and improve biodiversity. For this last element, it is specifically mentioned that it is both about the built area and the area around Zandvoort.

The implementation of green and blue infrastructures covers a large part of the sustainability ambitions. The two main reasons for green and blue infrastructures in Zandvoort are climate adaptation and improvement of biodiversity. According to the document, climate adaptation in Zandvoort is needed to be able to deal with floods and extreme heat. Considering biodiversity, opportunities are noticed for a nature-inclusive design for the city, including buildings. In addition to these two main reasons, the attractiveness of the city is mentioned as a co-benefit. For both climate adaptation and biodiversity improvement, various practical examples of green and blue measures are given, e.g. green squares, parks, city ponds, and wadi's. In a small, quick sentence, also green roofs and vertical facade gardens are mentioned.

So, the municipality's vision has a good focus on climate adaptation and green infrastructure. However, also some critical notes can be made. First, no distinction between private and public space is mentioned in the document. As a consequence, measures are mainly discussed for public space. In addition, an ambition to involve residents is left out. Second, green roofs and nature-inclusive building practices are only quickly mentioned and seen as a possibility for only new to-be-built projects. Implementing these measures for current buildings is not discussed. Third, the benefits of green infrastructures that are mentioned, are limited. Health is for example not mentioned as a (co-)benefit. So, although the ambitions and vision of the municipality are sustainable, and consider green infrastructures, it also lacks some opportunities.

3.2.3 Housing corporation's vision on sustainability

Based on the website and the business plan of the housing corporation, sustainability – especially green measures – is not highly prioritized. On the website, one page can be found about making houses more sustainable. That includes better housing isolation to reduce energy and information about the possibility to install solar panels. The business plan, which can also be found on the website, discusses sustainability in one paragraph. It is mentioned as a topic for which the housing corporation is already on track and wants to continue staying on track. According to the business plan, the housing corporation commits to the Paris climate agreement, regarding CO₂ reduction and working towards an energy index of 1.0 by 2030. Isolation of houses is considered to be the most important. Further, building sustainable houses and climate adaptation is mentioned. The paragraph about sustainability concludes by stating that the housing corporation does not want to be a leader in sustainable measures and innovations, however, has a positive attitude towards the topic.

3.3 Operationalisation core variables

The theory on green infrastructure and values was used to formulate the statements for the interviews. These statements are about motivations as well as demotivations to implement green infrastructure. Demotivations are considered here as reasons to not implement green infrastructure. The formulation of the statements and their link with literature, will be discussed in the following sections.

3.3.1 Statement formulation

The statements are structured in a list of motivations and demotivations. The motivations include benefits of green infrastructure, external motivations, and personal motivations. The demotivations are about disadvantages and challenges, like money and time investments. Also other considerations that can play a role are considered, for example considering solar panels instead of a green roof. There are two separate lists: one for house owners and one for the housing corporation. In total, 25 statements (16 motivations, 9 demotivations) are used in the interviews with the house owners and 27 statements (19 motivations, 8 demotivations) for the interviews with the housing corporation.

The statements for this research are based on various sources. By following the Q-methodology, statements can be based on for example literature studies, interviews or media (McKeown & Thomas, 1988). For this research, the sources are categorised into four different types. First, the benefits of green infrastructure are used (Table 2). Second, outcomes of studies about stakeholders' motivations and barriers for climate adaptation measures are used. These include the motivators (Table 9) and demotivators (Table 10) that were previously discussed in Section 2.1.3. Third, internet sources that show practical examples of possible measures to motivate stakeholders, served as an inspiration (Groene Huisvesters, 2022; Van Ingen, 2019). Fourth, during a citizen information afternoon about the redevelopment of Zandvoort Nieuw Noord, information was collected. This afternoon was part of the redevelopment project at Witteveen+Bos and the aim was to inform stakeholders of the neighbourhood about the project. In non-structured interviews, citizens mentioned several

advantages and disadvantages related to green infrastructure, and some interesting ones were used for the formulation of the statements.

An overview of the statements and corresponding sources can be found in Appendix E.1 (house owners) and Appendix F.1 (housing corporation).

3.3.2 Link statement and value

The statements are formulated such that it is understandable for all stakeholders. To do so, they include relatable topics based on benefits, challenges, and practical examples. However, this research aims to understand what values can motivate stakeholders. Therefore, each statement should be linked to a value type. The different value types and corresponding definitions for this study have been discussed in Section 2.2. Creating the link between statement and value is different for the house owner statements and the housing corporation statements. Both will be explained here.

To start, all statements for the house owners have been linked to one single type of value. Generally, most (de)motivational factors and their corresponding statements have a clear, direct link with a value. For example, a better biodiversity is about ecological value. Therefore, not every single link will be explained here. However, for some statements this link is more complex. As a result, some motivational factors are described by more than one statement. This split is needed because more than one value type can be the underlying motivation. This can be illustrated with some examples. The aesthetic benefit has positive effects for the property owner as well as for the community or neighbourhood, and thus can be linked to both use value and social value, respectively. Similarly, climate adaptation can be a motivation because of use value, social value, and economic value. So, instead of one statement, two or three statements are formulated, and each is linked to a single type of value. The linked values are added to the list of statements in Appendix E.1. As can be noticed, the links between statement topics and values are similar to the links that are presented in the conceptual framework (Figure 2).

For the housing corporation, the statements have not been linked to a value in this part of the research. Similar to the house owner statements, some statements do have a clear link with one specific value type and some need to be split in order to link them to different value types. However, the difference here is that it is still unclear to what value types a statement can be linked, and thus how the split statements should be formulated. Too little is known about the possible motives of the housing corporation and therefore the possible underlying values are too complex. So, instead of formulating all these possibilities beforehand with a specific link to a value, the statements are formulated more generally. During the interview, the interviewer asked to find out the underlying motivations and values. The values that can be linked to the statements and corresponding topics will thus further be studied and discussed in the results of the interview.

3.4 Data collection

The data for this research were collected through semi-structured interviews with house owners and a housing corporation. The interviews were used as a qualitative method to gain insights into the values that can motivate property owners to implement green infrastructure. Doing interviews was selected as a method for two reasons. First, the motivation of property owners is mainly an individual point of view and thus the data should be collected individually. Second, by doing an interview, it is possible to ask further and thus to obtain more information compared to for example a survey. The following sections will go into more detail on the interview respondents and set-up.

3.4.1 Interview respondents

The interviews were conducted with the house owners and the housing corporation, and for each of these property owners, a different approach was used. The interviews with the housing corporation were planned on beforehand and were located at the office of the housing corporation. Three employees of the housing corporation were individually interviewed: 2 asset managers and 1 person

who is responsible for the approach of areas that are under social pressure. The interviews with house owners were done without an appointment. It took place right at the doorway or at the kitchen table of the house owner. In total 170 addresses were included for the research. 29 house owners agreed to do an interview and 35 house owners did not want to participate. All other house owners were not at home, or it was not possible to approach the house owner (e.g. a house without a doorbell). All 29 interviewed house owners own a backyard as well as a front yard. Generally, all gardens had similar sizes and there are some exceptions of house owners with a larger garden. An overview of the respondents is presented in Table 4.

All respondents were Dutch and thus the interviews were conducted in Dutch. The answers to the statements (small role, important role, no role) were written down. In addition, the full interviews were recorded. The introduction and concluding parts of the interview were fully transcribed. For the statements, only additional explanations were transcribed. Three house owners did not give permission for a recording, so the data of these interviews were registered by taking notes.

Table 4 Overview of interviews respondents

Property owner	Number of interviews	Contact
House owner	29	Door-to-door (without appointment)
Housing corporation	3 (2 asset managers, 1 area approach representative)	At the office (by appointment)

3.4.2 Interview set-up

The general set-up of the interview was similar for the house owners and housing corporation. After a short introduction, respondents were asked about their current situation, considering the implementation of green infrastructure. For example, did the house owner already have a green garden, and why (not)? These introduction questions were used to get insights into the initial motivation of the property owner, without suggesting possible (de)motivations.

The second part of the interview is where the statements were used. This was the main part of the interview. For each statement, the respondents were asked if the (de)motivation plays a role in the consideration to implement green infrastructure (house owners, housing corporation) or to set regulations (housing corporation). The possible answers were: it does not play a role, it plays a small role, and it plays an important role. The interviewer read the statements out loud one by one, and gave an additional explanation about the topic when needed. Next to the answer about the role it plays, there was an opportunity for the respondent to explain the choices. When someone gave very limited answers, the interviewer sometimes asked for an explanation to better understand the underlying reasons. Such an additional explanation is often used in the Q methodology (e.g. Guenat et al., 2019) and it can give useful insights.

In the third part of the interview, some concluding questions were asked. For example, were some topics or (de)motivations still being undiscussed? Further, the house owner was asked what type of help by the municipality could be useful, if any.

As mentioned, the general set-up of the interviews was similar for the house owners and housing corporation. However, the situation and possibilities around green infrastructures are different for these stakeholder types. To illustrate, house owners can only improve green around their house, while the housing corporation has different possibilities, which include motivating residents or implementing greenery at shared space. Therefore, there are also some differences between the interviews. The main differences are as follows.

- a) The formulation of the introduction and concluding questions. Also, for the housing corporations some extra questions were required (e.g. 'what does your work entail at this housing corporation?')
- b) The exact content of the statements. Overall, the topics are similar, however, there are some small variations. Some statements that apply to the situation of house owners do not apply to the housing corporation, and the other way around.

- c) Types of green infrastructure that were considered. The statements for the house owners are only about green in the backyard and front yard. A green roof is considered separately and mentioned in one of the introduction questions only. In contrast, the statements for the housing corporation were about all green possibilities.
- d) The duration of the interview. The interviews with house owners were unexpected for the respondents and in front of the door. In order to obtain a high response rate, the interviews were relatively short: approximately 10 minutes. The interviews with the housing corporation were about 30 minutes. The extra time was used to have a more in-depth interview.

The detailed structure and questions of the interviews can be found in Appendix E.2 (house owners) and Appendix F.2 (housing corporation).

3.5 Data analysis

The results of the house owners and housing corporation have been analysed separately. The results of the house owner interviews consist of a quantitative and qualitative part, which both have been documented by using Excel. The quantitative data include the scores for the statements (no role, small role, important role). Based on these scores, an overview of the importance of the statements was created. The qualitative data include the explanations on the statements and answers to the introduction and conclusion questions. The analysis of the qualitative data can be split into four parts. First, an overview was created with all additional explanations that were given about each of the statements. The explanations were structured based on the role perceived by the respondents. Third, all answers in the introduction and concluding part of the interview were listed per question. Similar answers were combined and for some parts, answers were grouped into categories. Answers that appeared more than once, were tracked when combining and categorising these responses. Fourth, also general comments repeated by several house owners, and surprising situations or elements during the interview, were summarised. These are thus not answers to the specific questions, however, these are comments that were made or situations that occurred during the interview. These comments and situations were structured into categories as well, in order to structure the long list. Finally, the interview results were linked to values based on the definitions as presented in Table 3.

The results of the housing corporation include only quantitative data and the analysis was done differently. For each question and each statement, the answers of the three respondents were summarised by using bullet points. In that way, an overview was created with all answers per question or statement. The introduction questions were used to understand the context and current situation of the housing corporation, considering green infrastructure. The answers to the statements were summarised in two separate tables: one highlighting statements where all respondents agreed, and one highlighting statements where the respondents had different opinions. Also here, a link with values was made by using the definitions of the values types.

4 Results

4.1 House owners

4.1.1 Current green infrastructure and interest

The house owners have different interests in green infrastructure (in private space) and thus the amount of greenery in their garden varies. Figure 4 provides an overview of the current situations of the house owners, considering the interest and amount of greenery in the garden. Important to mention is that these results are based on the answers in the interview, not on what the garden looks like. A distinction is made between house owners who have a positive opinion about green infrastructure and house owners who have a negative opinion. 26 house owners are positive and 3 house owners are negative. Within the two categories, there are various levels of interest by the house owners. Some, for instance, have an extremely green garden, and some replaced only a few tiles with plants.

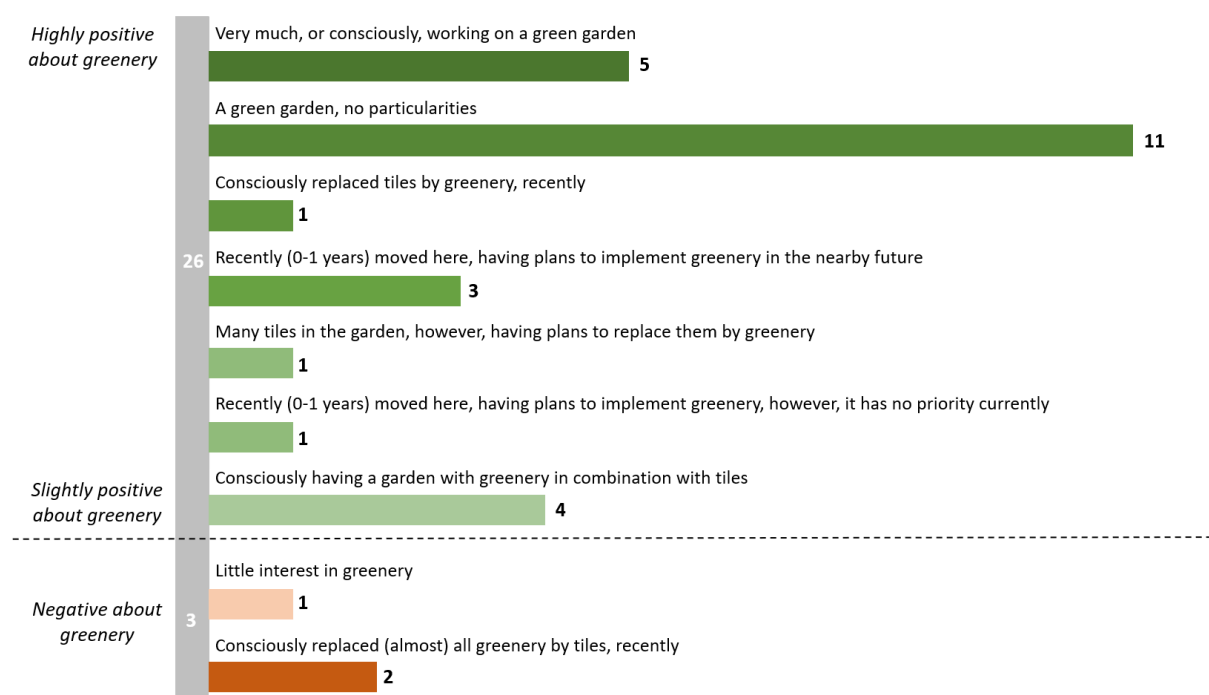


Figure 4 Overview number of house owners and their interest in green infrastructure

The house owners have various reasons why they want green in their garden or why they are holding back. Since these reasons were given before introducing the statements, the result gives an impression of the initial idea of the house owners, without being influenced by suggested (de)motivations. A distinction is made between reasons to implement green infrastructure and reasons to not implement green infrastructure. These reasons can all be linked to the six value types in order to understand what values play a role in the initial (de)motivation. Figure 5 and Figure 6 provide an overview the values that are linked. Some house owners mentioned only motivations, some only demotivations, and some mentioned both. Therefore, the number of respondents in Figure 5 and Figure 6 differs.

As can be observed, **use value (pleasure/comfort, aesthetic)** covers a major part the motivations to implement green infrastructure. Reasons that were mentioned often, are the aesthetics, gardening as a hobby, and watching birds or insects. Further, house owners mentioned heat or flood prevention as a reason. However, it is not fully clear whether this is from an ecological perspective or based on the individual benefit. Therefore, these reasons are linked to a combination of **ecological value** and **use value (pleasure/comfort)**, which covers 22% of the answers. Lastly, house owners mentioned biodiversity and the environment in general as reasons to implement green infrastructure (**ecological value**).

For the demotivation, **use value (time, physical hindrance)** plays an important role. Time for maintenance and space for other facilities (e.g. parking spot) were mentioned as reasons to have less green. Further, some house owners mentioned the costs as a reason why they did not (yet) implement green infrastructure (**economic value**).

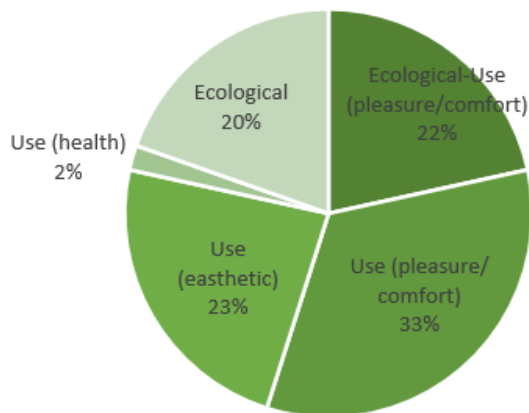


Figure 5 Pie diagram of values that link to the initial reasons to implement green infrastructure (n=26)

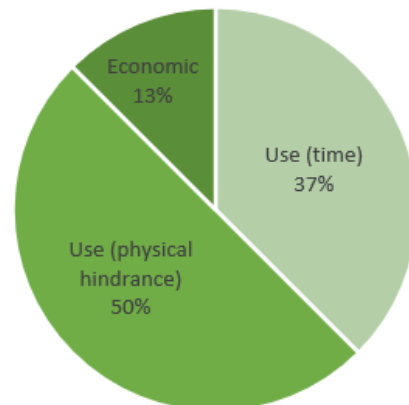


Figure 6 Pie diagram of values that link to the initial reasons to not implement green infrastructure (n=9)

4.1.2 Statements

Based on the results of the statements (Table 5), **use value (aesthetic and pleasure/comfort)** is of high influence on the house owner's decision to implement green infrastructure. The main motivation is the looks of the property; only two house owners indicated that this is not a motivation for them. In addition, animal watching and gardening were mentioned by the majority of the house owners as a motivation. Another statement with a high score is the looks of the street or neighbourhood. Although this statement was initially linked to social value, the results of the interview indicate that this is a use value as well. House owners want a beautiful street not only for their neighbours, however, also for their own benefit. To illustrate, one house owner responded that she also has to walk through the street. Therefore, this value has been added to the table.

In contrast, **exchange value** and **economic value** do not have an effect on the motivation to implement green infrastructure. The statements about the financial value of the property, preventing financial damage, and financial support score low. The majority of the house owners said that these topics do not play a role in the decision.

The results of statements that are linked to **ecological value**, **social value** and **use value (health)** are not as clear as the previously discussed topics. Biodiversity improvement and better air quality (ecological value) score relatively high, however, also a significant part of the house owners indicated that this does not play a role for them. Considering social value, the importance depends on the corresponding topic. While less nuisance and health improvement of the neighbourhood are moderately important, the influence of friends and family is low. Only three house owners indicated that friends or neighbours can positively influence the decision to implement green infrastructure. Lastly, for the statement about health (use value), the opinions are very almost evenly divided.

Considering the demotivations, it is remarkable that almost nothing plays a role for the interviewed house owners. In other words, there are only limited reasons for the house owners to not implement green infrastructure. When looking more closely, **use value (time and physical hindrance)** does play a role for some of the house owners. The time it takes and the amount of space for other facilities is part of the consideration to not implement green infrastructure.

As can be observed in Table 5, the statements about nuisance caused by extreme weather are linked to two types of values. The statements were initially formulated such that one was only linked to use value, and one was only linked to social value. However, some explanations by the house owners indicated that climate adaptation in general was a reason as well. Climate adaptation as a motivation links to ecological value. So, the motivation of nuisance caused by extreme weather conditions, is for

some house owners based on use value/social value and for some house owners it is based on ecological value. Therefore, both are included in the table.

In addition to the statement scores, another result is the comments that were made by house owners for each of the statements. Since it was not obligated to comment on each statement, the number of comments is variable per house owner and per statement. A summary of these comments is presented in Appendix G.1 and the most notable comments are listed here.

- a) Living in Zandvoort – a place that is surrounded by nature – was mentioned by house owners as a reason why certain topics do not play a role. This holds for air quality and health improvement.
- b) For the statements about financial damage, financial value of the house, and allergic reactions, house owners indicated that they had never thought about it before or they even doubt if the statement was true. It was thus a new topic or new information for them.
- c) There are differences in the thoughts about extreme weather conditions. Some house owners said that they are not aware this is the case, while others said that they had experienced flood or drought problems.
- d) For some disadvantages of green in the garden, house owners agreed that it can be the case, however, it does not hold them back to implement green infrastructure. They do not mind, have a solution for it, or do not experience it as a problem. This applies to time investments, vermin around the house, risk of allergic reactions, space for other facilities, and too much shadow.

The results for the statements include both house owners who are positive and house owners who are negative about green in private space. The three house owners with a negative opinion have only limited green in the garden, so most improvements can be made in their private space. Therefore, some interesting insights based on their separate results (Appendix G.2), will be discussed. There are hardly any reasons that motivate these non-interested house owners. The things that can potentially motivate, are related to use value (aesthetic, pleasure/comfort), economic value, and social value. The latter two are in contrast with the overall results. Surprisingly, there are also hardly any reasons to not implement green infrastructure. However, the one reason that was mentioned by all house owners is the required time investment. Use value (time) is therefore the main value for their demotivation. This corresponds with the overall results.

Table 5 Statements with corresponding scores and values, ranked by importance – house owners (n=29)

	Important role	Small role	No role	Value
(more) Green around my house				
My house looks more beautiful	23	4	2	Use value (aesthetic)
Watching animals that are attracted by the greenery	22	2	5	Use value (pleasure/comfort)
The street scene looks more beautiful	20	3	6	Social value, use value
Like to garden	15	5	9	Use value (pleasure/comfort)
Biodiversity improvement	13	7	9	Ecological value
Better air quality	12	3	14	Ecological value
Improvement of mental and physical health for my own household	11	8	10	Use value (health)
Less nuisance caused by extreme weather (water, heat and draught) in my neighbourhood	9	4	16	Social value, ecological value
Improvement of mental and physical health for people in my neighbourhood	8	7	14	Social value
Less nuisance caused by extreme weather (water, heat and draught) around my house	7	13	9	Use value (pleasure/comfort), ecological value
Learning about gardening and nature	7	5	16	Professional value
Harvest from my own garden (for example fruit tree or kitchen garden)	5	8	16	Use value (pleasure/comfort)
A financial compensation (for example subsidies or free plants)	4	6	19	Economic value
Friends or neighbours are also working on green in the garden	3	3	23	Social value
The financial value of my house increases	2	5	22	Exchange value
Preventing financial damage caused by extreme weather (water, heat, draught)	1	1	27	Economic value
No green or less green around my house				
Maintenance of greenery takes time	7	3	19	Use value (time)
Less space for other facilities (for example terrace or playground)	4	7	18	Use value (physical hindrance)
Vermin around my house	2	0	27	Use value (physical hindrance)
The purchase and maintenance costs	2	3	24	Economic value
Insufficient knowledge about implementation and maintenance of greenery	2	3	24	Professional value
Greenery in my garden gives too much shadow	0	5	24	Use value (physical hindrance)
It can cause dirt around my house (for example leaves or lice plaque)	0	2	27	Use value (physical hindrance)
Risk of allergic reactions for people of my own household	0	1	28	Use value (health)
Risk of allergic reactions for people in my neighbourhood	0	1	28	Social value

4.1.3 Green roof

For the motivation to install a green roof, two value types can potentially play a role: **ecological value** and **use value (aesthetic and pleasure/comfort)**. Only 2 of the 29 interviewed house owners have a green roof. The reasons for these 2 house owners are environment, biodiversity and isolation. House owners who do not have a green roof, listed their motivations to potentially or hypothetically install a green roof in the future. Their reasons are the aesthetic benefit, isolation, animals, and fresh air (no particular order). Remarkably, a few house owners mentioned the aesthetics and isolation as a demotivation. This illustrates that the opinions of house owners vary.

One of the main reasons why house owners do not want to install a green roof is the lack of knowledge. This knowledge gap appears from various answers. To start, 6 house owners clearly stated that they had never thought about it before. Further, some house owners directly indicated that a green roof was not possible since they have a sloping roof. However, these house owners have a small shed in the garden with a flat roof which can be suitable for a green roof. They did not realise this could be possible. In addition, some house owners had thought about a green roof, however, they were not sure if it is possible with the construction of their house or shed. Only in the latter case, the house owners are aware of their missing knowledge and only their motivation is therefore based on professional knowledge.

Other things that demotivate to install a green roof are based on **economical value** and **use value (physical hindrance)**. House owners indicated that the high costs form a barrier. For some house owners this was based on actual information and for others, it was only an expectation. Further, solar panels were mentioned as a reason to not have a green roof.

4.1.4 Support by the municipality

Surprisingly, a relatively high number of house owners indicated that they do not need support from the municipality. For example, they mention that they can search or ask for information themselves, or they do already have help. In addition, house owners indicate that they do not want to change something in their garden. The small number of house owners that is interested in help from the municipality, mentioned financial support, advice (e.g. what types of plants are suitable), and help in maintenance. Things that house owners would like to improve when they have help from the municipality, are the installation of a green roof, planting (extra) trees or plants, and replacing tiles. Because the motivations are mainly based on the idea that 'extra support is always helpful', they do not influence their decisions and are therefore not linked to values.

4.2 Housing corporation

4.2.1 Current green infrastructure and interest

The housing corporation does not focus on green infrastructure in their current projects, however, there are three ways in which the housing corporation does include green in their current housing. First, they join initiatives by the municipality or renters. Second, they inventory green possibilities in upcoming projects. Third, they sometimes stimulate residents to replace tiles with plants. Although for the latter it must be mentioned that not all participants agreed on this statement. One employee argued that motivating and stimulating residents is not a task for the housing corporation. Comparing these current activities with the possibilities for green infrastructure practices (e.g. Table 1 and Groene Huisvesters, 2022), it can be observed that the implementation of green infrastructure by this housing corporation is limited.

They aim to improve their sustainability practices (including green infrastructure) and want to develop more knowledge around this topic. To do so, a Green team has recently been formed and is now in its starting phase. Two of the interview respondents are part of this Green team. In total, the team is formed by five employees and they all do the Green team tasks next to their regular work at the housing corporation. Each member has their own specialism within the team: circularity, installations, conceptual construction, climate adaptation, and a chairman. Together, they function as a research

team for the housing corporation, looking for sustainable improvements and testing these. The outcomes are translated into recommendations for the management of the organisation. To illustrate, their current project is a test for the implementation of green parking spaces. They run a pilot at the parking lot next to the office, to gain experience and test the benefits. The test results will be used for recommendations for future projects.

The values that form the motivation to implement green infrastructure in some projects and to set up the Green team, are based on **ecological value**, **use value (aesthetic and pleasure/comfort)**, and **professional value**. Climate adaptation is an important motivator for the housing corporation, mainly related to heat and water problems. This is partly because of sustainability purposes (ecological value), and partly based on the liveability of renters (use value). By preventing the effects of climate change, the renters will experience fewer problems, and the satisfaction increases. Another motivator is the attractiveness of the neighbourhood. Again, this motivator is important in order to satisfy the residents. So, the liveability and satisfaction of renters have high priority for the housing corporation. The respondents explicitly mentioned that with everything the housing corporation does, they keep their renters in mind. Further, the green team has been set up because the housing corporation realises that sustainability is important and it needs more attention in their organisation (professional value).

The reasons why the housing corporation holds back on green infrastructure implementation have to do with **economic value** and **professional value**. First, the finances are mentioned as a reason to not implement green infrastructure. Especially the unknown financial benefit creates uncertainties. Further, there are technical issues that create reluctance. This was illustrated by the example of a green roof. Due to the weight of a green roof, it is difficult considering the construction, and can potentially lead to extra costs. In addition, according to one of the respondents, green infrastructure is not always the task of the housing corporation, instead, it is in some cases the task of the municipality.

4.2.2 Statements

In the answers to the statements, there were many variations among the three interview respondents. For a part of the statements the response was similar, however, for a surprisingly large part of the interview, the respondents had different answers. This illustrates that these three employees do not always have the same idea about the motivation of the housing corporation. The results can therefore be considered as two separate parts: statements about which the respondents agreed and statements about which the respondents disagreed (Appendix H, Table 15 and Table 16).

For the statements with various answers, it is hard to draw clear results or conclusions related to values. Especially since only three employees were interviewed, an opinion is now only underpinned by one or two respondents. Moreover, the level of variation between the answers differs. In some cases, the variation in answers is only limited, while in other cases, the answers are the complete opposite. This is the case in for example the statement about the influence of other housing corporations or companies. Two respondents say that this plays a role since they prefer to join each other's projects and do not want to leave behind. In contrast, the other respondent argues that this is not the case and that the housing corporation sets its own course. In this example, the respondents' understanding of the viewpoint of the housing corporation is totally different.

Based on the statements about which the respondents agreed, **use value (aesthetic, pleasure/comfort, health)** is important for the motivation. As mentioned before, the renter's liveability and satisfaction are important for the housing corporation and are large motivators. The aesthetic benefit of green infrastructure is therefore interesting, as well as the prevention of extreme weather problems and the improvement of health.

Further, **economic value** and **professional value** play an important role in the decisions about green infrastructure. Considering the statement results, there are two main topics that create reluctance for the implementation: finances and lack of knowledge. The costs of green infrastructure are considered as a disadvantage, especially with the corresponding uncertainties about the financial benefit. The respondents indicate that financial support can help to improve the implementation of green

infrastructure. Further, there are practical uncertainties for the future as well. One of the respondents illustrates this issue by giving an example of the installation of a green roof. Because it is a relatively new development, there are only limited examples that can show the green roof performance after 20 years. The lack of knowledge is an important aspect for this housing corporation. It is also one of the reasons why they put effort into the organisation of a Green team.

Good cooperation with the municipality and renters is important for the housing corporation and it helps to improve their green infrastructure practices. The respondents argue that joining an initiative by one of these stakeholders is interesting for several reasons. Overall, it makes processes less complex and the chance of succeeding increases. More specifically, there are three reasons why cooperation with the municipality is interesting. First, good cooperation with the municipality is important because a housing corporation has much to do with the municipality. Second, more can be achieved when working together and third, there is a possibility to share costs. In addition, three reasons were mentioned why joining an initiative and working together with renters is important. First, when there is an initiative, it means that renters bond and this contributes to the liveability and health of the residents. Second, it also means that renters are willing to do part of the work themselves, making it less intensive for the housing corporation. Third, when the housing corporation joins an initiative, they match the needs of renters. Fourth, for these types of initiatives, there is extra budget available and it is therefore financially interesting. Considering these explanations, again motivations are based on **use value (pleasure/comfort)** and **economic value**. In addition, social value plays a role since the connection between renters is considered as important. However, this motivation is only a small element in the full process of green infrastructure implementation, and therefore not an important motivator.

Further, two types of values do not have influence: **exchange value** and **use value (time)**. Respondents explain that the value of their property is not interesting since they do not sell the houses or do not use the property value in another way. Further, time for implementation or maintenance is not considered as a limiting factor. The explanations for this statement vary. One respondent argues it does not cost time, but money, while another respondent explains that other activities take time as well. To illustrate the latter, the installation of a green roof takes time, however, the installation of a regular roof takes time as well.

Taking together all statement results, there are some topics for which the respondents indicated that these are most important. The main reasons to implement green infrastructure are climate adaptation, liveability of renters, the aesthetics of the neighbourhood, and a vision on the future. The reasons to not implement green infrastructure or to be cautious are mainly uncertainties and a lack of knowledge, related to practicalities (e.g. technical issues) as well as finances. The respondents illustrate that the majority of these current limitations can be improved by enlarging the knowledge, gaining more experience, and learning from example projects of other housing corporations or other organisations. To conclude, ecological value, use value (aesthetic, pleasure/comfort), and professional value are of high influence on the decisions on whether or not to implement green infrastructure.

5 Discussion

5.1 Comparison of property owners

The results of the case study in this research show what values are important to house owners and a housing corporation for the implementation of green infrastructure. Values can have a positive, a negative or no effect on the implementation of green infrastructure. When a value plays a role in the motivation, it has a positive effect, while a value that plays a role in the demotivation has a negative effect. This matches the study by Bouman & Steg (2022), which demonstrates that values can lead to motivation and demotivation. Further, there are values that do not play a role in the consideration, these do not have an effect on the implementation of green infrastructure.

Table 6 summarises the level of importance of all values for house owners and the housing corporation, and its effect on the implementation of green infrastructure. These (de)motivations apply to the implementation of greenery in the garden or along the façade. It does not include the installation of a green roof, because this was only a small part of the interview. The following paragraphs will discuss the results for each of the values by comparing the property owners, making a link with literature, and discussing surprising results. Discussion points about green roof (de)motivations are only included when relevant.

Use value

To start, use value (aesthetic) and use value (pleasure/comfort) are highly important and have a positive influence on green infrastructure implementation for both types of property owners. However, the reasoning behind is somewhat different. House owners prioritise these values because they experience a direct, individual benefit, while the housing corporation finds these values important because of the benefit for their renters. It can be an indirect benefit for them as a housing corporation. To illustrate, house owners found the aesthetic benefit important, because they have a beautiful view through their own window. For the housing corporation, aesthetics is an interesting benefit because they expect a higher reinter satisfaction. Indirectly, renter satisfaction will lead to benefits for the housing corporation.

Also use value (health) has a positive effect on the motivations of both property owners, although it is less important than the previously discussed values. An explanation can be that the health benefits of green infrastructure are not as tangible as aesthetics and comfort. Especially mental health was referred to by house owners, because green made them happier. In that case, the benefit is more tangible and thus plays a more important role. Further, some house owners with mental or physical illnesses were more aware and found the health benefit more important.

Use value (physical hindrance) has a negative influence on the house owners' motivation and no influence on the housing corporation's motivation. For both property owners, the statement about use of space (which mainly links to this value) was sometimes difficult. They could not think of another facility that leads to the decision of having less green. At the same time, these facilities (e.g. parking spot or sitting area) were mentioned at another point in the interview. It is therefore expected that use value (physical hindrance) plays a more important role than the results initially demonstrate.

Lastly, use value (time) also has a negative influence on the decisions of house owners and no influence on the decisions of the housing corporation. However, it must be noted that the opinions were somewhat different among the three respondents of the housing corporation. For house owners, it was one of the main reasons to have no or less green in the garden. Especially the house owners who thought negative about green, mentioned this as an important limiting factor. The time investment is mainly related to maintenance of the garden. In contrast, some house owners mentioned that they like to do maintenance and do not mind that it can cost time. The prioritization of this value category is thus dependent on their interest in green and gardening.

Ecological value

Ecological value is important to both property owners, although it is more prioritised by the housing corporation. This difference in prioritisation can be explained by two reasons. First, the housing corporation has to commit to several climate policy agreements. In contrast, the house owner does

not have any official obligations to comply with climate adaptation regulations. The second reason is the house owners' lack of risk awareness and limited knowledge about the solutions. Although some house owners referred to flooding and heat prevention, the majority were not aware of the potential climate change effects in their own city. In addition, house owners did not always know how their property can contribute to solutions. This lack of knowledge and risk awareness corresponds with several previous study results (Dorst et al., 2022; Ferreira et al., 2020; Wamsler, 2016). A more extensive discussion on the lack of knowledge will be provided in Section 5.2.

Exchange value

For both property owners, exchange value is not important, however, they have different underlying reasons. The value of the property is not interesting for a housing corporation, because they do not benefit from it. Conversely, house owners can benefit from an increase in property value. However, they are not aware and therefore it does not play a role. Literature provides only limited evidence on the economic benefits of green infrastructure. So, it is explainable that this benefit receives limited attention (e.g. in media) and consequently, house owners are not aware. Evidence of economic benefits is growing (Bockarjova et al., 2020; Mutlu et al., 2023), so this is expected to change.

Economic value

While economic value influences the housing corporation's decisions, it does not play a role for house owners. The latter is one of the most surprising results of this research. It contradicts several other studies which demonstrate that financial incentives can be a motivation or that limited financial support can be a barrier (e.g. Ferreira et al., 2020; Wamsler, 2016). Moreover, the average income of the case is low, creating the expectation that money can play a role in a negative way (Allecijfers.nl, 2022b). An explanation can be that the focus is only on green in the garden. The results namely demonstrate that economic value does play a role for green roof installation, which is related to higher costs. Another explanation is that only house owners were interviewed, who generally have a better financial situation than citizens in a (social) rented apartment.

Currently, municipalities use financial support aiming to encourage citizens to implement green infrastructure (e.g. Broeken, 2022; Voets, 2022). However, the question now arises whether this actually helps to motivate. On the one hand, the interviewed house owners argue that it does not influence their decisions (except for green roof installation). Those who already want to implement green infrastructure, will make use of financial support, although without they would have implemented it as well. Those who do not want green infrastructure, were not interested in financial support and it did not influence their opinions. On the other hand, financial incentives can potentially play a role in raising awareness (Bor & Mesters, 2018). And awareness can lead to motivation (Wamsler, 2016). So, in that case, financial support can have an indirect positive effect on the motivation.

Professional value

Professional value is highly important to the housing corporation, and influences green infrastructure decisions both positively and negatively. The housing corporation has a lack of knowledge and experience (and is aware of that), which makes them hold back on green infrastructure projects. At the same time, they are working on knowledge improvement by testing and implementing green infrastructure. They know about the urgency of climate adaptation and their contribution as a housing corporation. So, professional value has an effect on the motivation as well. This corresponds with the results by ten Brinke et al. (2022). In addition, ten Brinke et al. (2022) identify competition as a potential motivator, considering professional knowledge. However, this was not found in the results for the housing corporation; they do not benefit from competition. Instead, they are highly interested in cooperation with the municipality or other organisations.

In contrast, professional value did not play a role for house owners. They do have a lack of knowledge, however, are not aware of this. Consequently, lack of knowledge or ambition to improve knowledge is not identified as a (de)motivator for green infrastructure implementation. Therefore, it is not linked to professional knowledge (in contrast to the housing corporation). However, the comments that were made during the interviews, suggest that professional value is more important than initially thought.

House owners find it important that their front garden looks tidy. In addition, they expressed themselves about the garden of their neighbours during the interviews. This often included negative comments about what the garden looks like. These observations show that house owners do find it important what their impression is on their neighbours and that they are aware of their position towards others. Professional value is thus more important than they indicated with the answers to the statements. Furthermore, for green roof installation, house owners were in some cases aware of their missing knowledge. They said this was a small barrier. So, related to this type of green infrastructure, professional value is moderately important.

Social value

Based on the results, social value does not form a motivation for green infrastructure implementation for the housing corporation as well as the house owners. At the same time, some comments in the interviews with house owners illustrate that social value is important in a certain way. Some said they want to inspire neighbours with their green garden and some received positive comments about their green garden. As mentioned in the previous paragraph, house owners also told their opinion about other's garden during the interview. Further, some house owners wanted that financial support is spent on the ones 'who need it'. Previous studies demonstrate that the social aspect can be a motivation for climate adaptation action (Baack & Vinke-de Kruijf, 2022; Ferreira et al., 2020; Lo, 2013). Possibly, the neighbourhood of the case study has a lack of social cohesions and consequently, social value does not play a role in the motivation of these house owners. An increase in social cohesion can potentially lead to motivation.

Table 6 Overview of the importance (high, moderate, low) of (de)motivation for house owners and housing corporation, and its influence (positive, negative, none – coloured green, red, yellow) on the implementation of green infrastructure

Value	House owners	Housing corporation
Use value (aesthetic)	Highly important; positive influence	Highly important; positive influence
Use value (pleasure/comfort)	Highly important; positive influence	Highly important; positive influence
Use value (physical hindrance)	Moderate important; negative influence	Not important; no influence
Use value (health)	Moderate important; positive influence	Moderate important; positive influence
Use value (time)	Moderate important; negative influence	Not important; no influence
Ecological value	Moderate important; positive influence	Highly important; positive influence
Exchange value	Not important; no influence	Not important; no influence
Economic value	Not important; no influence	Highly important; negative influence
Professional value (business, house owner)	Not important; no influence	Highly important; negative influence Highly important; positive influence
Social value	Not important; no influence	Not important; no influence

5.2 Lack of knowledge

In addition to the identified values, the results of this research suggest another factor that is of influence on the (de)motivation of property owners: a lack of knowledge. Although lack of knowledge closely links to professional knowledge, it will be discussed separately. The housing corporation is aware of their lack of knowledge, while most house owners are not (except for green roof installation). Differences were found in the type of knowledge that is missing. For example, most house owners are not aware of climate adaptation, while that is one of the main motivations for the housing corporation. Instead, the housing corporation has limited knowledge about implementation. Overall, all types of missing knowledge can have a large influence on green infrastructure implementation.

House owners are mainly missing knowledge about the effects of climate change and how green infrastructure can help to adapt. This result matches the findings of previous studies (Ferreira et al., 2020; Kreemers et al., 2020). The lack of knowledge was analysed based on the following results and observations. First, house owners had different ideas and experiences on (potential) extreme weather conditions. While some referred to recent floods in their city, others argued that the effects of climate

change are not a problem yet in the Netherlands. Second, for some statements, house owners mentioned that they had never heard about it and some even doubted if a statement was true (e.g. property value increase). Third, house owners had different understandings of what a 'green garden' entails. To illustrate, one house owner was very enthusiastic about greenery in his garden and the related biodiversity improvement. However, a large part of his garden was covered with tiles and there was only a limited number of plants. Of course, there is no straight line between a grey or a green garden, however, there are guidelines that house owners can follow (e.g. Milieu Centraal, 2021). Further, the results of this research suggest that house owners who are aware of the problems, take action and want to improve the amount of green in their garden. Some house owners who are aware of climate adaptation, mentioned this as a motivation for green infrastructure implementation. Awareness was based on their own experiences (e.g. heat in a garden with tiles) or external information (e.g. newspaper). Moreover, one house owner who was not interested in green infrastructure, said that she will consider implementing more green when the municipality informs her about the urgency to do so. Literature confirms that increased awareness of climate change effects and risks, can be a motivation (Wamsler, 2016). So, an improvement in the knowledge and risk awareness of the house owners, can lead to more motivation to implement green infrastructure. As mentioned, the housing corporation's missing knowledge is mainly related to the implementation of green infrastructure and corresponding finances. This is something that can partly be improved by absorbing information and gaining experience, as the interviewed housing corporation currently does. However, for some aspects it will be challenging to improve knowledge at this moment in time, because there simply is no information available. The quantification of benefits is complex, especially when it is context-specific (Dorst et al., 2022; O'Donnell et al., 2017).

5.3 Reflection on approach and method

For the data collection of this research, semi-structured interviews were performed. The interview included statements for which the property owners were asked whether the topic of the statement applies to them. These statements helped to discuss several topics within a limited amount of time. Based on the answers in the introduction and conclusion of the interview, almost all topics were covered by the statements. Only two additional motivations were mentioned by house owners: the creation of privacy by planting shrubs in the front yard, and having green in the garden because the pets like it. The statements also included topics that the property owner did not think about himself. This is useful for the research insights, however, it also leads to the first reflection point on the interview approach. Some house owners were surprised by a certain topic or statement (e.g. allergies) and just responded without cautiously thinking about it. Further, the statements were sometimes confusing for house owners who already had a green garden. They argued that something was not a motivation 'because I already have a green garden'. Another reflection point is the limited amount of time for the interview. On the one hand, small interviews were useful to interview as many house owners as possible and to obtain a high response rate. On the other hand, only limited explanation about the answers could be given, due to the limited amount of time. So, for future research it is recommended to have sufficient time when doing interviews that include statements and to make sure all participants always have the same interpretation of the statements.

Another point of reflection is the representativity of the neighbourhood. Zandvoort Nieuw Noord can be categorised as a post-war neighbourhood, which is a common type of neighbourhood in the Netherlands (CBS, 2018; Gemeente Zandvoort, 2008). Some characteristics are low income and houses with a backyard as well as a front yard, which also applies to Nieuw Noord (Allecijfers.nl, 2022b; CBS, 2018; Kluck et al., 2017). So, based on this characterisation, the case is comparable with several other neighbourhoods in the Netherlands. Considering the financial situation only, the case is comparable with 9,2% of all other neighbourhoods in the Netherlands (Allecijfers.nl, 2022a). Both the urban design characteristics (e.g. backyard and front yard) and the financial situation can influence the decisions for green infrastructure implementation. For example, other measures must be considered when having back yard and front yard, compared to only a balcony. Further, there is another factor that makes the

case more context-specific and this should be taken into account when comparing the case with other areas. Zandvoort is located in a nature-rich environment. This influences the opinions of property owners, especially related to ecological value. Some property owners even mentioned that their answers would be different when they live in a large, crowded city.

Also, the representativity of the respondents is an important point of reflection. First of all, only two types of property owners (house owners and housing corporation) were interviewed. Initially, also businesses would have been interviewed, however, there was no response or interest. A broader variety of property owners would have enabled a more extensive comparison between property owners. Secondly, the employees of the housing corporation had for some topics very divergent opinions and answers. As a result, it is not always clear what the actual opinion of the housing corporation entails. Lastly, the majority of the respondents had an affinity with the topic of green infrastructure; only 3 house owners were not interested. It is not possible to state whether this is representative compared to the general opinion of Dutch citizens, because no relevant data was found. However, a comparison can be made with data about green-grey distributions in gardens, when assuming that the positive and negative opinion of house owners corresponds with a (semi-)green and grey garden, respectively. In the Netherlands, 70-85% of the houses with a garden have a (semi-)green garden and 15-30% have a grey garden (Kullberg, 2016). These numbers suggest the respondents of this research were slightly more positive than the average. However, one must keep in mind that this is only based on the afore made assumption. For future studies, it will be interesting to include both the opinion of stakeholders about green and the amount of green in their garden.

Based on the theory in this research, results were linked to different types of values. For some results, the link with a value type is directly clear. However, for some results, various links are possible. The links can be interpreted differently, leading to other conclusions. In addition, it is sometimes complex to find the underlying value of a motivation. More in-depth research will be needed to understand these values. This applies for example to the motivation of the housing corporation to satisfy renters.

6 Conclusion and recommendations

6.1 Conclusion

This research aims to identify the values that motivate house owners and housing corporations to implement green infrastructure in privately owned urban areas. An important part of climate adaptation measures (including green infrastructure) must be implemented by private actors, so the municipalities are highly dependent on this stakeholder. Insights into their values can help municipalities to better involve private actors in climate adaptation practices.

Previous studies on climate adaptation motivations did not focus on values. This research states that value creation and value capture can lead to (de)motivation to implement green infrastructure. Therefore, theory on green infrastructure and values has been combined. The conceptualisation demonstrates that benefits of green infrastructure can create value, and can thus motivate to implement. Further, it demonstrates that other motivators and demotivators (obtained from literature) can be based on values. All benefits, motivations, and demotivations link to specific types of values. This link is in some cases clear, however, in some cases rather complex and interpretable from different points of view.

Based on the case of Zandvoort Nieuw Noord, a neighbourhood in the Netherlands, the values of house owners and a housing corporation were studied. By doing interviews, values were found that influence their motivation as well as their demotivation to implement green infrastructure at their own property. Similarities, as well as differences, were found in the values that these property owners find important. The results from the case study provide insights for the municipality of Zandvoort.

For house owners, use value is highly important. The aesthetics, pleasure/comfort, and health element of use value form a motivation for the house owners. Conversely, the time and physical hindrance that are associated with green infrastructure, result in demotivation. Surprisingly, economic value is not prioritised by house owners. Further, it was found that social value does currently not lead to motivation, however, it can potentially do so when social cohesion improves.

For the housing corporation, use value forms a motivation as well. In addition, ecological value and professional value play an important role in the motivation. At the same time, professional value also creates reluctance, because there is a lack of knowledge and experience. Another value that creates demotivation for the housing corporation is economic value.

In addition to the identification of values, this research found that a lack of knowledge can negatively affect green infrastructure implementation. The majority of the house owners are not aware of the risks of climate change and the need for climate adaptation. In addition, not all house owners know what types of green infrastructure can be implemented and what the benefits are. Most house owners are not aware of their lack of knowledge. In contrast, the housing corporation knows about climate adaptation and the possible solutions. However, they have insufficient knowledge about the implementation of green infrastructure measures. Furthermore, the unknown financial benefit causes uncertainties. They are aware of this missing knowledge and work on improvements.

To summarise, this research studied the types of values that can lead to motivation or demotivation for the implementation of green infrastructure by property owners. Based on a case study, values are identified that can (de)motivate house owners and a housing corporation. An understanding of these values can help the municipality to better understand how private actors can be involved in climate adaptation practices.

6.2 Recommendations for municipality

As stated in the introduction of this research, it can be complex and challenging for municipalities to involve private actors in green infrastructure planning. Insights into their values can help to better understand what motivates them and how they can be involved. So, one of the aims of this research is to provide insights for the municipality on how to motivate and involve private actors. Therefore, recommendations for the municipality are formulated, based on the results of the case study. Although

these recommendations focus on the municipality of Zandvoort, they can also provide insights or inspiration for other municipalities.

Involve different types of stakeholders in different ways

The house owners and housing corporation that were interviewed for this research, prioritised different types of values. That means they will be motivated to implement green infrastructure by different factors. The better the match between participation methods and values of a stakeholder, the better the expected response and involvement of this stakeholder. It is thus recommended to involve different stakeholders in different ways. The following recommendations will therefore be dedicated to a specific type of property owner.

Do not mainly focus on financial support (house owner)

The results demonstrate that economic value does not influence the decision of house owners to implement green in the garden. Those who do not want green infrastructure, are not motivated by financial support. And those who do want green infrastructure, say they will do it also without financial support. However, financial incentives can potentially create awareness and subsequently work as an indirect motivation. Further, house owners indicated that financial support can help for the motivation of green roofs, which is a more expensive measure. So, it is recommended to not fully focus on financial support, however, consider the provision of financial support for more expensive measures and to raise awareness.

Inform about climate change effects and the solutions (house owner)

The interviewed house owners had limited or no knowledge about climate adaptation. They were not always aware of the risks associated with climate change and/or how green infrastructure can help to adapt. Literature demonstrates that risk awareness can help for a higher motivation to take climate adaptation action. Therefore, it is recommended to better inform house owners about these topics and what they can do at their own property. The house owner who already were aware, mostly referred to experiences at their own property. In addition, use value was found to be highly important for the house owner. Therefore, it is recommended to make the information relatable for house owners and to focus on the positive effects that green infrastructure can have on the use of their property.

Create social cohesion (house owner)

Currently, social value does not influence the decision to implement green infrastructure for the interviewed house owners. In contrast, literature shows that social factors can positively affect the motivation for climate adaptation. For the interviewed house owners, it is expected that this can be the case as well. The results namely demonstrate that social interactions did play a role in some way. To let this social value play a role, an increase in social cohesion is needed. So, it is recommended to improve social cohesion in order to let social value play a role in the implementation of green infrastructure.

Provide financial support (housing corporation)

In contrast to the house owners, economic value is important for the housing corporation. Finances are a limiting factor for green infrastructure implementation. This is partly because of the limited knowledge about the economic benefit of green infrastructure; a barrier cannot directly be solved. It is recommended to provide financial support for the housing corporation, to increase their number of green infrastructure implementations.

Promote and enhance cooperation (housing corporation)

The housing corporation is positive about cooperations with, among others, the municipality. They prefer these cooperations, because it makes processes less complex, and costs can be shared. So, when the municipality initiates projects related to green infrastructure, in which the housing corporation can participate or cooperate, there is a good chance they will be interested. It is therefore recommended to initiate cooperation with the housing corporations where possible.

6.3 Recommendations for future research

After the findings and reflections of this research, recommendations for future studies can be formulated. In the discussion on the approach and method (Section 5.3), already some small recommendations were given. Here, the recommendations will be discussed in more detail and refer to the overall research.

First, it is recommended to focus more on the motivations of different types of stakeholders in urban areas. Currently, most studies look at citizens or private actors in general, while this research demonstrates that there are different types of values that motivate different types of stakeholders. Insights into these differences can help municipalities to more efficiently involve private actors. Further, when looking at different stakeholders, it is recommended to include as many types as possible. This research includes two types of property owners, which represent a large part of stakeholders in an urban area. However, there are more types of stakeholders and it is expected that they have different interests (e.g. businesses or citizens in a rented apartment).

Second, it is recommended to do more in-depth research on the values that (de)motivate private actors. This research identified several types of values, however, in some cases the actual underlying value was not fully clear. More in-depth interviews can help to explore these values in more detail.

Third, it is recommended to look into participation methods that match the values of stakeholders. Based on values, this research provides guidelines to better involve property owners. Further research will be needed to prove how participation methods that focus on values, turn out in practice. Also, research can help to investigate what types of participation methods match the values of stakeholders. For example, studies can look into the practices that can best be implemented to create use value for house owners, or how information about climate change can best be provided.

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Appendix

Appendix A Definitions of green infrastructure

Table 7 Definition of green infrastructure, split up in elements

Network of...	Area	Aim	Reference
Natural and semi-natural areas with other environmental features, green (land) and blue (water) spaces	Not specified	Deliver wide range of ecosystem services	(European Commission, 2013)
Green spaces and water systems, including parks and reserves, gardens and backyards, waterways and wetlands, streets and transport corridors, pathways and green- ways, farms and orchards, buffers and windbreaks, squares and plazas, roof gardens and living walls, sports fields, and cemeteries	Not specified	Deliver multiple environmental, social and economic values and services to urban communities	(Pitman et al., 2015)
Natural and semi-natural areas, features and green spaces	Rural and urban, and terrestrial, freshwater, coastal and marine areas	Enhance ecosystem health and resilience, contribute to biodiversity conservation and benefit human populations through the maintenance and enhancement of ecosystem services	(Naumann et al., 2011)
Natural and semi-natural areas, including green and blue spaces	Urban	Deliver multiple values to urban communities	Formulation in this research

Appendix B Green infrastructure motivators and demotivators

Appendix B.1 Selected studies

Table 8 Overview of selected studies about motivators and demotivators

What is studied?	Type of measure/action	Stakeholder	Reference
Positive effects on motivation (motivators)			
Societal driving forces	Participation in the process for climate adaptation	Citizens	(Wamsler, 2016)
Benefits, perceived by stakeholders	Nature-based solutions	Citizens, stakeholders in urban environment	(Ferreira et al., 2020)
Motivations	Participation in the process for nature-based solutions		
Motivations	Individual climate adaptation measures	Citizens	(Baack & Vinke-de Kruijf, 2022)
Drivers	Mainstreaming climate adaptation	Private sector	(ten Brinke et al., 2022)
Negative effects on motivation (demotivators)			
Societal barriers	Collaborative climate adaptation	Citizens	(Wamsler, 2016)
Risks, perceived by stakeholders	Nature-based solutions	Citizens, stakeholders in urban environment	(Ferreira et al., 2020)
Challenges	Nature-based solutions		
Challenges	Participation in the process for nature-based solutions		
Barriers	Engagement in the process for nature-based solutions	Citizens, private sector	(Dorst et al., 2022)

Appendix B.2 List of motivators and demotivators

Table 9 Potential motivators for the implementation of green infrastructure

Motivators	Reference
Benefits of nature-based solutions/green infrastructure (Table 2)	(Ferreira et al., 2020)
Awareness of climate impacts and risks	(Wamsler, 2016)
Financial incentives	(Wamsler, 2016)
General readiness to help others	(Wamsler, 2016)
Social interactions	(Baack & Vinke-de Kruijf, 2022; Ferreira et al., 2020)
Interest in gardening	(Ferreira et al., 2020)
Knowledge and skills development	(Ferreira et al., 2020; ten Brinke et al., 2022)
Corporate image enhancement (applicable to businesses and organisations)	(ten Brinke et al., 2022)
Corporate social responsibility (applicable to businesses and organisations)	(ten Brinke et al., 2022)
Competitive advantage (applicable to businesses and organisations)	(ten Brinke et al., 2022)
Impressing regulators (applicable to businesses and organisations)	(ten Brinke et al., 2022)

Table 10 Potential demotivators for the implementation of green infrastructure

Demotivators	Reference
Nuisance (e.g. dirtiness, insects, leakage)	(Dorst et al., 2022; Ferreira et al., 2020)
Damage to property	(Ferreira et al., 2020)
Allergies	(Ferreira et al., 2020)
Maintenance and monitoring	(Dorst et al., 2022; Ferreira et al., 2020)
Time constraints	(Ferreira et al., 2020; Wamsler, 2016)
Financial constraints	(Dorst et al., 2022; Ferreira et al., 2020)
More trust in quality of grey infrastructure	(Dorst et al., 2022)
Complex implementation process	(Dorst et al., 2022)
Passive attitude	(Wamsler, 2016)
Lack of political support/guidance	(Ferreira et al., 2020)
Demands for clear instructions and guidance	(Wamsler, 2016)
Reliance on governmental assistance	(Wamsler, 2016)
Not feeling responsible	(Dorst et al., 2022; Wamsler, 2016)
Lack of knowledge: environmental problems, the risks, and possible solutions	(Dorst et al., 2022; Ferreira et al., 2020; Wamsler, 2016)
Lack of knowledge: benefits of nature-based solutions	(Dorst et al., 2022)
Lack of evidence of the success and efficacy of the solutions	(Ferreira et al., 2020)
Scepticism towards nature-based solutions	(Dorst et al., 2022)
More focus on short-term instead of long-term	(Dorst et al., 2022)
Financial return is unclear	(Dorst et al., 2022)
No clear business case (applicable to businesses)	(Dorst et al., 2022)
Lack of skilled workers (applicable to businesses)	(Ferreira et al., 2020)

Appendix C Ownership situation



Figure 7 Ownership situation neighbourhood Zandvoort Nieuw Noord

Appendix D Photos Zandvoort Nieuw Noord



Figure 8 Apartment building (1)



Figure 9 Apartment building (2)



Figure 10 Facade (1)



Figure 11 Facade (2)



Figure 12 Front yard (1)



Figure 13 Front yard (2)



Figure 14 Front yard (3)



Figure 15 Front yard (4)

Appendix E Interview protocol house owners (Dutch)

Appendix E.1 Stellingen

Er zijn voor iedere stelling drie verschillende antwoorden mogelijk.

1. Het speelt geen rol in de overweging om wel/geen groen te plaatsen
2. Het speelt een kleine rol in de overweging om wel/geen groen te plaatsen
3. Het speelt een belangrijke rol in de overweging om wel/geen groen te plaatsen

Table 11 Stellingen huiseigenaren, gekoppeld aan values

Stelling	Value	Source	Information from source
Meer groen in mijn voor- en achtertuin			
Minder overlast door weersextremen (water, hitte en droogte) rondom mijn huis	Use value (pleasure/comfort)	Table 2	Flooding protection/water management, water scarcity management, urban heat island reduction
Minder overlast door weersextremen (water, hitte en droogte) in de wijk	Social value	See previous statement	-
Voorkomen van financiële schade door weersextremen (water, hitte en droogte)	Economic value	See previous statement	-
Betere kwaliteit van de lucht	Ecological value	Table 2	Air quality improvement
Verbetering van de biodiversiteit	Ecological value	Table 2	Biodiversity increase/protection
Verbetering van de mentale en fysieke gezondheid van mijn eigen huishouden	Use value (health)	Table 2	Mental and physical health improvement
Verbetering van de mentale en fysieke gezondheid van de mensen in mijn wijk	Social value	See previous statement	-
Mijn huis ziet er mooier uit	Use value (aesthetic)	Table 2	Attractiveness of urban area
Het straatbeeld ziet er mooier uit	Social value	See previous statement	-
De financiële waarde van mijn huis stijgt	Exchange value	Table 2	Higher real estate value
Vrienden of burens zijn ook bezig met vergroenen	Social value	Table 9	Social interactions
Leren over tuinieren en de natuur	Professional value	Table 2	Improved connection humans with nature, environmental education
		Table 9	Knowledge and skills development

Kijken naar de dieren die op het groen afkomen	Use value (pleasure/comfort)	Table 2	Improved connection humans with nature
		Resident information afternoon ¹	Resident likes to watch bats in the tree, resident likes to watch insects in the garden
Leuk om te tuinieren	Use value (pleasure/comfort)	Table 9	Interest in gardening
Oogst uit eigen tuin (bijvoorbeeld fruitboom of moestuin)	Use value (pleasure/comfort)	Table 2	Food source
Een financiële tegemoetkoming (bijvoorbeeld subsidie of gratis planten)	Economic value	Table 9	Financial incentives
		(Van Ingen, 2019)	Example from practice: subsidies
		(Van Ingen, 2019)	Example from practice: exchange tiles for plants
Geen of minder groen in mijn voor- en achtertuin			
Het onderhoud van groen kost tijd	Use value (time)	Table 10	Time constraints
Ongedierte rondom mijn huis	Use value (physical hindrance)	Table 10	Nuisance (e.g. dirtiness, insects, leakage)
Kans op allergische reacties voor de mensen binnen mijn huishouden	Use value (health)	Table 10	Allergies
Kans op allergische reacties voor de mensen in mijn wijk	Social value	<i>See previous statement</i>	-
Het kan voor vuil rond mijn huis zorgen (bijvoorbeeld bladeren of luizenplak)	Use value (physical hindrance)	Table 10	Nuisance (e.g. dirtiness, insects, leakage)
		Resident information afternoon ¹	Resident has problems with plaque from lice
De aanschaf- en onderhoudskosten	Economic value	Table 10	Financial constraints, lack of political support/guidance
Onvoldoende kennis over de aanleg en het onderhoud van groen	Professional value	Table 10	Lack of knowledge, lack of political support/guidance
Door groen heb ik minder ruimte voor andere faciliteiten (bijvoorbeeld terras of speelplek)	Use value (physical hindrance)	-	-
Groen in mijn tuin geeft te veel schaduw	Use value (physical hindrance)	Resident information afternoon ¹	Resident does not want a tree because of shadow on the solar panels

¹ As part of the redevelopment of Zandvoort Nieuw Noord (case), an information afternoon was organized for residents in the neighbourhood

Appendix E.2 Protocol

Introductie

Goedendag, mijn naam is Dian en voor mijn opleiding aan de Universiteit Twente doe ik onderzoek naar groene tuinen en daken. Ik wil er graag achter komen wat huiseigenaren motiveert om wel, of juist niet, meer groen in hun tuin of op het dak te plaatsen. Hiervoor neem ik korte interviews af met verschillende bewoners in deze wijk. Heeft u interesse om ook deel te nemen aan een interview van ongeveer 10 minuten?

Extra informatie en toestemming

Voordat ik start met het interview, wil ik graag eerst wat extra informatie geven en uw toestemming vragen. Het doel van dit onderzoek is om meer inzicht te krijgen in de motivatie van huiseigenaren, bedrijven en de woningcorporatie om te vergroenen. Tijdens het interview zal ik een paar open vragen stellen en een aantal stellingen voorleggen. De antwoorden worden op papier genoteerd en, wanneer u daarvoor straks toestemming geeft, opgenomen. De opname zal later als tekst worden uitgetypt. Het interview is geheel anoniem. Verder zijn er geen risico's verbonden aan de deelname, en u hoeft geen vragen te beantwoorden die u niet wilt beantwoorden. De deelname is vrijwillig en u kunt uw deelname op elk gewenst moment stoppen. Tot slot heeft u het recht een verzoek tot inzage, wijziging, verwijdering of aanpassing van uw gegevens te doen. Heeft u hierover nog vragen?

1. Geeft u toestemming voor dit interview op de manier zoals zojuist is beschreven?
2. Geeft u toestemming om een audio-opname te maken?

Introductie

1. *Inventarisatie: heeft de huiseigenaar een voor- en/of achtertuin?*

Leg uit dat het gaat om groen in de voor- en achtertuin, en groen op het dak. Stel de volgende vragen.

2. Bent u al bewust bezig met het vergroenen van de voor- en of achtertuin?
 - ➔ Op welke manier en hoe veel bent u hiermee bezig?
 - ➔ Waarom bent u hier wel/niet mee bezig?
3. Heeft u al eens nagedacht over een groen dak?
 - ➔ Waarom heeft u dit wel/niet overwogen?

Stellingen en bijbehorende vragen

Neem de lijst met stellingen door en vraag de huiseigenaar aan te geven of wel of geen rol speelt in de overweging om groen aan te leggen in de voor- en achtertuin. Vul de lijst tijdens het interview in.

- ➔ *Licht toe dat dit alleen over de voor- en achtertuin gaat, niet over een groen dak.*
- ➔ *Geef ruimte om de huiseigenaar een toelichting te laten geven.*

Afsluiting

1. Zijn er, naast de stellingen die we zojuist hebben besproken, nog andere redenen die meespelen in de keuze om wel of geen groen te plaatsen?
2. Stel de gemeente hulp bied aan voor het vergroenen, in iedere mogelijke vorm (bijvoorbeeld geld of advies). Welke hulp zou voor u dan interessant zijn? En wat zou u dan willen aanpassen in de tuin?

Appendix F Interview protocol housing corporation (Dutch)

Appendix F.1 Stellingen

Er zijn voor iedere stelling drie verschillende antwoorden mogelijk.

1. Het speelt geen rol in de overweging om als woningcorporatie wel/niet bezig te zijn met groen
2. Het speelt een kleine rol in de overweging om als woningcorporatie wel/niet bezig te zijn met groen
3. Het speelt een belangrijke rol in de overweging om als woningcorporatie wel/niet bezig te zijn met groen

Table 12 Stellingen woningcorporatie

Stelling	Source	Information from source
Meer groen rondom de woningen		
Minder overlast door weersextremen (water, hitte en droogte)	Table 2	Flooding protection/water management, water scarcity management, urban heat island reduction
Voorkomen van financiële schade door weersextremen (water, hitte en droogte)	<i>See previous statement</i>	-
Een betere kwaliteit van de lucht	Table 2	Air quality improvement
Een verbetering van de biodiversiteit	Table 2	Biodiversity increase/protection
Een verbetering van de mentale en fysieke gezondheid	Table 2	Mental and physical health improvement
De woningen zien er mooier uit	Table 2	Attractiveness of urban area
Het straatbeeld ziet er mooier uit	<i>See previous statement</i>	-
De financiële waarde van de woningen stijgt	Table 2	Higher real estate value
Andere bedrijven of woningcorporaties zijn ook bezig met vergroenen	Table 9	Competitive advantage
Het heeft positieve effecten op het imago van de woningcorporatie	Table 9	Corporate image enhancement
Klimaatadaptatie en vergroenen wordt steeds belangrijker, dus de ontwikkeling van kennis en vaardigheden binnen de woningcorporatie is nuttig	Table 9	Knowledge and skills development
Het maakt een positieve indruk op de gemeente of andere overheidsinstellingen	Table 9	Impressing regulators
Het bedrijf heeft een betere positie in de concurrentie met andere bedrijven	Table 9	Competitive advantage
Voldoen aan de afspraken in het klimaatakkoord	-	-
Een financiële tegemoetkoming (bijvoorbeeld subsidie)	Table 9	Financial incentives

Een initiatief (van bijvoorbeeld gemeente of maatschappelijke organisatie) waar de woningcorporatie bij aan kan sluiten	(Groene Huisvesters, 2022)	Example from practice: initiative by municipality for green project
Isolatie en daardoor een verlaging van het energiegebruik in het appartementencomplex	Table 2	Energy usage reduction
Minder groen rondom de woningen		
Aanleg en onderhoud kost tijd	Table 10	Time constraints
De aanschaf- en onderhoudskosten	Table 10	Financial constraints, lack of political support/guidance
Andere onderwerpen zoals betaalbaarheid en beschikbaarheid van woningen hebben hogere prioriteit	-	-
Er is een grote kans dat de bewoners het niet goed zullen onderhouden	(Groene Huisvesters, 2022)	Example from practice: poor garden maintenance by residents
Kans op ongedierte	Table 10	Nuisance (e.g. dirtiness, insects, leakage)
Kans op allergische reacties	Table 10	Allergies
Het kan voor vuil rond de woningen zorgen (bijvoorbeeld bladeren of luizenplak)	Table 10	Nuisance (e.g. dirtiness, insects, leakage)
	Resident information afternoon ¹	Resident has problems with plaque from lice
De voordelen zijn lastig te kwantificeren, waardoor het financieel onzeker is	Table 10	Financial return is unclear, no clear business case
Het bedrijf heeft onvoldoende kennis over het aanleggen en onderhouden van groen	Table 10	Lack of knowledge, lack of skilled workers
Door de aanleg van groen is er minder ruimte voor andere faciliteiten	-	-

Appendix F.2 Protocol

Vooraf had al een korte kennismaking plaatsgevonden waarin het doel van het interview was uitgelegd.

Extra informatie en toestemming

Voordat ik start met het interview, wil ik graag eerst wat extra informatie geven en uw toestemming vragen. Het doel van dit onderzoek is om meer inzicht te krijgen in de motivatie van huiseigenaren, bedrijven en de woningcorporatie om te vergroenen. Tijdens het interview zal ik een paar open vragen stellen en een aantal stellingen voorleggen. De antwoorden worden op papier genoteerd en, wanneer u daarvoor straks toestemming geeft, opgenomen. De opname zal later als tekst worden uitgetypt. Het interview is geheel anoniem. Verder zijn er geen risico's verbonden aan de deelname, en u hoeft geen vragen te beantwoorden die u niet wilt beantwoorden. De deelname is vrijwillig en u kunt uw deelname op elk gewenst moment stoppen. Tot slot heeft u het recht een verzoek tot inzage, wijziging, verwijdering of aanpassing van uw gegevens te doen. Heeft u hierover nog vragen?

1. Geeft u toestemming voor dit interview op de manier zoals zojuist is beschreven?
2. Geeft u toestemming om een audio-opname te maken?

Introductie

1. Wat is uw functie en wat zijn uw werkzaamheden binnen Pré Wonen?
2. Allereerst gaan we het even kort hebben over vergroenen door woningcorporatie in het algemeen, onafhankelijk van wat er op dit moment al gebeurt bij Pré Wonen.
 - ➔ Welke mogelijkheden denkt u aan bij vergroenen binnen een woningcorporatie?
 - ➔ Wat zouden hierbij de verantwoordelijkheden zijn van de woningcorporatie?
 - ➔ *Geef suggesties over groene mogelijkheden wanneer deze niet genoemd worden. Leg uit dat het interview zal gaan over alle mogelijkheden die bij deze vraag besproken zijn.*
3. Dan volgen er nu een paar vragen over vergroenen binnen [naam woningcorporatie].
 - a. Wat doet Pré Wonen momenteel aan vergroenen?
 - b. Zijn er ook dingen die Pré Wonen juist niet doet aan vergroenen? (terugkoppelen naar eerdere mogelijkheden die zijn genoemd)
 - c. Waarom worden deze dingen wel/niet gedaan?

Stellingen

Neem de lijst met stellingen door en vraag de medewerker aan te geven of het voor de woningcorporatie wel of geen rol speelt in de overweging om bezig te zijn met vergroenen.

- ➔ *Geef ruimte om een toelichting te laten geven.*
- ➔ *Vraag door wanneer er minimale toelichting wordt gegeven of een redenatie niet duidelijk is.*

Afsluiting

4. Zijn er, naast de stellingen die we zojuist hebben besproken, nog andere redenen die meespelen in de keuze om wel of geen groen te plaatsen?
5. Zijn er nog toekomstige plannen voor vergroenen bij Pré Wonen?

Appendix G Results house owners

Appendix G.1 Comments by house owners to statements

Table 13 Summary of comments by house owners, structured by statement topics

Statement topic	Comments mentioned more than once (number of times mentioned in parentheses)	
	Yes, it plays a (small) role	No, it does not play a role
(more) green around my house		
Less nuisance caused by extreme weather (water, heat and drought) around my house	House owners refer to water or heat problems (7).	house owners indicate that they do not experience extreme weather problems (2).
Less nuisance caused by extreme weather (water, heat and drought) in the neighbourhood	Flooding on the street is mentioned (2).	-
Preventing financial damage caused by extreme weather (water, heat and drought)	The only extreme weather condition with financial risks that is referred to, is a storm (3).	House owners never thought about it (3) or argue that there are no extreme weather problems (3).
Better air quality	-	House owners say Zandvoort already has good air quality (5) and it would have been different if they lived in a large city (2).
Improvement of mental and physical health	Especially mental health is mentioned, because greenery creates a pleasant living environment or it is a hobby (6).	Some house owners say this does not play a role, because there is sufficient nature in or around Zandvoort (2).
The financial value of the property increases	-	House owners doubt if this is true (4) or did not realise this is the case (3). Others argue they are not planning to sell their house (2).
Harvest from my own garden	-	Lack of space in the own garden is mentioned as a reason to not have a kitchen garden (3). Also, other house owners do have a kitchen garden, but located at a shared kitchen garden somewhere else in the city (2).
A financial compensation	Some house owners say financial support is "always nice" (2).	Further, house owners prefer to spend it on others who need it (2).
No green or less green around my house		
Maintenance of greenery takes time	-	House owners agree it takes time, however, they do not mind (4).
Risk of vermin	-	Some house owners do not have these problems (5). Others agree, however, they do not mind (8).
Risk of allergic reactions	-	Some house owners say they never thought about this (2). Some have hay fever, however, argue this will be the case without a green garden as well (2).

Insufficient knowledge about implementation and maintenance of greenery	-	House owners say you can ask help from acquaintances or professionals (3). Further, some house owners mention that knowledge grows with time (2).
Less space for other facilities	-	For house owners this is not a problem since it can be combined (4) or the garden is big enough (4). Other facilities mentioned by house owners are mainly a sitting area or parking space.
Greenery in my garden gives too much shadow	House owners keep this in mind (3). Further, in contrast with the statement, house owners also say they like the shadow (5).	It does not play a role, however, house owners keep it in mind for their garden design (3).

Appendix G.2 House owners with limited interest in green

Table 14 Statement scores house owners thinking negative about greenery, ranked by importance (n=3)

	Important role	Small role	No role	Value
(more) green around my house				
My house looks more beautiful	1	1	1	Use value (aesthetic)
Harvest from my own garden (for example fruit tree or kitchen garden)	1	1	1	Use value (pleasure/comfort)
A financial compensation (for example subsidies or free plants)	1	0	2	Economic value
Friends or neighbours are also working on green in the garden	0	1	2	Social value
All other statements	0	0	3	-
No green or less green around my house				
Maintenance of greenery takes time	3	0	0	Use value (time)
Vermin around my house	1	0	2	Use value (physical hindrance)
Insufficient knowledge about implementation and maintenance of greenery	1	0	2	Professional value
Less space for other facilities (for example terrace or playground)	1	0	2	Use value (physical hindrance)
It can cause dirt around my house (for example leaves or lice plaque)	0	1	2	Use value (physical hindrance)
The purchase and maintenance costs	0	1	2	Economic value
Greenery in my garden gives too much shadow	0	1	2	Use value (physical hindrance)
Risk of allergic reactions for people of my own household	0	0	3	Use value (health)
Risk of allergic reactions for people in my neighbourhood	0	0	3	Social value

Appendix H Results housing corporation

Table 15 Statements for which the respondents agreed – housing corporation

Statement topic	Does it play a role?	Comments/explanation
(more) Green infrastructure		
Less nuisance caused by extreme weather (water, heat and drought)	Yes	Residents also indicate they have problems with heat or water.
The street or neighbourhood looks more beautiful	Yes	Among others, it is positive for the health of residents. However, aesthetics of the street is not of main importance. Further, it is also the responsibility of the municipality.
Improvement of mental and physical health	Yes	This is important for the liveability for the residents.
Comply with climate agreement	Yes	The housing corporation just has to comply. In addition to the Paris agreement, there are regulations from the municipality of Haarlem and Metropoolregio Amsterdam. It helps, because working together with other parties can result in higher achievements.
A financial compensation	Yes	Finances can be a limiting factor.
An initiative that the housing corporation can join	Yes	There are various reasons why this is interesting: Initiative by residents – satisfy the needs of residents, residents have a connection, housing corporation is mostly facilitating, there is budget for resident's initiatives. Initiative by municipality – want to have a good cooperation with municipality, do not have to do everything alone, cost sharing.
The financial value of the houses increases	No	The housing corporation is not interested in the value, and the housing corporation does not sell the houses.
No or less green infrastructure		
There is a high probability that the residents will not properly maintain greenery	Yes	Because of time (monitoring and talk to residents) as well as money (hire a gardener to do maintenance).
The purchase and maintenance costs	Yes	Unless it is proven that it does not cost extra money.
Other topics like affordability and availability have higher priority	Yes	The respondents refer to prioritisation based on finances.
The housing corporation has insufficient knowledge about the implementation and maintenance of greenery	Yes	Currently, this is the case and consequently the housing corporation prefers safe choices. The Green team is set up to solve this knowledge gap.
Greenery takes time	No	The explanations are different. One respondent argues it does not cost time, but money. And another respondent argues that projects will take time and cost money in any case (e.g. replacing a regular roof takes time and costs money as well).
Risk of allergic reactions	No	Never thought about it and a minimal risk.

Table 16 Statements for which the respondents disagreed – housing corporation

Statement topic	Comment	
	Yes, it plays a role	No, it does not play a role
(more) Green infrastructure		
Preventing financial damage caused by extreme weather (water, heat and draught)	It is part of risk management.	There are currently no financial consequences. We know it will be in the future.
Better air quality	For the residents as well as climate change.	The housing corporation prefers to take care about the financial situation and comfort of residents.
Biodiversity improvement	For the residents as well as climate change.	Residents dislike insects.
The houses look more beautiful	<i>No explanation</i>	Especially with a focus on costs: an ivy plant can for example be beautiful, however, causes problems for the wall and thus maintenance is needed.
Other housing corporations or companies are also working on green improvements	Housing corporations are not competing. They like to join each other's projects, to adopt ideas. They do not want to leave behind.	The housing corporation does not run after others and sets its own course. However, when another party approaches with the question to join, the housing corporation is open for that.
It positively affects the image of the housing corporation	The image is important for a housing corporation. Towards municipality, because the better your image, the more you can accomplish. And towards the residents it can be important as well.	Is considered in decisions, however, it is not a main reason. The green team is for example formed because of intrinsic motivation, not because of external factors.
It can positively impress the municipality or other governmental organisations	<i>No explanation</i>	Not the aim, however, a positive side-effect.
Climate adaptation and greening become more important, so the development of knowledge and skills within the housing corporation is useful	Yes, but it is not a reason to not implement green infrastructure.	That is why the Green team has been set up. Knowledge is needed before implementing.
The housing corporation has a better position in the competition with other companies	<i>No explanation</i>	Other housing corporations as well as companies are no competitors.
Isolation and thus lower energy use of the houses	Generally, the residents do not have much money, so energy reduction is interesting. In addition, the extended lifespan caused by a green roof can be financially beneficial. According to one respondent, sustainability is a positive side-effect. According the another, water buffering is most in relevant (because a sedum has limited effect on biodiversity).	The required isolation value of a roof is hard to reach with a green roof only. Isolation is currently realised by using construction materials only (no green).

No or less green infrastructures		
Risk of vermin	Residents can experience this as nuisance.	Two of the respondents do not know.
It can cause dirt	Especially leaves at the streets. On the one hand, it is mainly the responsibility of the neighbourhood. On the other hand, a housing corporation wants to have a tidy neighbourhood.	<i>No explanation</i>
The benefits are hard to quantify, so it is financially insecure	<i>No explanation (respondent already mentioned this in the introduction question)</i>	One respondent does not know. Another respondent agrees that the benefits are hard to quantify, however, explains that the housing corporation argues it will be worth it. That is underpinned by the example of extreme weather.
Less space for other facilities	Residents prefer parking spots over greenery, and the housing corporation wants to satisfy their needs.	<i>No explanation</i>