

MASTER THESIS

Factors influencing climate change adaptation by residents

Comparative case study of projects in Eindhoven



Image of a street in Philipsdorp

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Preface

This thesis is the final academic course to meet the requirements for the Master of Civil Engineering and Water Management at the University of Twente. The subject of this final course is part of my specialization and my professional background "Urban Adaptation to climate change". This thesis aims to provide new insights regarding the implementation of adaptation dialogues for municipalities like the municipality of Eindhoven. The research provided insights into the participation activities that the municipality of Eindhoven used to motivate residents to undertake adaptive actions themselves in the private spaces.

During my academic courses I had an exciting time and learned a lot at the University of Twente. Therefore, I would like to thank people. Particularly, many thanks to Dr. Ir. Joanne Vinke-de Kruijf for supporting this graduation subject about Factors influencing climate change adaptation by residents. The feedback provided was an immense help during this present research and writing the final report. Additionally, many thanks to second supervisors Dr. Ir. Denie. Augustijn and to Ir. Luuk Postmes for also giving constructive feedback of my research.

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Summary

Climate change is a global environmental issue today and will continue to be in the future. Mitigation measures are not enough to stop climate change. The need to adapt is required at the global level, especially at the city level because of the high population who live in urban areas. The involvement of residents in adaptive actions alongside of local governments is increasingly important to decrease the impacts of extreme weather events. The Netherlands is vulnerable to climate change since 2/3 of its territory is located below sea level and it is also an urbanized and densely populated country per square kilometer compared to many countries. The DPRA aims to make the Netherlands climate resilient country by 2050. Other organizations like municipalities are expected to identify vulnerabilities in their area through a stress test, to conduct adaptation dialogues with relevant stakeholders and to formulate strategy to deal with these vulnerabilities. The municipality of Eindhoven started the adaptation dialogues in different projects to encourage residents to undertake adaptive actions themselves. According to studies (e.g., Sarzynski, 2015; Roggero, 2019; Wamsler, 2019), these residents' adaptive actions are generally influenced by factors such as regulations, financial incentives, participation and local-context conditions. This study aimed to explain the influence of adaptation dialogues, policy instruments (regulations and financial incentives) and local-context conditions on adaptive actions of residents in Eindhoven. This study also aimed to formulate recommendations to the municipality in order to stimulate residents' adaptive actions in the private spaces related to climate change adaptation.

To achieve the objectives of this study, a conceptual model was developed based on literature research. The model involves the factors (participation, policy instruments and local-context conditions) as independent variables and adaptive actions as dependent variables. The model shows a direct relationship between participation, policy instruments and adaptive actions. The model also states that the local-context conditions affect the relationships between participation, policy instruments and adaptive actions.

To explain and compare the influence of the factors, a single case, the city of Eindhoven was used. The case involves three projects: project A (Hastelweg/Strijpsestraat), project B (Vestdijk) and project C (Philipsdorp). The projects are embedded in a similar context, i.e. adaptation to climate change in the Netherlands, which is stimulated by the DPRA. Data (qualitative and quantitative) were collected via document analysis and interviews with civil servants involved in the projects. Data stemming from these two sources were compared to the total number of households per project to determine whether a factor scored high, medium or low. Furthermore, data were analyzed according to the literature.

Based on the conceptual model, the assessment of the projects shows that Project A scored medium on participation, and implemented the most adaptive actions probably because local-context conditions have a supportive influence. While project B also scored medium as project A on participation, but implemented the fewest adaptive actions probably because local-context conditions have a restrictive influence. Project C scored low on participation, and implemented the second most adaptive actions probably because more local-context conditions have a supportive influence. As for regulations, all projects scored high, whereas regarding financial incentives project A had the highest score compared to projects B and C. Furthermore, project A had the most supportive local-context conditions, followed by project C and project B.

Based on the findings of this present study, it can be stated that the municipality of Eindhoven can rely on participation to motivate residents to undertake adaptive actions in the private spaces. Furthermore, the influence of participation on adaptive actions of residents was likely affected by the local-context conditions such as house ownership. The influence of policy instruments on residents' adaptive actions was probably also affected by local-context conditions. To achieve its ambition to be a climate-proof in 2050, it is recommended that the municipality of Eindhoven should involve an active citizen advisory group for adaptive actions of residents such as project A. In addition, it is recommended to pay more attention to communication about the financial incentives of green gardens and green roofs. Moreover, future research should be focusing to the same characteristics of projects in terms of the type of houses.

Keywords: Climate change adaptation, adaptation dialogue, adaptive actions, participation, regulations, financial incentives, local-context conditions.

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1 Introduction

1.1 Background and problem context

Climate change is a global environmental issue today and will continue to be in the future. This is mainly due to its negative impacts on humans in different ways. Climate change is caused by both natural factors such as volcanic eruption and variation in solar output, and human induced causes mainly by the emission of greenhouse gases (IPCC, 2014). Since the entry into force of the Kyoto Protocol in 1997, several countries and international organizations have decided to take mitigation measures to reduce greenhouse gas emissions. However, those actions are not enough to stop or reverse climate change, and thus adaptation has gradually been recognized as a policy objective in addition to mitigation (Mees et al., 2012).

Nowadays, the need to adapt to climate change is now recognized at the global level. At this level, important policies for adaptation have been put in place such as the development of the Adaptation Fund and the promotion of National Adaptation Programs of Action (NAPAs) by the UN (Dilling et al., 2017). Adaptation to climate change can occur on different scales ranging from global, national, regional, and city settings (Bryant et al., 2000). The adaptation on each scale has its own characteristics. There is an urgent need for cities to adapt to climate change (IPCC, 2014). Climate change adaptation is defined as an adjustment to existing practices to reduce the impacts of current or future climate change (Osborne et al., 2010; Grothmann and Patt, 2005; Smit and Pilifosova, 2003). Adaptation of cities is necessary because more than half of the world's population now lives in urban areas and the climate change impacts are local (Bulkeley, 2010). Arguing that many of the actions that are necessary for climate change adaptation have to occur at the local level.

In this context, attention for climate change has shifted the climate adaptation responsibility from the inter(national) level to the city level. This responsibility has led cities to take stock of their situation and look for new ways to adapt and to create resilience (Wamsler et al., 2014). One of the new ways is the involvement of residents alongside of public authorities because adaptive actions to increase the resilience of properties can be undertaken by residents, and at the local scale (Adger et al., 2009). Moreover, the effectiveness of adaptive actions is directly related to the adaptation behaviour of residents and the level of their involvement (Wamsler et al., 2014).

The Netherlands is a low-lying country, about 2/3 is located below sea-level and is characterised by a high population density (470 inhabitants per km²), and intensive economic activities (Goosen et al., 2014). The country is very urbanized. Urban areas are more vulnerable to the possible consequences of climate change such as sea-level rise, changing precipitation patterns and river discharge, and increasing drought (Biesbroek et al., 2011). Therefore, urban areas need to reduce the effects of climate consequences by planning and implementing adaptive actions with the participation of residents. In the Netherlands this was reinforced in 2018 with a special plan of the Delta Program, the Delta Plan on Spatial Adaptation (DPRA), in which an important role is assigned to the municipalities to involve other actors such as residents in the adaptation process. The DPRA is a joint plan drafted by municipalities, regional water authorities (RWAs), provinces and the central government with the aim of establishing a climate adaptive country. The plan involves seven objectives: 1) mapping out the vulnerabilities, 2) conducting a risk dialogue and drawing up a strategy, 3) drawing up an implementation agenda, 4) capitalizing on opportunities for linkage, 5) encouraging and facilitating, 6) regulating and embedding and 7) responding to calamities (Deltaplan Ruimtelijke Adaptie, 2018).

The first objective of the DPRA, i.e., the stress test, provides insight into the vulnerabilities within the urban areas. The results of this stress test serve as input to conduct the risk dialogue. However, the risk dialogue can take place at various levels: in the region; city; and neighborhood, in which the participation of local authorities, companies and citizens is required. This study focuses on the risk dialogue in the neighborhood with residents and is referred to as adaptation dialogue. This dialogue is already being actively conducted with residents in Eindhoven. The municipality has several projects in which adaptation dialogue plays a role, in order to address climate change, such as Hastelweg/Strijpsestraat, Vestdijk and Philipsdorp.

Although much has been done in the area of adaptation dialogues in Eindhoven, this study focuses on the actions that individuals undertake to respond to climate change, as these are among the most important in the local adaptation realm (Nordgren et al., 2015). Specifically, the current study focuses on explaining the factors

(regulations, financial incentives, participation and local context conditions) that may influence the residents in the city of Eindhoven to implement adaptive actions, with a focus on flooding.

1.2 Problem statement

This research focuses on the city of Eindhoven in the province of North Brabant in the South of the Netherlands. The municipality of Eindhoven started to conduct the adaptation dialogues in the neighborhoods before the DPRA came into force. The municipality acknowledged that the adaptation dialogues that actively involve residents (i.e., citizens, companies) and civil servants are an effective adaptation approach that can positively affect the projects. Since residents can provide the municipality relevant information tailored to local settings for appropriate adaptive actions. The adaptation dialogues focus on making the neighborhoods climate resilient, liveable and healthy.

However, during the projects, the municipality has observed several barriers and factors influencing the adaptation dialogues like lack of motivation and trust, a conflict of interests among stakeholders (civil servants, entrepreneurs, citizens, groups of interests and companies), the choice of climate adaptive actions to be implemented, the number of stakeholders to be involved, the time allowed to conduct the dialogue, when to involve stakeholders, and whom to involve. The extent of influence of these barriers and factors varies considerably from one neighborhood to another. To tackle these barriers, the municipality used the financial incentives and set up several participation activities to actively involve residents in the projects. During these participation activities residents have been informed about the impacts of climate change on their neighborhoods. The goals of these activities are to enhance the adaptation dialogues and to increase the climate awareness of residents, which may result to more adaptive actions of residents.

Given the importance of participation and financial incentives, it remains unclear for the municipality how to conduct the adaptation dialogues based on the type of residents to encourage adaptive actions at the household level. Therefore, the municipality of Eindhoven wants to know the influencing factors. Additionally, the municipality wants to know how the financial incentives and participation activities influenced the residents' adaptive behaviour. Since, the practice of implementing adaptive actions can be described as adaptive behaviour (Brink and Wamsler, 2019).

The study aims to contribute to get insights into which factors may predict the adaptive behaviour of residents in the neighborhoods. To achieve this, existing theories will be used with regard to the adaptation dialogues, impacts of participation, financial incentives, regulations and local-context conditions to explain the adaptive behaviour of residents. Based on this explanation, factors about residents' adaptive actions can be identified which can be used by the municipality to compare the theoretical knowledge with the empirical outcomes. The results of this study can be used to determine whether the factors found in the literature can predict the adaptive behaviour of residents.

1.3 Research objective and research questions

The objectives of this study are twofold: *Firstly, this study aims to explain to what extent the adaptation dialogues, regulations, financial incentives and local-context conditions have influenced residents' adaptive actions in Eindhoven. Secondly, it aims to formulate recommendations to the municipality in order to stimulate residents' adaptive actions.* To achieve the objectives of this study, the main research question is as follows:

How do the local-context conditions, the adaptation dialogue and the local policy instruments influence the adaptive actions of residents in the city of Eindhoven?

In order to answer the main research question, the following sub-questions have been formulated.

1. *According to the literature, what are the factors that influence the implementation of adaptive actions by residents?*
2. *In the case of Eindhoven, to what extent do regulation, financial incentives, participation and local-context conditions influence the adaptive actions by residents of the case studies?*
3. *By comparing the case studies, what are the factors that explain the implementation of adaptive actions by residents?*
4. *What recommendations can be formulated to the municipality with regard to the adaptation dialogues in order to increase the adaptive actions of residents at the household level?*

1.4 Scope

Since climate change has an impact on residents at neighborhood level, adaptation dialogues have been introduced to stimulate the adaptive behaviour of residents like in Eindhoven. In view of this situation, the present study assesses the influence of factors on adaptive actions by residents in Eindhoven. To this end, municipal projects will be used in this study. The scope of this study is restricted to the influence of participation, regulations, financial incentives and the local-context conditions regarding residents' adaptive actions. The empirical study in this research is restricted to cases located across Eindhoven, wherein the effects of factors mentioned above were studied in documents and interview sessions. Further, the study also involves an analysis of adaptive actions implemented by residents. The scope of this study is limited to Eindhoven, and more specifically to those actions taken in private spaces.

1.5 Scientific relevance

There is general scientific literature on dialogues (e.g., Grunig & Grunig, 1992; Gao and Zhang, 2001) but no scientific literature on adaptation dialogues between local governments and stakeholders in the context of climate change adaptation. Therefore, understanding how factors related to regulation, financial incentives, participation and local-context conditions may influence the adaptive actions of residents is important in the adaptation realm. In order to improve this understanding, projects that aim to stimulate the adaptive behaviour of residents in the neighborhoods. Further, a better understanding could contribute to develop an adaptation dialogue approach to encourage them to increase their adaptive actions in the private spaces.

More research has focused on studying experience and risk perceptions, flooding and preparedness behaviour than on other motivational factors (Roggero, 2019). This study will focus on factors like participation, financial incentives, regulations and local-context conditions to analyse the adaptive actions. Therefore, it will contribute to increase our understanding about the influence of participation and other factors on adaptive actions. This study will derive different factors from the existing literature. First, an overview of local policy instruments such as regulations and financial incentives factors will be presented from the findings of researches such as Roggero (2019) and Porter et al. (2014). The public participation framework presented by Sarzynski (2015) will be included to get a better understanding of public participation in adaptive actions, then an overview of the local-context conditions will be presented, which may affect the adaptive behaviour of residents. These factors will be used to assess practical cases in Eindhoven and to identify the factors that may predict the adaptive actions of residents in the neighborhoods. The findings of this study will therefore contribute to gaining insight into the adaptive behaviour among residents and how to encourage them to undertake actions.

1.6 Research outline

To realize the objective of this research, in the first phase, literature on climate change adaptation, participation in climate change adaptation and factors and barriers influencing adaptation behaviour were studied (**chapter 2**). With this background, a conceptual model was developed to assess the influence of factors on adaptive actions of residents in the neighborhoods of Eindhoven (**chapter 2**). For this, data from municipal documents, interviews and municipality projects were collected (**chapter 3**). Based on these data, a comparison was made and an explanation was given with regard to factors that influence adaptive actions (**chapter 4**). Finally, a conclusion and a number of recommendations was formulated to the municipality of Eindhoven (**chapter 6**), Figure 1 gives an overview of the research framework.

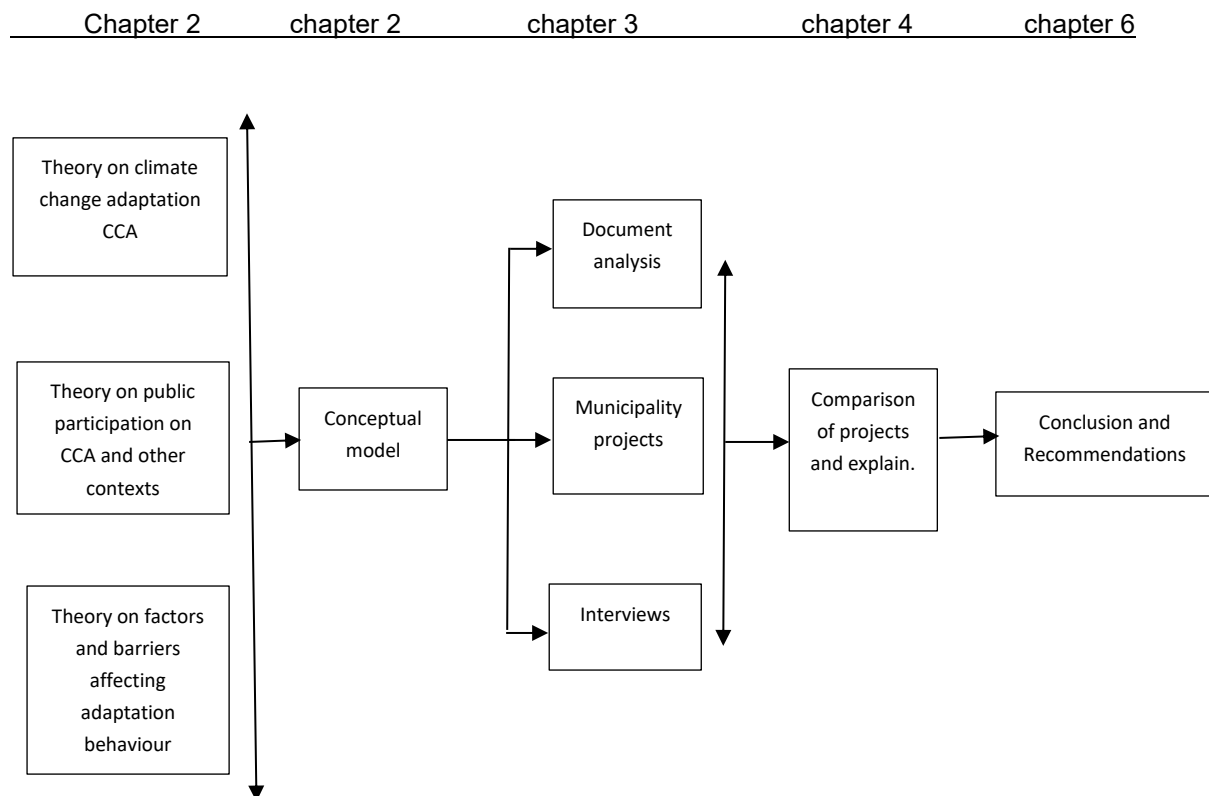


Figure 1: Research Framework

2 Theoretical Framework

This chapter will make use of existing theories to identify the factors that may influence the adaptive actions of residents. The findings of these theories will play a significant role in answering the first research question, namely "According to the literature, what are the factors that influence the implementation of adaptive actions by residents?". It will also attempt to outline the effects of these factors on adaptive actions and types of public participation. Subsequently, a conceptual model built from the factors will be presented.

2.1 Local adaptation and adaptive actions by residents

Adaptation has shifted from the national to the local level with a focus on the causes and impacts at this level (Baker et al., 2012). In this context, local authorities seem to have a leading role to incorporate climate change adaptation into their development plans and policies (Wamsler et al., 2014). Local authorities can take the leadership to coordinate different efforts across sectors and departments and facilitate implementation, but the response to climate adaptation issues needs to be addressed broadly with different actors (Chu et al., 2015). This supposes that actors other than local authorities should also adapt to climate change.

According to Baker et al. (2012, p.128), the implementation of adaptive measures is at risk because of "lack of clear roles and responsibilities for local authorities, an absence of statutory obligations and constraints on local authorities manifesting from the interplay between policies and regulations within broader governance frameworks". Baker et al. (2012) provide three recommendations that can improve local adaptation policies. Firstly, they emphasize that on-going financial support is needed in order for municipalities to collect the necessary information and create plans for the effects of climate change. Secondly, higher government levels should provide municipalities with requirements and standards for adaptation. And third, it is essential that the public participates in developing adaptation plans. Reported recommendations of local adaptation indicate that there is no single solution, likely reflecting the multiple and context-specific differences.

Residents have become a key player in the fight against climate change because residents' adaptive behaviour can significantly contribute to reducing the impacts of climate events (Wamsler and Brink, 2014). The broad term of climate change adaptation behaviour includes adaptive actions, adaptive behaviour, adaptation engagement and climate change adaptation (Grothmann & Reusswig, 2006; Wamsler and Brink, 2014; Snel, 2021). The adaptive actions in turn include any type of adaptive measures that an actor or group of actors take to reduce and adapt to disaster and risk, including measures related to climatic extremes (Wamsler and Brink, 2014).

Research on climate adaptation pointed out that adaptive actions and residents' consent are necessary to enhance the resilience of communities to climate change (Tompkins and Eakin, 2012; Mees et al., 2019). The adaptive actions of residents are both desirable and much needed in addition to local governmental adaptive actions. According to Wamsler (2017) adaptive actions refer to actions that residents undertake on the household level. Snel, (2021) distinguishes three forms of these actions: technical, financial and behavioural actions. The first is related to measures that residents take to enhance the resilience of their private property. The second refers to financial schemes as insurance that residents can get to recover from climate events and to increase climate resilience. The third includes participating in community emergency plans and monitoring flood forecasts. Here, the focus is on the first.

However, the residents' adaptive actions have to cope better with increasingly challenging weather and climatic conditions. Because some adaptive actions can increase exposure and vulnerability to climate change and be described as being maladaptive practices, such as adapting to flooding at the expense of the greater vulnerability of others (Glavovic and Smith, 2014). In order to reduce vulnerability, Hegger et al. (2017) presented in the domain of stormwater management adaptive measures that residents can take such as green roofs, (re)planting vegetation and rainwater harvesting. This is also explained through the Dutch urban water management policy, at the beginning of the 21st century which strives to disconnect the rainwater from the sewer system. In some cities, residents are made aware of their role and their contribution to the paving of gardens.

Adaptive actions by residents can take a variety of forms based on timing and intent. The timing includes actions such as anticipatory and reactive actions (Wamsler and Brink, 2014; Glavovic and Smith, 2014). Anticipatory adaptive action is proactive and takes place before climate change impacts are experienced.

Reactive or 'self-help' adaptive action takes place after climate impacts have been experienced. Both actions, anticipatory and reactive aim to increase the resilience of residents vis-à-vis of climate risks. While intent-based adaptation is an autonomous adaptive action, which refers to behavior that residents adopt without explicit planning or the assistance of local authorities or governments (Wamsler, 2016). Sarzynski (2015) refers to the adaptive actions of residents as a micro-scale adaptation. These actions are "low-tech" adaptation actions on private properties (Schrenk et al., 2016, p.317). Consequently, residents are considered also to have responsibilities in adapting to climate change by taking adaptive actions. However, there is significant evidence that residents adaptive actions can also be influenced by taking into account non-climatic conditions (e.g. Hallegatte et al., 2016; Sarzynski, 2015; Roggero, 2019; Brink and Wamsler, 2019; Dang et al., 2019). The following table includes adaptive actions that residents can undertake themselves and references.

Table 1: Overview of adaptive actions that constitute effective actions against the impacts of climate change (which include actions that residents can undertake)

| Forms of actions | Types of adaptive actions | References |
|-------------------------------|---|---|
| Technical actions (prevent) | Storage: temporary rainwater storage (underground and aboveground) | Schrenk et al., 2016; Hegger et al., 2017; Brink and Wamsler, 2019; Snel, 2021; Baack and Vinke-de Kruijf, 2022 |
| | Vegetation: (re)planting vegetation in gardens and on roofs. Using plants and trees to improve drainage | |
| | Drainage systems: managing flood pathways | |
| | Water resources and quality: separate drainage systems for surface water and foul water | |
| | Flood defenses: raise and flexible use of ground floor level | |
| Financial Actions (recovery) | Insurance: extreme weather insurance for resilient climate events recovery | Slavíková et al., 2020; Snel, 2021 |
| | Subsidy: governments relief subsidies | |
| | Buy-outs | |
| Behavioural actions (prepare) | Monitoring flood forecasts | Kuhlicke et al., 2020; Snel, 2021 |
| | Storing emergency supplies | |
| | Joining community emergency plans | |

2.2 Factors affecting adaptive actions by residents.

Recent research indicates that the process of adaptation to climate change at individual level includes adaptive actions that can also be categorised into short-term and long-term, which in turn can be affected by various factors (Dang et al., 2019, Roggero, 2019, Brink and Wamsler, 2019). This section will give an overview of the factors that affect the protective adaptive actions of residents. It will try to get more insights into the climatic and non-climatic factors, namely the regulation, financial incentives, the participation of residents and the local-context conditions. Then, a conceptual model will be introduced that was developed for assessing the policy instruments, participation levels and local context of the different case studies.

2.2.1 Regulations and financial incentives

According to Roggero (2019), attempts to link policy instruments like regulations and financial incentives to a more successful diffusion of adaptive actions are necessary for adaptation. Because the self-interest of residents may not always be sufficient to a more successful diffusion of adaptive actions. Furthermore, there is a lack of responsibility by residents, although they have the means of supplying resources to facilitate adaptation (Agrawal, 2008). Adaptation itself is a local policy in which residents are actively encouraged to take responsibility by implementing adaptive actions in and around the house (Mees et al., 2019). Table 2 presents

the definition of regulations and financial incentives and their effects on adaptive actions by residents, including sources.

According to Roggero (2019), local governments may increase the adaptive actions under their regulations by relying on conditions. Specifically, they can design or set conditions of adaptive actions to encourage residents to adapt to climate change. However, local governments need to be engaged in communication by disseminating conditions on adaptive actions to residents. Since this dissemination allows the residents to be aware and can lead them to accept the conditions. Acceptance of conditions will positively shape residents' attitudes and will appear to stimulate the adaptive actions (Roggero, 2019). Additionally, local governments use conditions as a tool to compel residents to take different type of adaptive actions to protect themselves. These adaptive actions can vary from small to large with different performance in terms of benefits against climate change. Moreover, according to Hallegate et al.(2011), local governments cannot expect spontaneous adaptive actions by residents without conditions. This means that conditions can compel residents but also to be used to organize residents' adaptive actions for adaptation.

Local authorities introduced various financial programmes in order to stimulate citizens to undertake adaptive actions (Mees et al., 2019). Because taking adaptive actions also involves costs. In addition, most if not all adaptive actions take place primarily on the households level (Osberghaus et al., 2010). Porter et al. (2014) state that the adoption of adaptive actions are unlikely to happen in households without financial incentives. They argue that there is a positive relation between the proactive adaptation by households and the greater financial incentives. This means that financial incentives are an important determinant factor that increases adaptive actions. The statements correspond with a study by Mees et al. (2019) who point out that financial incentives are worth more on private property than on public ground. However, long-term financial incentives by households is required to maintain this relation at a satisfaction level. The financial incentives can help to increase the adaptive capacity (e.g. financial resources and access to information) and to better facilitate adaptive responses of individual house owners (Porter et al., 2014). Further, financial incentives can support adaptive actions for a longer period (Mees et al., 2019).

Table 2: Overview of policy instruments and their influence on adaptive actions

| Local policy instruments (factors) | Definitions | Influence | References |
|------------------------------------|--|---|--|
| Regulations | Regulations refers to the conditions of adaptive actions | Acceptance of conditions will positively shape residents' adaptive behaviour | Roggero,2019 |
| Financial incentives | supports from governments to motivate the initiatives or continuation of household adaptive actions. | The financial incentives increase adaptive actions. However, if the financial incentives are not sufficient, there might be a negative relation | Porter et al., 2014; Mees et al., 2019; Roggero,2019 |

2.2.2 Participation

Sarzynski (2015) states that participation will increase the effectiveness of adaptive actions because it bridges the gap between bottom-up and top-down approaches to adaptation. Besides its function as a bridge in adaptation governance, in order to establish and implement adaptive action, it is necessary to involve different stakeholders and provide them with the possibility to contribute to the adaptation process (Wamsler, 2017). In table 4, an overview of factors that consist of each element of the participation is given, including their definition, expected influence and references.

Local governments should actively encourage citizens to get involved in adaptive actions (Tonkens, 2014). This means a shift of responsibilities from local governments to citizens (Mees et al., 2019). As a result, citizens are increasingly responsible for adapting to climate change. This “responsibilisation” of citizens can open a window of opportunity such as collaboration (Mees et al., 2019). Collaboration is understood as a dimension of interaction between governments and residents (Brink and Wamsler, 2018). According to Uittenbroek (2014), many adaptive actions in cities are the results of a collaboration, which may emerge between local authorities and residents or among residents. Therefore, collaboration can emerge as a mode of meaningful participation and is becoming more prevalent as a local climate response (Sarzynski, 2015). The research by Roggero (2019) found that cities with large adaptive action do so through collaboration. Furthermore, he argues that climate adaptation is a collective action that can best be addressed by fostering collaboration, and mutual understanding among actors. For this to happen and to further development of adaptive actions, municipalities must allow for collaboration with other actors. Therefore, collaboration can be considered as a form of participation of different actors, even though the collaboration can be temporary (Sarzynski, 2015).

Participation requires communication between participants (Uittenbroek et al., 2019). This communication can address concerns about climate change and the adaptive actions to be implemented at the household level. This is where the availability of information on climate risks and specific adaptive actions at the household level plays a crucial role in avoiding maladaptation (Osberghaus et al., 2010; Glavovic and Smith, 2014). This information should be disseminated through multiple available sources, and would naturally aim to enhance the adaptive actions of household actors (Smit & Wandel, 2006; Osberghaus et al., 2010). The dissemination of information to residents can also be seen as a form of involving residents in adaptive actions (Roggero, 2019).

It is widely stated throughout the literature that information is vital to ensure that adaptation is carried out by people in an adequate and timely manner (Stern, 2007; Osberghaus et al., 2010). According to Hallegate et al. (2011) the most effective method that allows households to adapt is to ensure that residents have access to the same information regarding how to adapt. This dissemination of information can benefit the adaptive actions and possibly change the adaptive behaviour of residents (Roggero, 2019). This has been illustrated in the study of Kievik and Gutteling (2011) who state that information on actions seems to coincide with the intention of residents to take self-protective adaptive actions. They indicate that the more residents have access to information, can lead to an increase in actions taken by residents. Furthermore, the increasing awareness of responsibility could become more manifest when residents have access to information. However, this information regarding adaptive actions can also be obtained from the municipalities. Nevertheless, information can be very different depending on the area, which can be locally or globally focused information.

In some literature participation was studied as a process of dimensions. In the scientific paper of Fung (2006), he distinguishes three dimensions that describe a decision-making process. They are: participant selection (public inclusion); communication and decision process (intensity); and authority and power (degree of influence). Fung’s dimensions have been used by Dietz and Stern (2008) to develop five dimensions to illustrate the structure of participation in governance processes: breath, openness, intensity, influence, and goals. Further, Sarzynski (2015) used the five dimensions of Dietz and Stern to assess the public participation in the governance of urban climate adaptation. This participation structure is used in this study to analyse participation of residents in adaptive actions. Table 3, presents the five dimensions, which are further elaborated below.

Table 3: Public participation in climate change adaptation (Dietz and Stern, 2008)

| Dimensions | Breadth (who) | Openness (when) | Intensity (how much) | Influence (what) | Goals (why) |
|--------------------------------------|---------------|---|----------------------|---|--------------|
| Active participation at the top ↑ | Broad | High (Pre-planning + planning + development) | High | High (Empower + collaborate) | Both |
| | Moderate | Moderate (Development + Implementation) | Moderate | Moderate (Collaborate + consult) | Intrinsic |
| | narrow | Low (Implementation + Evaluation) | Low | Low (Consult + Inform) | Instrumental |

Breadth

Planning and implementation of climate adaptive measures require the participation of the public (Hegger et al., 2017). This means that public participation should not be limited to a small circle of influential stakeholder groups (Junker et al., 2007). Ayers et al. (2014) indicate that an adaptive action is successful if affected communities are involved to take measures to reduce climate impacts, but also awareness of other communities to start adaptation. However, Junker et al. (2007) emphasize that involving a broad public in the decision making process makes it difficult to reach a consensus. In research on participatory processes, public are those people who have a general interest in decision making (Krywkow, 2009). Sarzynski (2015) defines the public as anyone such as citizens, private actors, governmental actors and NGOs. Breadth entails who participates and can be scored as narrow (if only decision-makers are engaged), moderate (if the directly affected public is engaged) or broad (if anyone who is interested is engaged).

Openness

Sarzynski (2015) distinguishes five phases in which stakeholders can be involved in adaptation to climate change, namely pre-planning, planning, development, implementation and evaluation phase. Many studies argue that a meaningful participation requires the stakeholders to participate in the early stage of the planning process (Uittenbroek et al., 2019; Klein et al., 2018). This is supported by Few et al., (2007) who state that it is very important to involve participants from the beginning of the process. While, later participation in the decision-making process merely to provide information to stakeholders (Uittenbroek et al., 2019). This may also be a case of window dressing by decision-makers to legitimize decisions (Mees et al., 2014). Additionally, Wamsler (2017) argues that stakeholders should be involved "during the entire adaptation strategies process: set-up, assessment of local knowledge, risk context, the identification and selection of adaptation options, and designing the implementation and evaluation" (p.155). Openness thus entails when participation happens and the score for this aspect refers to the timing of public engagement in the decision-making phase (Dietz and Stern, 2008).

Intensity

Intensity is related to the number of opportunities offered to stakeholders to participate in the decision making process. An intense participatory process will enable deliberation among stakeholders and thus lead to enhanced social learning (Glucker et al., 2013). However, according to Dietz and Stern (2008), an intensely participatory process can create mistrust among participants. In case of low trust, frustration may emerge between the government and participants. Further efforts are needed through meetings to restore trust. In addition, a participatory process in which wide participation is solicited makes it difficult to increase opportunities to influence the decision-making. This means intensity may be associated with breadth and understanding. Intensity implies the time allowed to stakeholders in the process, and the number of interaction among stakeholders (Dietz and Stern, 2008).

Influence

The results of a participatory process will depend on the participation method, but more on the influence of stakeholders (Uittenbroek et al., 2019; Sarzynski, 2015). Whatever the participation method, a dialogue should take place in which stakeholders can share their views (Uittenbroek et al., 2019). This is supported by Few et al., (2007) who argue that "stakeholders must have the opportunity to construct, discuss and promote alternatives options" (p.56). But they need to understand the problem and the decision-making process (Dietz and Stern, 2008). Additionally, a collaboration or a community-based adaptation method in which government actors and community participants are actively involved has the most influence, because crucial decisions have been taken by all parties. The level of influence in the participation can be scored as informing, consulting, collaborating or empowering (Sarzynski, 2015).

Goals:

In the research of Sarzynski (2015), the goal is the last aspect of the participation structure. The goal to solicit public participation varies and depends on the objective of participation. According to Sarzynski (2015), the goal of participation can be both intrinsic and instrumental. She defines intrinsic as a "means of democratic expression and procedural justice" (p.55). An example of an intrinsic goal is seeking consensus among participants. While instrumental is "what it brings", such as knowledge, resources, truth, and so on. An example of an instrumental goal is informing and educating public.

Table 4: Overview of participation levels and their influence on adaptive actions

| Participation levels (factors) | Definitions | Influence | References |
|--------------------------------|---|--|--|
| Breadth (who) | The number and diversity of involved participants | Including all parties that are interested or affected has a positive influence on adaptive behaviour | Dietz and Stern, 2008; Sarzynski, 2015 |
| Openness (when) | The phase in which residents participate | Including participants early on in the process has a positive influence on the process. | Dietz and Stern, 2008; Sarzynski, 2015; Newig et al., 2018; Uittenbroek et al., 2019 |
| Intensity (how much) | The number of interactions and time involved in interactions | There is a positive influence when an intensive collaboration increases understanding of climate change among those who do participate | McCormick, 2006; Dietz and Stern 2008 |
| Influence (what) | Influence is what happens when residents participate. | There is a positive influence when a high influence increases the transparency of process to better understand the climate change | Kinney et al., 2002; McCormick, 2006; Dietz and Stern 2008 |
| Goals (why) | Goals are the objectives of and value placed on participating in the process. | The expected influence can be either intrinsic, instrumental or both | Dietz and Stern 2008; Sarzynski, 2015 |

2.2.3 Local-context conditions

Adaptive actions by residents can be influenced by several factors that were categorized into two groups: demographic and socio-economic factors (Brink and Wamsler, 2019; Dang et al., 2019; van Valkengoed et al., 2019). The demographic factors involve five factors i.e. age, gender, household size, hazard experience and geographical vulnerability. The socio-economic factors are: income, education level, house ownership and place attachment.

Demographic factors

First, the demographic factors will be discussed. Below, a comprehensive overview of the factors is elaborated. Table 5 presents the factors, including their definition, influence and references.

Age

The consideration of age in adaptation to climate change is a way to reflect the importance of experience. Dang et al. (2019) distinguish two contrasting arguments on the age issue. They argue that, on the one hand, older people have more experience with climate change. This means that they have an extensive observation knowledge of the reality of climate change which probably allows them to understand the need to take adaptive actions. Such experience plays an important role for greater adaptive actions. On the other hand, the older people are, the more conservative they can be. It seems to be difficult for older people to change their behaviour regarding adaptive actions. The arguments also correspond with an earlier study by Lujala et al. (2015). They state in their study on natural disasters and climate change effects that age affects people's view of climate change and its effects. Additionally, the negative relation between older people and adaptation measures is also supported by Brink and Wamsler (2019) who argue that older people have a negative worldview, which tends to decrease their motivation for adaptive actions in particular regarding being told to adapt by someone else. Despite this negative influence, older people are more often in contact with local authorities about their vulnerability (Brink and Wamsler, 2019). Therefore, Brink and Wamsler, (2019) determined that old age is presumably associated with higher vulnerability and lower adaptive actions, while younger people see adaptation as a major challenge and are open to being told to adapt (Lujala et al., 2015; Brink and Wamsler, 2019).

Gender

Gender is another factor that influences adaptive actions. It represents the difference in the ways of thinking and doing between male and female. This difference determines their variation in the decisions-making process. This might be explained by their difference in motivations. Because males are more motivated by economic values, while females appear to be more motivated by social values related to adaptive actions (Brink and Wamsler, 2019). It can be concluded that both motivations, economic and social values are most important for adaptive actions. Therefore adaptation cannot be separated from gender. Another difference between males and females is risk behaviour. Dang et al., (2019) argue that males tend to be risk-takers, in order to undertake adaptive actions. Conversely, females would prefer safe and traditional actions. Therefore, women are less likely to change, thus to adapt. This is due to social barriers, which prevented female from information and other resources, restricting them from adopting adaptive actions (Dang et al., 2019). Interestingly, however, there is an opposite view that females are more likely to undertake adaptive actions, due to active, intensive involvement (Dang et al., 2019). Therefore, it is reasonable to say whether males and females undertake adaptive actions might be in fact, contextual (Dang et al., 2019).

Household size

Dang et al. (2019) emphasize that the number of people in each household affects adaptation. Household size was argued to influence adaptive actions positively. This is supported by a previous study by Kreibich, (2011) who points out that the number of people in a household was positively linked to the number implemented of adaptive actions. It was inferred that the chances of taking adaptive actions would be enhanced with any increase in household size. The reason is that the number of people who could be impacted by climate events is higher. In terms of rationale, the perception of risks increases with household size.

Hazards experience

A hazard refers to “the possible, future occurrence of natural or human-induced physical events that may have adverse effects on vulnerable and exposed elements” (Cardona et al., 2012, p.78-79). Exposure refers to “the inventory of elements in an area in which hazard events may occur” (Cardona et al., 2018, p.78-79). Natural hazards are part of human history and their experience is important in motivating protective response (Harvatt et al., 2011). Subsequent research indicated that past or recent experience of natural or climate-related hazard events can lead to significant positive or negative changes in an individual’s attitudes and perception of climate change (Lujala et al., 2015). Addressing the importance of positive changes, Birkmann et al. (2010) and Brink and Wamsler (2019) point out that a disaster due to climate hazard events can increase adaptation measures in terms of both preparedness and prevention related activities. Because citizens’ adaptive actions concern both proactive and reactive responses to local climate hazards. Therefore, a climate hazard experience has the potential to change the way people think and act vis-à-vis of adaptive actions. Researches of Harvatt et al. (2010) and Brink and Wamsler, (2019) emphasize that adaptive actions of citizens are often linked to past experiences with climate hazards. Thus, literature on hazard experience argues that experience is an opportunity to motivate protective response (e.g. Birkmann et al., 2010; Van Den Berg and Coenen, 2012). Also, in fact, when people know that they cannot avoid climate hazards, they are widely receptive to implementing adaptive actions to address climate change (Geng et al., 2020).

However, the relation between experience of natural hazards and adaptation efforts can also be negative. Bihari and Ryan (2012) argue that when a personal experience of damage from hazards is not perceived as negative or is not viewed as a disaster, the hazard experience has a negative effect on the number of adaptive measures. This means that the possible impacts of hazards can be managed without any effort and it can lead to a sense of invulnerability by people. This could stimulate a negative relation between experience of hazards and adaptive measures. All these findings reveal that the experience of natural hazard events differs from one individual to another and, hence, may lead to different results in adaptation measures. This difference may be partially explained by factors such as gender, age, political preferences and resources available that influence people’s view on climate change and its effects (Lujala et al., 2015). But, repeated exposure of citizens increases adaptive measures to climate change (Harvatt et al., 2010).

Geographical vulnerability

Studies on adaptation to climate change consider adaptation as a response to climatic effects, thereby reducing vulnerability to hazards. However, Cutter (1996) points out that vulnerability to climate change can be related to attribute of places such as geographical location. In this context, the climate change impacts may always vary considerably at national/ regional and city scales, and within a city due to the difference in geographic conditions. Barron et al. (2012) argue that climate change poses a considerable threat to low-lying areas. It is widely believed that low-lying areas will bear the greater damage of climate change (Seo, 2011). Additionally, Harvatt et al. (2011) argue people living in high-risk areas have the most recent and direct personal experience of flood events. Such geographic conditions influence people to take individual adaptive actions to their property to reduce the climate risks (Adger et al., 2012). These adaptive actions should be carefully scaled, up or down, considering the geographical differences (Barron et al., 2012). However, even in low-lying vulnerable areas there is a lack of motivation to implement individual adaptive actions or do little to reduce their vulnerability because of a lack of recent direct personal experience of climate events (Harvatt et al., 2011).

Table 5: Overview of the demographic factors and their influence on adaptive actions

| Local-context conditions | | Definitions | Influence | References |
|--------------------------|--------------------------|---|--|---|
| Demographic factors | Age | The period of time someone is alive and can be classified into children, young people and old people. | Age and adaptive actions have a negative correlation. | Kreibich, 2011; Brink and Wamsler, 2019; Dang et al.,2019 |
| | Gender | The distinction between male and female. | Females are influenced by social values whereas males are influenced by economic values | Brink and Wamsler, 2019; Dang et al.,2019 |
| | Household size | The size of people living in a house. | A larger size of the household is a positive driver for adaptive actions. | Kreibich, 2011; Dang et al.,2019 |
| | Hazard experience | A natural climatic event, such as flooding exposed householders to various effects. | Hazard can have a positive or negative influence depending on the opinion of residents about the impacts. However, repeated experience of households and a large size of effects positively influences adaptive actions. | Harvatt et al., 2011; Kreibich, 2011; Lujala et al., 2015; Van Valkengoed and Steg, 2019; Brink and Wamsler, 2019 |
| | Geographic vulnerability | A geographic location that is affected or exposed to flooding | Geographic vulnerability of households has a positive influence on adaptive actions. | Cutter,1996; Harvatt et al., 2011; Barron et al., 2012 |

Socio-economic factors

Next to the demographic factors, many studies also describe the socio-economic factors as important in shaping an individual adaptive behaviour (Kreibich, 2011; Glaas et al., 2015; Brink and Wamsler, 2019). Therefore, an overview of these factors is discussed below. Table 6 presents the factors, including their definition, influence and references.

Income

Income represents the level of household wealth. According to Dang et al.(2019), income can contribute to whether people are willing to conduct adaptive actions. Because a higher income allows people to adopt actions that are expensive and probably more effective in response to climate change. Literature on factors influencing adaptive actions, shows that income has a significant positive influence on adaptative measures (e.g. Dang et al., 2019; Brink and Wamsler, 2019). Having a high income is an important factor to motivate people to undertake adaptive actions. Brink and Wamsler, (2019) argue that people with high income are more motivated than people with lower income. Additionally, people with greater income tend to be more aware about the environment and, therefore, to be involved in activities such as taking measures for the adaptation of their environment (Jones et al., 2012). While people with lower income may perceive less self-efficacy in adaptive actions (Van Valkengoed and Steg, 2019).

Education level

The term education refers to an important factor in people level and forms of adaptation (Dang et al., 2019). The reason is that education allows people to access appropriate information and encourages the introduction of improved adaptation action. Education is a factor that significantly underlies residents intentions to adapt (Dang et al., 2019). Recent studies on adaptation have demonstrated that education increases the probability of taking adaptive measures (e.g. Dang et al., 2019; Brink and Wamsler, 2019). This means that people with a higher level of education are generally associated with adaptive measures than those with a lower education level (e.g. Dang et al., 2019; Brink and Wamsler, 2019). Also people with a higher level of education tend to consider climate change as a major challenge rather than people with a lower level of education.

House ownership

According to Kreibich, (2011) house ownership is important in encouraging people to take adaptive actions. In this study, house ownership refers to a property that is owned rather than rented. He argues that house owners seem to have more adaptive behaviour than tenants. Glaas et al. (2015) state that there is a high relation between house ownership and adaptive actions. This is due to the risk perception related to possible consequences of climate change among individual house owners, and therefore on their properties. House owners envisage that their property could be ruined during a climatic hazard. House owners more often act by taking out house insurance to cover risks. However, there is considerable evidence that house owners often fail to act even when the risk perception is high, letting house owners bear at least partially the cost could force them to take adaptive actions (Lujala et al., 2015).

Place attachment

Attachment to place emphasizes the connections of people with places (Altman and Low, 1992; Van Valkengoed and Steg, 2019). According to Altman and Low (1992) place attachments are rich and varied, and can be examined to a variety of places such as place identity, insideness as well as type of place (e.g. home, plaza, types of neighborhoods). They suggest that people can invest strongly in their homes and neighborhoods, because they are connected to place and community. This suggestion is in line with the research of Valkengoed and Steg, (2019) with regard to the influencing factors on adaptive actions. They found that there is a positive relation between type of place and individual's adaptive behaviour. Because people who live in such a place care a lot and often do not hesitate to invest in adaptive actions. Therefore, the type of place may motivate people to undertake actions.

Table 6: Overview of the socio-economic and their influence on adaptive actions

| Local-context conditions | | Definitions | Influence | References |
|--------------------------|------------------|---|---|--|
| Socio-economic factors | Income | Cash as well as non-cash income received in a form that can be spent or consumed, thus it represents the level of household wealth. | Income has a positive influence on adaptive actions | Van Valkengoed and Steg, 2019; Dang et al.,2019; Brink and Wamsler, 2019 |
| | Education level | The level of education | Education has a significant positive influence on adaptive actions. | Dang et al.,2019; Brink and Wamsler, 2019 |
| | House ownership | Buying a private house, i.e., possessing a house | House ownership has a positive influence on adaptive actions | Harvatt et al., 2011 |
| | Place attachment | Connection of residents to a place | More connection has a positive influence on adaptive actions | Van Valkengoed and Steg, 2019; Brink and Wamsler, 2019 |

2.6 Conceptual model

To guide case study research, insights from existing theories are integrated in a conceptual model (see figure 2).

The conceptual model is organized into two parts: The factors and their effects (outcomes). First, the policy instruments like regulations and financial incentives that the municipality used to motivate residents to take adaptive actions. Participation can also be considered as a policy instrument but, in this study, it has been separated from policy. That is understood as the engagement of residents in adaptive actions. The local-context conditions are related to the local factors of a project area. The outcome is the implementation of adaptive actions. The policy instruments, participation and local context include a number of factors, and the implementation of adaptive actions includes self-protective actions. In this study, these actions are related to flood protection. The model shows a direct relationships between the local policy instruments, the participation and the outcomes to achieve. It merely states that the local-context conditions affect the relationships between the three variables (policy instruments, participation and adaptive actions). Here the local-context conditions are the moderating variables. The relationship does not state that the local-context conditions affect either policy instruments and participation. Although there is a relation among them, the present study will focus in particular on the contribution of the policy instruments, participation and local-context on the goal (implementation of adaptive actions).

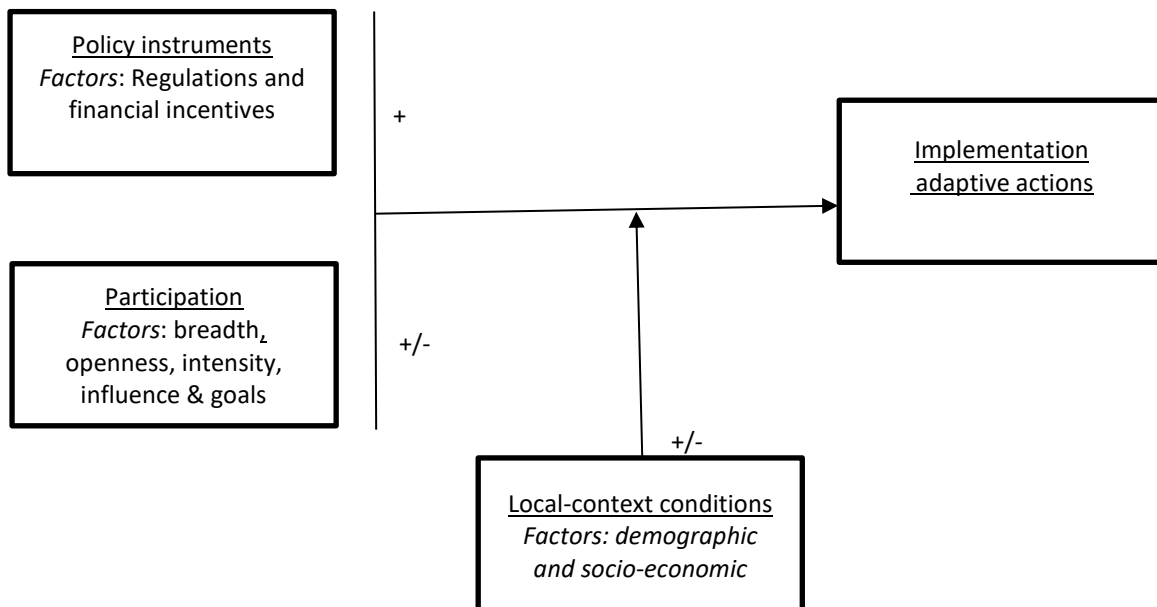


Figure 2: Conceptual mode

3 Methodology

This chapter presents how this study was conducted. First, the chapter describes the research strategy and projects selected. Then, how data was collected and analysed to answer the research questions.

3.1. Research strategy

The aim of this study is to explain the factors that influence the adaptive behaviour of residents. Qualitative case study research is chosen as main research strategy and comprises one single case, the city of Eindhoven. The case is one of the cities that experiences urban flooding during the summer periods due to heavy rainfall. As a result, the national government through the DPRA established a plan that describes how cities can accelerate the process of climate change adaptation. Each city has to identify vulnerabilities by conducting tests, organizing dialogues and implementing measures to protect their citizens and infrastructures from climate-related hazards. Further, the case is deliberately chosen as it allows for an in-depth analysis of the case. The single case involves three projects as unit of analysis that are embedded in a similar context, i.e., adaptation to climate change in the Netherlands, which is stimulated by the DPRA. The selected projects are examples of projects through which the municipality of Eindhoven tried to implement adaptation dialogues to respond to climate change by encouraging residents to undertake adaptive actions themselves. At the same time, the projects are unique because of their participatory approach, regulations and financial incentives, and local conditions. The projects provide new insights into the influence of factors on adaptive behaviour. Therefore, an explanatory approach is chosen to understand the influence of factors by analyzing and comparing three projects. Therefore, the study is an embedded case study.

3.2. Project selection and research unit

As mentioned in the strategy, the research case in this study is the municipality of Eindhoven. The study focuses on three renovation projects that have similarities and differences in terms of: who (actors involved), what (project scope), why (project objectives), when (start and implementation project), where (location) and how (implementation). The three projects are indicated with a star in figure 3. To ensure that they would be comparable, the selected projects had to satisfy the following criteria:

- Be a public project at the municipal level (Eindhoven)
- Be related to urban development
- Have climate adaptation objectives, hence, related to protection against or limiting urban flooding
- Had various actors involved in the project
- The implementation phase of the project has been completed.

In addition to this, the selected projects were from different neighborhoods. This was due to a) increase the internal validity of the present research and b) to explain to what extent, the participation influences the adaptive actions by residents. The selected projects are geographically dispersed and present similar problems in terms of climate change impacts. Based on the criteria, the selected projects are presented in table 7 and are described below.

Table 7: Characteristics of the selected projects (Gemeente Eindhoven, 2018a; Gemeente Eindhoven, 2018d; Gemeente Eindhoven, 2022e)

| | Project A: Hastelweg/Strijpsestraat | Project B: Vestdijk | Project C: Philipsdorp |
|-----------------------------|--|--|---|
| Who? | Municipality of Eindhoven | Municipality of Eindhoven | Housing corporation and municipality of Eindhoven |
| What? | Renew the street, add rainwater sewer and underground water storage; and green space for flood risk reduction. | Renew the street, add rainwater sewer and underground water storage for flood risk reduction. | Replacement of existing sewage system (rainwater and waste sewers) and create more green space for flood risk reduction. |
| Why? | Improve safety by reducing cars speed, improve rainwater transport and water storage capacity of the area to reduce flooding in and around the Willemstraat. | Improve air quality, reduce traffic, improve rainwater transport, and water storage capacity of the area to reduce flooding in Vestdijk. | Renovate and modernize houses by improving living conditions and improve the sewage system to avoid and reduce flooding in the area and Willemstraat. |
| When? | 2018-start project 2019- design phase is finished 2020-implemented | 2013-start project 2017-design phase is finished 2019-implemented | 2007-2008-start project. 2019-design phase is finished 2019-implemented (Project is still ongoing) |
| Where? | Between Vonderkwartier and Philipsdorp. | City center. | Philipsdorp. |
| How? | Inclusion of all the relevant municipal departments in the project team and an active citizen advisory group. | Inclusion of all the relevant municipal departments in the project team and a citizen advisory group. | Inclusion of all the relevant municipal departments in the project team in the project team and a citizen advisory group under the leadership of the housing corporation. |
| Number of streets | Two streets | One street | Thirty-five streets |
| Number of houses | 265 | 445 | 1774 |
| Type of houses | Terraced houses (houses of row or similar houses linked together) and flats (apartments) | Flats (apartments), buildings, shops and offices | Terraced houses (houses of row or similar houses linked together) |
| Number of residents | 597 | 890 | 3090 |
| Number of downspouts | 126 | 152 | 887 |
| Number of gardens | 238 | 52 | 1774 |
| Number of roofs | 238 | 52 | 1774 |

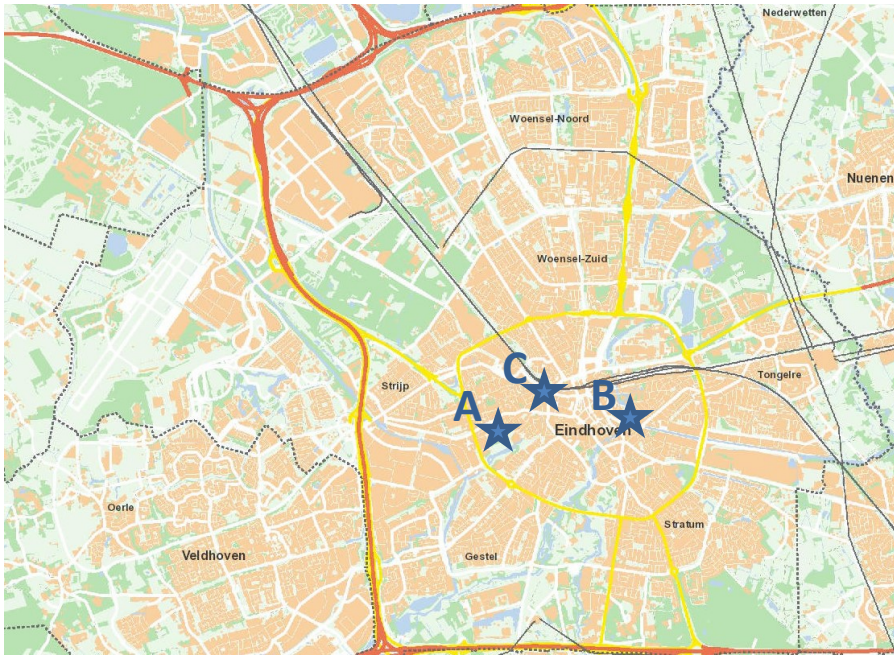


Figure 3: Location project A (west), project B (east) and project C (center). Source: (Gemeente Eindhoven, 2022)

Project A: Hastelweg/Strijpsestraat streets

In 2017, the municipality of Eindhoven decided to renovate the road. The reason for this renovation was the poor condition of the pavement, which no longer met the basic quality. Besides this, the Water Team conducted tests to identify areas of the city that are vulnerable to urban flooding. Conducting the tests allowed the Water Team to gain insights into strengths and weaknesses of the city and opportunities for climate adaptation. As result, the Water Team of the municipality of Eindhoven decided to join the Hastelweg/Strijpsestraat project to enhance the climate resilience of Willemstraat.

In the case of Hastelweg/Strijpsestraat streets, the Water Team had to create an underground water storage and add an extra rainwater sewer in the Hastelweg/Strijpsestraat. The reason was to reduce the impacts of flooding in the Willemstraat. The streets, Hastelweg/Strijpsestraat and Willemstraat are characterised by relatively variable topography from high-lying Hastelweg/Strijpsestraat to low-lying Willemstraat. This difference in topography is the main cause of floodings in the Willemstraat.

What is striking in this project is the involvement of the citizen advisory group (i.e. small group of residents of the streets), which in principle contributed to initiate the project. This allowed the project team (i.e. civil servants) to take into account the opinions of the citizen advisory group, as well as to be willing to learn and adjust. Additionally, the engagement of the citizen advisory group in combination with the adaptation, inspired the project team to reduce the pavement of the road and the sidewalk in favor of more green spaces and also to connect the downspouts to the water storage. Furthermore, it is notable that the residents accepted the reduction of the sidewalks to install the green spaces, because they wanted to retain more water in their streets to reduce urban flooding in the Willemstraat.

Project B: Vestdijk street

The Vestdijk is located in the center of Eindhoven with heavy car traffic. This leads to poor air quality. Besides, the street is located in a very vulnerable position and has experienced urban flooding in the past. The municipality is therefore focused on finding solutions that protect the street and its residents.

In this project, the project team took into account the guideline provided by the municipality to implement the measures that can reduce extreme climatic conditions like urban flooding. However, during the project, this was not enough according to the water expert of the municipality, who participated in the project to adapt the street to climate change. The municipality received additional information regarding the risks of urban flooding in the future and the water expert noticed that the residential areas near the project area were also at risk of flooding. In order to act and protect the residents, the water expert decided to install an underwater storage

under the road within the project area to also reduce the risk of flooding in the neighbouring areas. To achieve this, the water expert had to closely collaborate with the other members of the project team.

What is special about this project is the engagement of the project team to reduce the air pollution and to implement the measures that increase the climate resilience of the street, beyond the limits of the project scope. This was so strong that the municipality adapted the design of the project to also reduce the risk of urban flooding in the neighbouring areas. In addition, it is important to note that the policy of the municipality and the Water Board is to create rainwater storage, particularly in low-lying areas to avoid urban flooding.

Project C: Philipsdorp streets

In 2007, the housing corporation took the decision to renovate the houses because the corporation owns all the houses. The corporation asked the municipality to join the project. For this project, the municipality followed a different process and invited all the relevant municipality departments to join the project team and influence the project by adding their requirements, as well as by providing solutions. The municipality decided to create more green space and change the sewer system. A citizen advisory group was invited to be involved by participating in workshops. The results of the workshops were taken into consideration by the project team as user requirements. This project is the only one that is still ongoing by the time the present study was completed. This was due to the large project area.

What is special in this project is that in 2007, when the project started, the concept of adaptation dialogue did not really exist, and climate adaptation was not a priority. However, the municipality tried to include climate adaptation objectives by asking residents to implement green themselves. Philipsdorp is a long-term project where the project team adjusted to climate change and learned lessons about engaging residents in climate adaptation. Furthermore, the project is characterized by a clear role allocation between the housing corporation, the municipality and the citizen advisory group.

3.3. Data collection methods

Most data used for this research was obtained through desk research. For some of the data collection, it was necessary to conduct interviews because these data were not fully available or clear in relevant documents. However, data was already available through official documents and newsletters published by the project teams. Official documents that include data on the participation, regulations and incentives that influence the adaptive actions of residents were retrieved via an official project file. Also, data related to the local-context conditions were found in the municipality documents and the database of the Dutch Central Bureau of Statistics (in Dutch: Centraal Bureau voor de Statistiek, CBS). Demographic and socio-economic factors, as well as information on the flooding per neighbourhood were obtained from the documents of the municipality (Gemeente Eindhoven, 2016; Gemeente Eindhoven, 2018d). Demographic and socio-economic factors data were also retrieved from the CBS in your neighbourhood (in Dutch: CBS uw buurt (CBS, 2020)). Newsletters with regard to the participation were available on the internet and in the project file of the municipality. In addition, a total of six interviews have been conducted to measure the influence of participation level and policy instruments. This means that per street or project two civil servants were interviewed, who were involved in the project. The interviews were semi-structured so that the interviewee had enough place to contribute while remaining close to the subjects. Table 8 presents an overview of the data collection methods. Before starting the interviews, an interview guide was created with the purpose to uncover the factors that affect the adaptive actions by residents. The interview guide can be found in Appendix A. Additionally, ethics has been considered in order to be able to conduct the interviews in a proper manner, which can be found in Appendix B. An overview of the civil servants that were interviewed can be found in Appendix C.

Table 8: Overview of data collection methods

| Data | Collection methods | |
|--------------------------------|--|---|
| | Documents | Interviews |
| Regulations | Project file (newsletter) and official documents | Semi-structured interviews with civil servants involved in the projects |
| Financial incentives | Project file (newsletter) and official documents | Semi-structured interviews with civil servants involved in the projects |
| Participation | Project file (newsletter) and official documents | Semi-structured interviews with civil servants involved in the projects |
| Demographic and socio-economic | Official documents and CBS | |

3.4 Data analysis

The data and the findings from the previous section were used to answer research questions 2 and 3: *“In the case of Eindhoven, to what extent do regulations, incentives, participation and local-context conditions influence the adaptive actions of residents of the case studies?”* and *“by comparing the case studies, what are the factors that explain the implementation of adaptive actions by residents?”*

First, an Excel file was created in which the data (qualitative and quantitative) were collected per factor and the project was structured. Data regarding the regulations indicated the number of households that were aware of the conditions of adaptive actions per project. Data on the financial incentives indicated the number of households that made use of financial incentives, and data on the adaptive actions indicated the number of households that implemented adaptive actions per project. Then, these data were compared to the total number of households per project to determine whether a factor scored high, medium or low. Since, the projects had different number of households. The scores were used to compare the projects.

This assessment is included for comparison because a factor scored high if at least 50 percent of houses were aware of the conditions, made use of financial incentives or implemented adaptive actions, medium, if 25 to 50 percent of houses were aware of the conditions, made use of financial incentives or implemented adaptive actions, low, if at most 25 percent of houses were aware of the conditions, made use of financial incentives or implemented adaptive actions.

The scores of the participation activities that were organized during each project were created based on the public participation dimensions identified in the studies by Dietz and Stern (2008) and Sarzynski (2015). The scores of each participation activity were combined to come to an overall score of the participation per project. This overall score allows determining the highest and lowest participation in order to compare the projects with one another.

Subsequently, the scores of local-context conditions were based on the influence of those factors on adaptive actions according to the literature. The influence can be supportive or restrictive. Furthermore, the type of housing was a way to measure place attachment.

4 Results

This chapter compares and explains the influence of regulations, financial incentives, participation and the local-context conditions on the implementation of adaptive actions by residents in the selected projects. To distinguish an influential factor from a less influential one of projects, the study builds upon the assessment model that was developed in chapter 2. The first section provides an introduction of policy instruments and participation in Eindhoven. The second and third sections compare the regulations, financial incentives and participation activities of projects on adaptive actions. The fourth section compares the expected influence of local-context conditions on adaptive actions. The fifth section compares the adaptive actions implemented by residents in different projects.

4.1 Introduction of policy instruments and participation in Eindhoven

Climate change adaptation in the Netherlands is actively stimulated by the DPRA. This plan is part of the Delta Program of 2018, and its implementation requires the engagement of municipalities. For example, the municipality of Eindhoven sees adaptation as a commitment and is aware of the need to adapt. Furthermore, adaptation has a significant importance, its urgency has increased over the past years. Therefore, to accelerate and intensify the adaptation of the city, the municipality has included the adaptation in its policy through the waterproof and water-robust design (Gemeente Eindhoven, 2018-c).

To promote the adaptation by the residents, the municipality of Eindhoven relied on policy instruments, such as financial incentives and regulations. First, the financial incentives were intended to stimulate the residents to remove pavement or tiles and to connect the downspouts to the rainwater sewer or water storage. Then, to regulate the removal of pavement and the connection of downspouts to the rainwater sewer or water storage, the municipality had set conditions. With regard to removal of pavement, to benefit from the financial incentives, the residents needed to remove at least twenty square meters of pavements or tiles in their own gardens or roofs and to install green gardens or roofs. As for the connection of downspouts to the rainwater sewer or water storage, the downspout had to be on the private property and at the front of the house. Another important condition was the permission of residents to connect the downspout from their private property to the rainwater sewer or water storage in public space (Gemeente Eindhoven, 2018-c). Besides these conditions, since 2018, the municipality developed a water tool for private property (in Dutch; de rekentool) based on climate change adaptation. The tool aims to motivate residents to implement more green in their private spaces. This is because, more greenery results to a lower water task. Another important regulation of green was the creation of eight square meters of green space by residents on their private property for private projects. Finally, the green compensation that consisted of compensating the creation of green by residents on their own property.

Besides, the financial incentives and regulations, the municipality of Eindhoven had developed two types of resident participation. The first participation was related to the implementation of adaptive actions in the public space. The second focused on the adaptive actions that residents themselves can undertake on their own property. This was needed; because one-thirds of the land belongs to the municipality and the other two-thirds to the residents. However, in Eindhoven, both types of participation took place simultaneously during the projects initiated by the municipality. Therefore, the participation mechanism that can be distinguished was informing and engaging the public (Gemeente Eindhoven, 2018-a). This participation mechanism involved participation activities that were often interrelated and inseparable.

In general, during all municipal projects, residents were informed via newsletters (in Dutch *wijkinfo*) en meetings. First, all residents in the project areas received the newsletters in their mailbox and the newsletters were also made available on the website of the municipality for everyone with an interest in the project. The first newsletter was published at the start of the projects and informed the residents about the project and the possibility to join the citizen advisory group (in Dutch: *klankbordgroep*). The first newsletter was followed up by other newsletters. In general the other newsletters provided information about the progress of the project (Gemeente Eindhoven, 2018a). The municipality used the newsletters to publish its plans for each stage and to provide information about the collaboration with the citizen advisory group. In the last years, the newsletters contained information about the adaptive actions that residents can implement themselves. The newsletters were also used as an important communication tool to invite citizens and organizations to participate to the project. They were invited to attend information meetings and designing sessions. Information meetings were organized at the start of a new phase during the project. These meetings were also used to present the design

and every residents and the citizen advisory group have the opportunity to review and provide feedback. Civil servants were also present to provide residents with further information and advice about what residents could do themselves in terms of actions (Gemeente Eindhoven, 2008b). Therefore, three types of participation activities can be distinguished in Eindhoven, namely: the public information (newsletter), the feedback meetings (public participation) and the stakeholders meetings (stakeholder participation). In this present study, the stakeholders meetings refer to the meetings between citizen advisory group and civil servants.

4.2 Assessment of the regulations and financial incentives of the projects

This section compares the projects based on the regulations and financial incentives. Table 9 presents the scores on regulations and financial incentives per project.

With regard to regulations, according to civil servants involved in the projects, the projects A and B have in common that all residents were likely aware of the conditions of adaptive actions (interviews 1 to 4, Appendix C). Whereas, in project C, all residents were likely unaware of the conditions of adaptive actions. As can be seen in table 9, only in project A, the residents likely made use of financial incentives for adaptive actions. Especially for downspouts connection and green roofs. However, more residents made use of financial incentives to connect the downspouts compared to green roofs; and no resident made use of financial incentives for green gardens. While, in projects B and C, the residents likely did not use the financial incentives for adaptive actions.

With regard to regulations, the findings reveal that all projects had the same or similar score. More specifically, projects A and B had the same score, while project C was the only one that differs. Project C received a lower score, yet still a high one. As for financial incentives, the project A scored highest for downspouts connections. The project B received a lower score for downspouts connection. While, project C did not receive a score. In addition, the findings show that all projects received a lower score for green gardens and roofs.

Table 9: Scores on regulations and financial incentives per project data from documents and interviews (Gemeente Eindhoven, 2018 c; Gemeente Eindhoven, 2018d; Appendix A and C).

| Local policy instruments (factors) | Project A | Project B | Project C |
|------------------------------------|--|--|--|
| Regulations | 100 percent of houses were aware of the conditions. (Very High) | 100 percent of houses were aware of the conditions. (Very High) | About 50 percent of houses were aware of the conditions (High) |
| Financial incentives | Downspouts connection: about 90 percent of the houses connected downspouts and houses made use of financial incentives. (High) Green roofs: two houses installed green roofs and made use of financial incentives. (Low) Green gardens: installed green gardens but no house made use of financial incentives. (Low) | Downspout connection: no connection and no house made use of financial incentives. (Low) Green roofs: no green roof and no house made use of financial incentives. (Low) Green gardens: installed green gardens but no house made use of financial incentives. (Low) | Downspout connection: all houses connected downspouts, but no house made use of financial incentives. (No score) Green roofs: no green roof and no house made use of financial incentives. (Low) Green gardens: installed green gardens but no house made use of financial incentives. (Low) |

With regard to financial incentives, in project C, all downspouts were connected to the rainwater sewer or water storage. However, project C did not receive a score because the residents could not make use of financial incentives. At that time, the municipality had no policy based on financial incentives to connect the downspouts to the rainwater sewer or water storage. In addition, all projects did not make use of financial incentives even though they installed green gardens. As mentioned in section 4.1, this was because the green gardens installed were less than twenty square meters.

4.3 Assessment of the participation of the projects

This section compares the participation activities of projects based on the five dimensions proposed by Sarzynski (2015). Table 10, 11 and 12 present the scores on participation per type of activity of projects. Then, table 13 displays the highest and lowest participation for the three activities per project.

With regard to the newsletter, according to civil servants involved in the three projects, the residents who live in projects A and B received the newsletters, but also a newsletter was made public on the website of the municipality (interviews 1 to 4, Appendix C). Anyone in the projects areas who was interested was included. Therefore, the breadth of this type of participation was high. In projects A and B, the first newsletter was distributed in the design phase. This indicates that participation started in the design phase and not in the first phase of the project. The openness of participation was medium. Since in projects A and B, the newsletters were distributed during the design phase and not from the start, the participation activity seems to be not very intense, and would thus score medium. The residents did not have any influence on the policy through the newsletters in the projects A and B. Therefore, the influence remains at the lower level, i.e. inform, and would thus score low. The goal of this activity was high because the goal of the newsletter was both intrinsic, as a means of Eindhoven's procedural policy, in the sense that residents have to be informed about changes in their neighborhoods as well as instrumental. The later because the newsletter was used as a means to inform, invite and involve residents. In contrast, according to civil servant (interviews 5 and 6, Appendix C), in project C, no newsletter was distributed to the residents, because adaptation was not yet a priority of the municipality at that time. This means that there was no participation via the newsletter.

According to civil servants involved in the three projects, the feedback meetings were open for any residents in the projects A and B (interviews 1 to 4, Appendix C). The invitation for the meetings was send via post to all residents inside as well as outside the area, but also announced on the website of the municipality. Therefore, in both projects, this type of participation was high. According to civil servants (interviews 5 and 6, Appendix C), in project C, residents who live outside the project area were excluded, thus breadth was scored as medium. In all projects, the first feedback meeting took place when the preliminary design was finished thus taking place during the design phase. The openness of participation was medium. In two projects A and C, a total of two feedback meetings took place one for the preliminary design and one for the final design. In project A, an additional meeting took place regarding the adaptive actions. Therefore, in project A, the intensity scored medium, whereas, in project C, the intensity scored low. In project B, more feedback meetings took place for the preliminary and final designs, but also one meeting took place with some residents in project B regarding the adaptive actions. Therefore, the intensity scored high. In all projects, the residents did have some influence in the feedback meetings because, their opinions and preferences are collected, therefore, influence remains at the consult level, and scored medium. The goal of the feedback meetings seemed to be both intrinsic as well as instrumental, and thus scored high. The first because the meetings gave residents a voice, and thus democratic expression. The second because residents could have information that contributed to increase the adaptive actions.

According to civil servants involved in the three projects, the stakeholders meetings had the goal of collecting knowledge of the project area and feedback on the design and were especially organized for the stakeholders in the three projects (interviews 1 to 6, Appendix C). The invitation for the meetings were not made available on the website. Therefore, the breadth of this type of participation was low. In all projects, the first meeting was organized in the planning phase, and scored high. More than four meetings were organized during the entire project, the participation activity seems to be very intense, and thus scored high in the three projects. In project A, a citizen advisory group came up with the idea to improve the streets and the group encouraged residents to take adaptive actions through the distribution of prototype of actions such as plants for green gardens. Therefore, the influence was scored high. Whereas, in projects B and C, the citizen advisory group of residents was asked to come up with the ideas but their influence to motivate others residents to implement adaptive actions was limited. Therefore, the influence remains at the level of inform, and scored low. The goal

of involving citizen advisory groups can be both intrinsic as well as instrumental because it contributed to democratic expression, but also could improve the quality of the project through the knowledge of citizen advisory groups. Therefore, goal of this type of activity was high.

Table 10: Scores on participation (activity: newsletter) based on data from documents and interviews (Gemeente Eindhoven, 2018 c; Gemeente Eindhoven, 2018d; Appendix A and C).

| Activity (factor) | Project A | Project B | Project C |
|-----------------------------------|---|---|------------------|
| Informing and engaging the public | | | |
| Breadth | High: newsletter was announced on the website | High: newsletter was published on the website | No participation |
| Intensity | Medium: three newsletters were distributed from the design phase | Medium: three newsletters were distributed from the design phase | No participation |
| Influence | Low: Content of newsletters was determined by the municipality | Low: Content of newsletters was determined by the municipality | No participation |
| Openness | Medium: first newsletter was distributed in the design phase and later in the implementation phase | Medium: first newsletter was distributed in the design phase and later in the implementation phase | No participation |
| Goal | High: intrinsic and instrumental | High: intrinsic and instrumental | No participation |

Table 11: Scores on participation (activity: feedback meeting) based on data from documents and interviews (Gemeente Eindhoven, 2018 c; Gemeente Eindhoven, 2018d; Appendix A and C).

| Activity (factor) | Project A | Project B | Project C |
|-----------------------------------|--|--|---|
| Informing and engaging the public | | | |
| Breadth | High: meeting was announced on the website | High: meeting was announced on the website | Medium: residents inside the project area were invited |
| Intensity | Medium: three meetings were organized | High: more than three meetings were organized | Low: two meetings were organized per year |
| Influence | Medium: residents gave feedback on designs | Medium: residents gave feedback on designs | Medium: residents gave feedback on designs |
| Openness | Medium: meetings took place in design phase | Medium: meetings took place in design phase | Medium: meetings took place in design phase |
| Goal | High: intrinsic and instrumental | High: intrinsic and instrumental | High: intrinsic and instrumental |

Table 12: Scores on participation (activity: Stakeholders meeting) based on data from documents and interviews (Gemeente Eindhoven, 2018 c; Gemeente Eindhoven, 2018d; Appendix A and C).

| Activity (factor) | Project A | Project B | Project C |
|-----------------------------------|---|---|---|
| Informing and engaging the public | | | |
| Breadth | Low: one Invitation was send to the citizen advisory group | Low: one Invitation was send to the citizen advisory group | Low: one Invitation was send to the citizen advisory group |
| Intensity | High: five meetings were organized | High: six meetings were organized | High: one meeting was organized per month |
| Influence | High: distributed prototype of actions to all residents | Low: citizen advisory group did not motivate residents | Low: citizen advisory group did not motivate residents |
| Openness | High: first meeting took place in the planning phase and later in the evaluation phase | High: first meeting took place in the planning phase and before the implementation phase | High: first meeting took place in the planning phase and before the implementation phase |
| Goal | High: intrinsic and instrumental | High: intrinsic and instrumental | High: intrinsic and instrumental |

As can be seen in table 13, projects A and B scored highest for participation for the newsletter activity, whereas project C did not have a score. However, project C will likely have a participation score as the project is still ongoing and the adaptation policy is now at the forefront in all renovation projects. With regard to feedback meeting, the findings reveal that the project B scored highest for participation. The second-highest participation score was found in project A, whereas project C scored lowest. As for stakeholders meeting, project A scored highest for participation, whereas projects B and C had the same score.

Table 13: Overall scores on participation activities based on data from documents and interviews (Gemeente Eindhoven, 2018 c; Gemeente Eindhoven, 2018d; Appendix A and C).

| Activity | Project A | Project B | Project C |
|----------------------|------------------------------|------------------------------|--|
| Newsletter | Participation: Medium | Participation: Medium | Participation: no participation |
| Feedback meeting | Participation: Medium | Participation: High | Participation: Low |
| Stakeholders meeting | Participation: High | Participation: Medium | Participation: Medium |

4.4 Assessment of the local-context conditions of the projects

This section compares the different projects based on the expected influence of the demographic and socio-economic factors on adaptive actions. The expected influence represents the likelihood that residents of that project will implement adaptive actions compared to residents of other projects. Tables 14 and 15, show an overview of the demographic and socio-economic factors and their expected influence on adaptive actions.

With regard to the demographic factors (see table 14), there is a relatively small difference between the projects in terms of gender, age and household size. In terms of gender, project B had the highest male/female ratio, whereas project A had the lowest ratio. As for age, project B had relatively young residents due to the high number of students. Regarding the household size, project B had the lowest number of residents who live in a house. However, there is a significant difference between the projects in terms of hazard experience and geographical vulnerability. In projects A and C, the residents had no experience with flooding but they witnessed flooding and damage in the nearby Willemstraat. While, in project B, the residents had experienced flooding but their property did not suffer damage. As for geographical vulnerability, project B is a low-lying street, whereas the projects A and C are more elevated streets. Thus, residents in projects A and C are less vulnerable to flooding.

Regarding the demographic factors, the findings show that in all projects there had more men than women. This means more residents were likely to implement adaptive actions for economic benefits rather than social benefits. Therefore, gender was expected to have a supportive influence for economic benefits and not for social benefits. The projects had in common a relatively young resident. Project B had the youngest residents and more often they do not yet own their own house. The residents might be less motivated to implement adaptive actions, and thus, age was expected to have a relatively restrictive influence compared to projects A and C. As for the household size, the findings show that this is the smallest for project B. Project B included flats and buildings in which usually smaller households live. People living in flats are usually less engaged in adaptive actions, therefore the household size was expected to have a relatively restrictive influence compared to projects A and C. The findings on the experience of hazard and the geographical vulnerability indicate that, on the one hand, the residents of project B could likely implement adaptive actions because the flooding may increase their concerns. On the other hand, the flooding could probably have a negative impact on adaptive actions of residents because their property did not suffer damage. Therefore, the expected influence can be either relatively supportive or restrictive compared with other projects A and C. In projects A and C, the findings also show that witnessing the flood damage in the Willemstraat could likely change residents' opinions or motivation in favor of adaptive actions. Thus, both factors are expected to have a relatively supportive influence compared to project B. Table 14 presents the expected influence of these factors on adaptive actions.

Table 14: Overview of the demographic factors of projects, data from Gemeente Eindhoven (Gemeente Eindhoven, 2016; Gemeente Eindhoven, 2018d) and CBS in uw buurt (CBS, 2020) and expected influence on adaptive actions.

| Local context conditions (demographic factors) | Project A | Project B | Project C |
|--|--|---|---|
| Gender | Male=302 Female=295 | Male=519 Female=371 | Male=1639 Female=1451 |
| | Male=50,63% Female=49,37% | Male=58,26% Female=41,74% | Male=53,03% Female=46,97% |
| | Supportive influence | Supportive influence | Supportive influence |
| Age | 00-14yr:16% 15- 24yr:15% 25- 44yr:33% 45- 64yr:24% 65+yr:12% | 00-14yr:5% 15-24yr:24% 25-44yr:48% 45-64yr:14% 65+yr:9% | 00-14yr:8% 15-24yr:16% 25-44yr:46% 45-64yr:20% 65+yr:10% |
| | Average age=30. But younger residents live in Strijpsestraat. | Average age=22,70 | Average age=28,80 |
| | Restrictive influence | Restrictive influence | Restrictive influence |
| Household size | 1,8 people on average | 1,4 people on average | 1,6 people on average |
| | Supportive influence | Restrictive influence | Supportive influence |
| Hazard experience | Streets had no experience of flooding but residents often witnessed flooding and damage in Willemstraat. | Street had experienced flooding but without damage. | Streets had no experience of flooding but residents often witnessed flooding and damage in Willemstraat.. |
| | Supportive influence | Supportive/restrictive influence | Supportive influence |
| Geographical vulnerability | Higher altitude compared to Willemstraat | Low-lying street | Higher altitude compared to Willemstraat |
| | Supportive influence | Supportive/restrictive influence | Supportive influence |

With regard to the socio-economic factors (see table 15), there is a relatively small difference between the projects in terms of income. Project B had on average the highest income, whereas projects A and C had a lowest income. There is a significant difference in terms of level of education and house ownership. Project B and a part of project A have the highest level of education. The lowest level of education is found in a part of project A and project C. As for the house ownership, the highest percentage of residents who owned a house is found in project A. In contrast, the projects B and C have the lowest percentage of house ownership. This means, the percentage of tenant is high in projects B and C. Regarding to place attachment, in projects A and C, the residents live in terraced houses and fewer flats, whereas in project B, the residents live in flats, buildings, shops and offices.

With regard to the socio-economic factors, the findings indicate that residents likely had nearly the same income to implement actions. Therefore, income was expected to have a restrictive influence. As for the level of education, the findings show that the residents in project B and in a part of project A could have a better understanding of climate change and its impacts. This could probably stimulate them to undertake more adaptive actions, and thus education level was expected to have a relatively supportive influence compared to project C and in a part of project A. For the house ownership, the findings suggest that the residents in projects B and C could generally be less encouraged to invest in their property for adaptive actions than in project A. This means that house ownership in projects B and C was expected to have a relatively restrictive influence compared to project A.

The finding indicates that in projects A and C, the residents could be more connected to their neighborhood and could be likely motivated to invest more in their neighborhood for adaptive actions. Therefore, place attachment was expected to have a relatively supportive influence in projects A and C compared to project B.

Table 15: Overview of the socio-economic and place attachment factors of projects, data from Gemeente Eindhoven (Gemeente Eindhoven, 2016; Gemeente Eindhoven, 2018d) and CBS in uw buurt (CBS, 2020) and expected influence on adaptive actions.

| Local context conditions (socio-economic and place attachment factors) | Project A | Project B | Project C |
|--|---|---|--|
| Income | Low: 32% Middle: 39% High: 29% | Low: 39% Middle: 38% High: 20% | Low: 35% Middle: 40% High: 25% |
| | Average income=30000 euro Restrictive influence | Average income=32000 euro Restrictive influence | Average income=30000 euro Restrictive influence |
| Education level | Middle in Hastelweg and high education in Strijpsestraat. Supportive influence | High or university education. Supportive influence | Low or middle education. Restrictive influence |
| House ownership | Own: 67% Rental: 32% Rest: 1% Supportive influence | Own: 20% Rental: 73% Rest: 7% Restrictive influence | Own: 16% Rental: 83% Rest: 1% Restrictive influence |
| Place attachment | Terraced houses (houses of row or similar houses linked together, side-by-side) and few flats. Supportive influence | Flats (apartments), buildings, shops and offices. Restrictive influence | Terraced houses (houses of row or similar houses linked together, side-by-side) Supportive influence |

4.5 Assessment of the adaptive actions of the projects

This section compares the adaptive actions implemented by residents in the different projects. Table 16, presents the scores on adaptive actions by residents per project.

With regard to the downspouts connection, according to civil servants involved in the projects, there is a significant difference between the projects (interviews 1 to 6, Appendix C). In project A, most houses probably connected the downspouts to the rainwater sewer or water storage, whereas in project C all houses likely connected the downspouts to the rainwater sewer or water storage. In project B the downspouts were likely still connected to the wastewater sewer. As for green gardens, projects A and C probably implemented more compared to project B. However, project A implemented more green gardens compared to project C. Regarding green roofs, only in project A, two houses installed green roofs (see table 16).

Table 16 shows that most downspouts were likely connected to the rainwater sewer or water storage in project A and C, and therefore this action scores very high compared to project B. As can be seen in table 16, the findings indicate that the residents who live in project A probably installed most green gardens. Therefore, this action scores high compared to projects B and C. The second highest implementation of green gardens was found in project C, and thus this action scores medium compared to projects A and B. The number of residents that installed least green gardens was found in project B, and thus this action scores low to no action compared with the other projects. As for green roofs, the findings show that in none of the projects this was a popular action, and therefore this action scores low to no action.

Table 16: Scores on adaptive actions per project data from documents and interviews (Gemeente Eindhoven, 2018 c; Gemeente Eindhoven, 2018d; Appendix A).

| Adaptive actions | Project A | Project B | Project C |
|----------------------|---|---|---|
| Downspout connection | 90 to 95 percent of houses connected the downspouts to the water storage or rainwater sewer. Very high action | No house connected the downspout to the rainwater storage or rainwater sewer but, to the wastewater sewer. Low to no action | 100 percent of houses connected the downspouts to the rainwater sewer. Very high action |
| Green gardens | More than 60 percent of houses removed pavement for green gardens. But more of them live in the Strijpsestraat. High action | Only 2 to 5 percent of houses (a part of Vestdijk) are intending to remove. pavement for green gardens. Low to no action | 40 to 45 percent of houses removed pavement for green gardens. Medium action |
| Green roofs | Two houses removed hardening for green roofs in Strijpsestraat. Low to no action | No house removed hardening for green roofs. Low to no action | No house removed hardening for green roofs. Low to no action |

Project C, all houses likely connected the downspouts to the rainwater sewer or water storage than project A. The interviewees (interviews 1 and 5, Appendix C) stated that, this was partly because, in project C, all houses do have a small front gardens compared to project A. Therefore, it was easier for the corporation and residents who live in project C to give permission to the municipality to connect the downspouts from their front door to the water storage or rainwater sewer due to less damages in their gardens. Since without the permission of residents, the municipality cannot connect the downspouts. In contrast, in project B, all downspouts were connected to the wastewater sewer. This is because the downspouts were not in front of flats. Additionally, downspouts were installed inside the flats and buildings. Regarding green gardens in project C, according to interviewees (interviews 1 and 5, Appendix C), the corporation allowed residents to remove pavement.

4.5.1 Comparative analysis of the factors and adaptive actions of the projects

Table 17 presents a general overview of the scores on factors and adaptive actions of projects. The scores on factors are given in three colors: green, yellow and red. With regard to regulations, financial incentives and participation, the green color means that the score is high or very high, yellow is medium and red is low. As for local-context conditions, the green color means that the influence is supportive, yellow can be either supportive or restrictive and red is restrictive. Based on the results above, six local-context conditions that made the difference in terms of adaptive actions between the projects in this study were selected i.e. household size, hazard experience, geographical vulnerability, education level, house ownership and place attachment.

As can be seen in table 17, project A had the most green-colored score. Since, project A scored very high on regulations and medium on financial incentives and participation. Then, local-context conditions had likely to have a supportive influence on adaptive actions. Therefore, project A had likely implemented the most adaptive actions. The second most green-colored score was found in project C. Because, project C scored high on regulations but low on financial incentives and participation. In project C, the local-context conditions like household size, hazard experience, geographical vulnerability and place attachment had likely to have a supportive influence on adaptive actions, whereas education level and house ownership had likely to have a restrictive influence on adaptive actions. As a result, project C had likely implemented the medium adaptive actions. Project B had the least green-colored score. Project B scored very high on regulations but low on financial incentives and medium on participation. The local-context conditions like household size, house ownership and place attachment had likely to have a restrictive influence on adaptive actions in project B. The

hazard experience and geographical vulnerability could have a supportive or restrictive influence on adaptive actions. However, in project B, only the education level had likely to have a supportive influence on adaptive actions. Thus, project B had likely implemented the fewest adaptive actions.

Table 17 shows that the factors could explain the adaptive actions. With regard to policy instruments and participation, project A scored highest compared to projects B and C. Project B had the second highest score, whereas project C scored lowest. The highest score on policy instruments and participation in project A may therefore explain that residents likely implemented the most adaptive actions. In project B, residents likely implemented the fewest adaptive actions despite the second highest score, whereas project C had the lowest score, but residents likely implemented the second most adaptive actions. As for local-context conditions, project A had the most supportive influence factors compared to projects B and C. While project C had the second most supportive influence factors compared to project B. As a result, project A likely implemented the most adaptive actions, followed by project C and project B.

Table 17: General overview of the scores on factors and adaptive actions per project (green: very high / high, yellow: medium, red: low) and (green: supportive, yellow: supportive / restrictive, red: restrictive).

| Type of variable | Factors | Project A | Project B | Project C |
|--|--------------------------|--|--|---|
| <u>Independent variable</u> | Regulations | | | |
| Policy instruments | Financial incentives | | | |
| <u>Independent variable</u> | Participation | | | |
| <u>Independent variable</u> | Household size | | | |
| Local-context conditions (three demographic) | Hazard experience | | | |
| | Geographic vulnerability | | | |
| <u>Independent variable</u> | Education level | | | |
| Local-context conditions (three socio-economic) | House ownership | | | |
| | Place attachment | | | |
| <u>Dependent variable</u> | Adaptive actions | Most action: downspout connection= 90 to 95% of houses green garden= more than 60% of houses green roof= two houses | Least action: downspout connection= 0% of houses green garden= 2 to 5% of houses green roof= no house | Medium action: downspout connection= 100% of houses green garden= 40 to 45% of houses green roof= no house |

5 Discussion

This chapter is comprised of three parts. The first discusses the cases and conceptual model of the present study. The second focuses on the results of the assessment of an empirical study investigating the influence of participation on residents' adaptive actions. Then, the results of the policy instruments and local-context conditions. The third part discusses the limitation of the method used in this research.

5.1 cases and conceptual model

The study investigates the factors that influence residents' adaptive behaviour. Therefore, the study used three municipal projects in Eindhoven, of which the implementation phase has been completed. It is important to ensure that cases effectively reflect the phenomenon of interest (Yin 2009). This calls for purposeful case selection rather than random sampling. The projects are geographically spread in the center and outside. The selected projects reflect the adaptive actions implemented by residents in the context of climate adaptation, in line with the aims of the present study. They can be safely considered as a purposeful case selection.

Project C resulted directly from a request from the housing corporation. While projects A and B came from the municipality. Housing corporation made considerable contribution (e.g. spend time to organise meetings) showing its willingness concerning the project C. All projects provided information on both factors and adaptive actions.

To find the influence of participation on residents' adaptive actions in Eindhoven, a conceptual model was developed through existing literature (figure 2). The two variables of the model relate (i) to participation dimensions and (ii) to adaptive actions. Since, the relationships were frequently mentioned in the identified literature. The work of Dietz and Stern (2008) and Sarzynski (2015) was identified as significantly important for this study regarding the contribution of participation to adapt. Their work had been mentioned in previous thesis (e.g. Groeneveld, 2019; Van Dijk, 2021) regarding climate change adaptation. The model also links other factors like policy instruments and local-context conditions to adaptive actions. There have been a large number of arguments in favor of these factors. Recent studies (e.g. Dang et al., 2019; Brink and Wamsler, 2019; Roggero, 2019) still provide new arguments to use these factors to explain residents' adaptive actions. Furthermore, the model demonstrates that the adaptive actions of residents and participation do not necessarily translate into adaptation itself and that local-context conditions are thus required. The model also highlights the potential that the municipality has to improve or to influence the participation and the policy instruments for residents' adaptive actions. In fact, the model reveals how local-context conditions can influence the adaptation efforts of the municipality both supportive and restrictive regarding residents' adaptive actions.

5.2 Findings

From the results of the assessment of the study several interesting findings emerge. First, based on the interviews and desk research of the three municipal projects, this study shows that participation displays a murky picture of its influence on residents' adaptive actions. On the one hand, in project A, the participation likely contributed to increase the implementation of adaptive actions compared to projects B and C. Since, the interviews with civil servants that were involved in the projects gave a profound insight into the way residents were engaged. All Projects were great ways of involving residents and stimulating them to undertake adaptive actions themselves. However, regarding the stakeholder meeting activity, in project A, a citizen advisory group was actively involved in a high intensity and high influence in implementing green gardens, whereas the citizen advisory group in projects B and C were in a high intensity and low influence engaged. According to Dietz and Stern (2008), this high intensity can help residents to better understand and respond to climate change. In addition, high influence generally leads to higher transparency of the participation. Moreover, having high transparency of the participation also enhances the understanding of residents for climate adaptation (McCormick, 2006; Dietz and Stern, 2008). Thus, this can lead residents to accept, and therefore to undertake adaptive actions (Uittenbroek et al., 2019). On the other hand, in projects B and C, the participation likely did not really contribute to the implementation of adaptive actions. Since project B had the same score as project A compared to project C, while project B likely implemented the fewest adaptive actions. Regarding the feedback meeting, in project B, residents were engaged in a high breadth and high intensity, whereas in project C, residents were engaged in a medium breadth and low intensity. In project B, residents were regularly updated on the design process so that they knew what was going on and the planning for feedback meetings compared to project C. According to Dietz and Stern (2008), high intensity can lead to a lower breadth. This was not the case in project B, because the high intensity of the feedback meeting activity was able to reach a

relatively large resident compared to project C. The two dimensions of participation did not make the feedback meeting an effective participation activity to ensure a successful outcome regarding residents' adaptive actions in project B. According to Uittenbroek et al. (2019), in public meetings, there is often limited time for public to understand climate change, even when multiple meetings are organized. Additionally, as for newsletter activity, in projects A and B, participation took place, whereas in project C there was no participation. According to Sarzynski (2015), participation could increase the outcomes for adaptation. Here, too, this participation activity did not motivate residents in project B to implement more adaptive actions than project C. Particularly in projects B and C, this implies that regardless of the score of participation, factors other than participation seemed to have an influence on the relationships between participation and adaptive actions.

Second, while previous research has mainly emphasized that local governments increase the number of residents' adaptive actions by relying on policy instruments, like regulations and financial incentives (Porter et al., 2014; Mees et al., 2019; Roggero, 2019), the study results show that these instruments probably influenced residents' motivation for adaptation in project A compared to projects B and C. This means that the argument of previous research is partly validated by this study. In fact, the study shows that regarding the regulations, in all projects, residents were aware of the conditions of adaptive actions, but this awareness did not result in most adaptive actions, especially in projects B and C compared to project A. Partly surprisingly, project A did not experience flooding but make use of financial incentives for adaptation, while project B did not use them despite experiencing urban flooding in the past. This contrast with the common use of financial incentives to motivate residents to take adaptive actions whose main purpose is to foster adaptation at scale.

Third, the study also highlights the influence of local-context conditions in the projects, not only on the relationships between policy instruments and residents' adaptive actions, but especially on the relationships between participation and residents' adaptive actions. Adaptation cannot be separated from local-context conditions (see e.g., Kreibich, 2011), and it is therefore comprehensible, given the different amount of adaptive actions taken by residents in all projects. In general, house ownership was found to be the most motivating factor for residents in project A to adapt compared to projects B and C. Additionally, other factors like place attachment, geographic vulnerability, hazard experience and household size were found to motivate residents in projects A and C to adapt compared to project B. These results are in line with other research that suggested that these factors contribute to increase adaptive actions for climate change (Kreibich, 2011; Valkengoed and Steg, 2019; Brink and Wamsler, 2019).

5.3 Limitations of the methodology

As chapter 1 explains, this study aims to find the factors that influence the adaptive behaviour of residents. Therefore, to achieve this aim, three projects were selected with different characteristics. Projects A and C were characterized more by terraced houses, whereas project B was characterized by flats, buildings, shops and offices. In addition, projects A and C had their own gardens and roofs. This means that the residents had the possibility to implement adaptive actions in their own gardens and roofs in project A and C, whereas in project B most residents did not have this possibility. As result, in project B, residents who live above the ground floor did not have their own gardens or roofs to implement adaptive actions. Furthermore, project C was much larger in size compared to projects A and B. To further reinforce the results of this study, it is necessary to also investigate projects that have the same characteristics in terms of the type of houses and their size to identify the factors influencing the adaptive actions by residents.

Furthermore, to identify the factors that influence the adaptive actions by residents, this study used the newsletter, other documents of the municipality, website of the CBS and the interviews to collect and analyse data instead of the survey method. Therefore, further research is needed for which questions will be sent out to residents of the three projects to identify the influence of regulation, financial incentives, participation and local-context conditions on adaptive actions. The findings of the present study and survey method can then be compared with each other.

Finally, this study only used the demographic and socio-economic factors and not the cognitive factors studied by various researches (e.g. Grothmann and Patt, 2005; Dang et al., 2019; Brink and Wamsler, 2019). This is considered a limitation because the adaptive actions also includes changes in cognitions, which are mainly influenced by society. Therefore, further research is needed including the perception of climate change and its impacts as a determinant factor affecting the adaptive actions by residents.

6 Conclusion & Recommendations

This chapter is organized into two parts. The first part is the conclusion that briefly answers the research questions by summarizing the findings of this study. The second part addresses future research.

6.1 Conclusion

The findings of the present study involve the identified factors that influence the implementation of adaptive actions of residents. These factors were found by investigating the existing literature about climate adaptation. Based on the findings a conceptual model was developed. This model was applied on the data collected and analyzed by studying three relevant projects in the city of Eindhoven. Based on this an answer was found for the research questions.

According to the literature, what are the factors that influence the implementation of adaptive actions by residents?

This research explored the factors influencing residents' adaptive actions. These were obtained by studying academic articles from the domain of climate adaptation and other contexts. Table 18 presents an overview of the specific influencing factors.

Table 18: Overview of factors influencing residents' adaptive actions.

| Influencing factors | |
|----------------------------|--|
| Policy instruments | |
| Regulations | Local governments can increase adaptive actions by relying on conditions of adaptive actions. |
| Financial incentives | Adaptive actions are unlikely to happen in households without financial incentives. |
| Participation | Adaptive actions are collective actions that require the participation of the public. |
| Demographic | |
| Gender | Men and women have different reasons for implementing adaptive actions. |
| Age | Aging residents are less likely to adopt adaptive actions. |
| Household size | Larger households are more able to accomplish adaptive actions. |
| Hazard experience | Adaptive actions of residents are often linked to past experience. |
| Geographical vulnerability | Residents living in low-lying areas can be motivated to adapt. |
| Socio-economic | |
| Income | Higher household income increases the chance of adaptive actions by enhancing the possibility to invest in adaptation. |
| Education level | Residents with a higher education level have a greater probability and ability to adapt. |
| House ownership | The ownership of a house is more motivated than a tenant to implement adaptive actions. |
| Place attachment | Residents that are connected to a place have less hesitation to invest in adaptive actions. |

In the case of Eindhoven, to what extent do regulation, financial incentives, participation and local-context conditions influence the adaptive behaviour of residents of the case studies?

Three projects municipal projects were chosen in which residents were involved in adaptive actions on private spaces. For the analysis of residents' adaptive actions, influencing factors like regulations, financial incentives, participation, and local-context conditions were analyzed. Based on these analyses, the following conclusions may be stated:

In project A, regulations that represented the conditions to implement adaptive actions scored very high. The financial incentives were more used to connect the downspouts to the rainwater sewer or water storage. The participation scored medium, but the stakeholders' meetings scored high in intensity and influence. This was because the citizen advisory group was actively involved in encouraging other residents to undertake adaptive actions. The local-context conditions like the household size, hazard experience, geographical vulnerability, house ownership, education level and place attachment were likely to have a supportive influence on residents' adaptive actions.

For project B, the score on regulations was also very high, whereas score was low for financial incentives. In addition, the score on participation was medium as project A. Only the education level was likely to have a supportive influence on adaptive actions. However, this was not enough to motivate residents to increase their adaptive actions, probably because other local-context conditions like household size, house ownership and place attachment were more likely to have a restrictive influence on residents' adaptive actions.

Project C, scored high on regulations whereas scores on the use of financial incentives and participation were low. However, local-context conditions like household size, hazard experience, geographical vulnerability and place attachment were likely to have a supportive influence on residents' adaptive actions. Whereas house ownership and education level were likely to have a restrictive influence on residents' adaptive actions.

By comparing the case studies, what are the factors that explain the implementation of adaptive actions by residents?

Project A implemented the most adaptive actions probably because participation likely contributed to increase adaptive actions. In addition, in project A, the house ownership seemed to be the most motivating factor compared to projects B and C. Then, project B, implemented the fewest adaptive actions despite a higher score on participation than project C. Therefore, participation probably did not really contribute to adaptive actions of residents. This could be explained by the fact that almost all local-context conditions (see table 17) were likely to have a restrictive influence on residents' adaptive actions. Finally, project C, implemented the second most adaptive actions despite a lower score on participation. This seems that participation likely did not contribute to increase adaptive actions. The implementation of adaptive actions was likely due to the supportive local-context conditions like household size, hazard experience, geographic vulnerability, and place attachment.

What recommendations can be formulated to the municipality with regard to the adaptation dialogue in order to increase the adaptive actions of residents at the household level?

The municipality of Eindhoven acts proactively in the field of climate adaptation and the active involvement of residents. The municipality anticipated various ambitions of the DPRA, such as carrying out a stress test and the adaptation dialogue. However, this is no reason to slow down and not identify the factors that influence the adaptive actions of residents. Since the municipality has set itself the ambition to be a climate-proof city by 2050.

One of the main findings in this study is that a project with a strong focus on the active involvement of a citizen advisory group in adaptation can probably increase the likelihood of residents' adaptive actions. This strong focus can likely motivate some residents even living in flats and tenants to undertake more adaptive actions. In addition to the municipality's efforts for adaptation, it is therefore, recommended that the municipality should engage an active citizen advisory group in participation for adaptation of residents such as the stakeholders' meetings activity in project A. Additionally, by distributing newsletters at the start of the project, rather than in the design phase, more awareness can be created regarding the importance of adaptive actions by residents. Moreover, financial incentives should receive more attention by being clearly communicated to residents.

6.2 Recommendations for future research

To further gain insights on factors that influence the adaptive actions of residents in the city of Eindhoven, this study used qualitative research, which offers opportunities to obtain in-depth understandings of factors that influence adaptive behaviour. It might be interesting to look at quantitative research that can present meaningful facts and figures. It might be interesting to use a combination of quantitative and qualitative research in future research to achieve more comprehensive explanations of factors influencing adaptation to climate change. Future research should focus on studying projects that have the same characteristics in terms of the type of houses for better comparison.

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8 Appendices

Appendix A

Interview handleiding

De onderstaande interview handleiding is het basismodel geweest dat beter aansluit bij de kennis en expertise van de respondent, en de doelstelling. Dit wil zeggen dat bij sommige interviews enkele vragen zijn besproken of behandeld volgens de doelstelling. Er zijn twee soorten vragen opgenomen. De eerste soort vraag betreft de beleidsinstrumenten en de tweede soort vraag gaat over de participatie van bewoners. Beide vragen richten zich op adaptatiemaatregelen, zoals het afkoppelen van regenpijpen en het vergroenen van tuinen en daken die bewoners zelf kunnen implementeren. Deze vragen zijn gebruikt om te spreken met respondenten die in hun werk bezig zijn met het uitvoeren van het Deltaplan Ruimtelijke adaptatie.

Toelichting Interview

- Introductie door interviewer: Adama Coulibaly
- Afstudeeronderzoek MA CEM
- Noteer gegevens
- doel van het onderzoek: *“in welke maat de adaptatiedialogen, de lokale context en andere beleidsinstrumenten beïnvloeden de adaptatiemaatregelen van bewoners”*
- hoofd onderzoeksvraag: *“hoe beïnvloeden de adaptatiedialogen, de lokale context en de beleidsinstrumenten de adaptatiemaatregelen van bewoners in de stad Eindhoven?”*
- Beschrijf de interviewprocedure
 - o Duur: ongeveer een uur
 - o Open vragen
 - o Interview wordt opgenomen en er worden notities gemaakt
 - o Geïnterviewde heeft de mogelijkheid om vragen te stellen

| | |
|--|---|
| <p>Bedankt voor uw komst voor dit interview. De vragen dat ik u ga stellen, gaan over uw functie, betrokkenheid en de inzet van beleidsinstrumenten binnen het openbare project.</p> <p>Ik zou u allereerste twee vragen willen stellen over u functie en rol in het project</p> | |
| Functie project | Zou u zichzelf willen voorstellen (organisatie, functie)? |
| | Antwoord: Landschapsontwerpers, water adviseurs en uitvoering coördinator bij de Gemeente Eindhoven; |
| Betrokkenheid project | Zou u kort iets willen vertellen over het project en wat was u rol? |
| | Antwoord: Verantwoordelijk voor project A, B en C |
| <p>Beleidscontext (beleidsinstrumenten) In dit stuk gaat de vragen over beleidsinstrumenten zoals het reguleren en de subsidies aanvraag van de adaptatiemaatregelen (bijvoorbeeld: afkoppelen regenpijpen en vergroenen) die van toepassing waren in het project om bewoners te stimuleren om zelf maatregelen te nemen op hun eigen terrein.</p> | |
| Reguleren | Waren de bewoners geïnformeerd over de gemeentelijke voorwaarden van het afkoppelen van de regenpijpen van de gemengde riolering en het verwijderen van verharding voor groen tuinen en daken? Zo ja: |
| | Antwoord: |
| | Hoe waren de bewoners geïnformeerd over de gemeentelijke voorwaarden van het afkoppelen van de regenpijpen van de gemengde riolering en het verwijderen van verharding voor groen tuinen en daken? |
| | Antwoord: |
| | Hebben de bewoners de regenpijpen afgekoppeld of het verwijderen van verharding voor groen of wilden ze gaan doen door de voorwaarden? |
| | Antwoord: |
| Subsidies | Hoeveel bewoners hebben de subsidies aangevraagd om de regenpijpen te koppelen aan de waterberging of het regenwaterriool in de straat? |
| | Antwoord: |
| | Hoeveel bewoners hebben de subsidies aangevraagd om de verharding te verwijderen voor groene tuinen in de straat? |
| | Antwoord: |
| | Hoeveel bewoners hebben de subsidies aangevraagd om de verharding te verwijderen voor groene dak in de straat? |
| | Antwoord: |

| | |
|--|--|
| <p>Participatie: De volgende vragen hebben betrekking op de participatie van bewoners bij openbare projecten met als doel dat ze zelf adaptatiemaatregelen nemen op hun eigen terrein. Participatie verwijst naar het betrekken van een actor in het maken van beleid. Participatie activiteiten zijn methoden om deze participatie te realiseren, bijvoorbeeld door het organiseren van informatieavond of afkoppelen.</p> | |
| Activiteiten | Wat voor participatie activiteiten zijn georganiseerd gerelateerd aan het nemen van adaptatiemaatregelen door bewoners op eigen terrein? (Bijvoorbeeld: wijkinfo, informatieavond en feedbackavond) |
| | Antwoord: |
| Wie deed er mee | Wie participeert in deze activiteiten (direct betrokken bewoners of iedereen die wilt participeren)? |
| | Antwoord: |
| Wanneer deed er bewoners mee | Wanneer hebben de bewoners deelgenomen aan deze activiteiten? (Bijvoorbeeld: planningsfase, ontwerpfase, uitvoeringsfase, evaluatiefase) |
| | Antwoord: |
| Bewoners invloed | Hoeveel invloed hebben de bewoners op deze activiteiten? |
| | Antwoord: |
| Vaak en duren van participatie | Hoe vaak hebben de bewoners deelgenomen aan deze activiteiten? |
| | Antwoord: |
| Participatie doel | Wat zijn de doelen van de participatie activiteiten? |
| | Antwoord: |

Afsluiting

- Zijn er nog aanvullingen?
- Mag er contact opgenomen worden per mail als er nog verdere vragen zijn?
- Kunnen jullie relevante documenten sturen?
- Is het mogelijk om een vervolg interview te plannen?
- Bedankt voor de tijd.

Appendix B

Toestemmingsverklaringsformulier

Onderzoek: het verklaren van de condities die van invloed zijn op de implementatie van adaptatiemaatregelen door de bewoners.

Onderzoeker: Adama Coulibaly

Hierbij verklaar ik dat ik het informatieblad van het onderzoek heb gelezen en begrepen en ik ben akkoord met de genoemde punten in dit informatieblad. Ik ben in staat gesteld om vragen te stellen over het onderzoek, en mijn vragen zijn beantwoord tot mijn tevredenheid. Ik stem vrijwillig in met deelname aan dit onderzoek en begrijp dat ik mag weigeren antwoord te geven op vragen en me kan terugtrekken als participant op elk moment van het onderzoek.

Voor het registreren van data mag de volgende persoonlijke informatie gebruikt worden:

- Naam
- Functie
- Organisatie

Voor het refereren van data mag de volgende persoonlijke informatie gebruikt worden:

- Naam
- Functie
- Organisatie

| Deelnemer | | Onderzoeker | |
|---------------------|--|---------------------|--|
| Naam: | | Naam: | |
| Datum: | | Datum: | |
| <i>Handtekening</i> | | <i>Handtekening</i> | |

Informatieblad

Doel van het onderzoek

Dit onderzoek streeft ernaar om inzicht te krijgen in de implementatie van het Delta Plan Ruimtelijke Adaptatie in Eindhoven om de (toekomstige) implementatie in (andere) straten te bevorderen. Daarbij ligt de focus op bewonersparticipatie. Om hierin inzicht te krijgen zullen de participatiemechanismen die de gemeente Eindhoven hebben gebruikt worden beschreven aan de hand van een theoretisch kader.

Het onderzoek kan voor de te interviewen personen geen ongemak of risico's met zich meebrengen, omdat zij enkel input leveren over hun ervaring met de participatie van bewoners in de implementatie van DPRA. De commissie ethiek van de faculteit civiele techniek heeft dit onderzoek beoordeeld en goedgekeurd.

Mogelijkheid tot terugtrekking

Mocht de deelnemer gedurende het onderzoek zich willen terugtrekken is dit mogelijk. Indien deelname ook niet anoniem voortgezet mag worden, kan de deelnemer contact opnemen met Adama Coulibaly om de deelname te beëindigen en de gegevens en informatie te wissen.

Gebruik van (persoonlijke) informatie

Persoonlijke informatie- dat is naam, functie, organisatie- zal aan het begin van het interview gevraagd worden aan de deelnemer. De deelnemer moet in het toestemmingsverklaringsformulier aangeven wat er met deze persoonlijke informatie gedaan mag worden zowel voor het registreren van de data (intern) als de bronvermelding bij de data (extern). Daarbij kan de deelnemer kiezen uit:

- Organisatie
- Functie en organisatie
- Zowel naam, functie als organisatie

de deelnemer heeft het recht om deze keuze te wijzigen gedurende het hele onderzoek.

Tijdens de interviews zal de informatie die de deelnemer verstrekt genoteerd worden, daarnaast wordt een opname gemaakt van het interview zodat zeker is dat alle informatie beschikbaar is. De informatie die voortvloeit uit de interviews zal worden opgeslagen. Er wordt dus vertrouwelijk met de informatie omgegaan. De informatie die uit het interview wordt gehaald en gebruikt wordt in de thesis zal tijdens het proces nog opgestuurd worden naar de deelnemers, met het verzoek om akkoord te geven. De deelnemers hebben dan de mogelijkheid om de informatie aan te passen en/of te wissen.

Planning onderzoek

De informatie die verkregen wordt voor dit onderzoek zal beschikbaar zijn voor de gemeenteprojecten. Mocht een deelnemer hier bezwaar tegen hebben, zal de informatie afkomstig van de betreffende deelnemer gewist worden na voltooiing en goedkeuring van het onderzoek.

Contactgegevens

Verantwoordelijke onderzoeker:

Adama Coulibaly, a.coulibaly@student.utwente.nl of a.coulibaly@eindhoven.nl

Begeleiders: Joanne Vinke-de Kruijf, joanne.vinke@utwente.nl;

Denie Augustijn, d.c.m.augustijn@utwente.nl;

Luuk Postmes, l.postmes@eindhoven.nl

Appendix C-Interviews

Respondents civil servants per project and interview number

| | | |
|------------------------------------|---|--------|
| Project A (Hastelweg/Stripsetraat) | 2 | 1 en 2 |
| Project B (Vestdijk) | 2 | 3 en 4 |
| Project C (Philipsdorp) | 2 | 5 en 6 |

Wie is

Landschapsontwerper (1) bij de Gemeente Eindhoven betrokken bij project A

- Ontwerp van openbare ruimte o.a.
 - 15 procent ontharden
 - Ontwerp van stoeptegels en rijweg
 - Ontwerp van groenvakken
 - Ontwerp van bomen
- Adviseert citizen advisory group over planten

Wie is

Landschapsontwerper (3) bij de Gemeente Eindhoven betrokken bij project B

- Ontwerp van openbare ruimte o.a.
 - 15 procent ontharden
 - Ontwerp van stoeptegels en rijweg
 - Ontwerp van planten soorten in groenvakken
 - Ontwerp van bomen

Wie is

Landschapsontwerper (5) bij de Gemeente Eindhoven betrokken bij project C

- Ontwerp van openbare ruimte o.a.
 - Ontwerp van stoeptegels en rijweg
 - Ontwerp van groenvakken

Wie is

Uitvoeringscoördinator (2) bij de Gemeente Eindhoven betrokken bij project A

- Stuurt en coördineert de uitvoering activiteiten namens de gemeente

Wie is

Wateradviseur (4) bij de Gemeente Eindhoven betrokken bij project B

- Adviseert watersysteem openbare ruimte

Wie is

Wateradviseur (6) bij de Gemeente Eindhoven betrokken bij project C

- Adviseert watersysteem van openbare ruimte