Aligning densification and climate resilience in post-war neighborhoods

Aiming for a Pareto optimum in the Western Garden Cities of Amsterdam

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Abstract

This thesis explores the alignment between two topic policy goals: densifying the city to fulfill the enormous demand for affordable housing and making the city climate-resilient to respond to possible future (climate-related) shocks and stresses. This study pictures both the already implemented governance mechanisms and the governance mechanisms that could improve the alignment of densification and climate resilience goals. With multiple conflicts between the two policy goals being identified, the research shows that the currently implemented governance mechanisms lack the impact to foster the alignment between densification and climate resilience as the climate resilience paradigm is undervalued. To improve the alignment, this thesis suggests creating integral visions that structurally map the climatic strengths and weaknesses of an area before shaping the densification plans.

Table of content

1. Introduction

Problem statement

The city of Amsterdam is proliferating, and its economy is increasing fast. In the last decades, the city gained more residents, jobs, and businesses (Kruyswijk, 2019). Resultantly, the municipality of Amsterdam is planning on expanding with 150.000 new dwellings for the anticipated 250.000 new inhabitants by the year 2050 (Gemeente Amsterdam, n.d.). However, the city's enormous growth also has a severe limitation as the expanding possibilities are exceptionally narrow. The Amsterdam newspaper Parool mentioned the status quo in the summer of 2022: "Amsterdam has a problem with space: the city has reached its outer limits. No matter which way you turn, everywhere, Amsterdam encounters obstacles, other municipalities, or green spaces we have agreed not to build. Bigger is no longer possible; we have to make it with the space we have" (Kruyswijk, 2022).

Still, it is estimated that by 2050 Amsterdam will count 1.125.000 inhabitants who will all have to live within the city's current borders (Couzy, 2021). With the current housing crisis (Hochstenbach, 2022), the municipality of Amsterdam experiences enormous pressure to respond to the existing and future housing shortage. To ensure that all the new inhabitants of Amsterdam will acquire proper housing, the municipality has been planning on densifying the city (Gemeente Amsterdam, n.d.)

Besides the housing shortage, the city council of Amsterdam also has committed to act against another severe issue: climate change. Action to counteract climate change is urgently needed since the city's high concentrations of people and infrastructures increase the potential impact of climate change (Erlwein et al., 2023). There is a general consensus that the adverse effects of climate change can no longer be entirely prevented due to the exceeding of tipping points (Eichhorn et al., 2021). The impacts of climate change are already detectable within the densely built and highly sealed parts of the city (Hagen et al., 2020). Therefore, in addition to climate mitigation measurements, the municipality of Amsterdam strives to improve its neighborhood's climate adaptability and resilience (Gemeente Amsterdam, 2020; 2021).

Implementing adaptation measurements to decrease vulnerability to climate change is essential to many European cities (Eichorn et al., 2021). Climate resilience, the ability to anticipate, prepare for, and respond to hazardous events, trends, or disturbances related to climate, is an issue that has gained more and more priority in policymaking during the last years (Geneletti & Zardo, 2015). Looking at the Netherlands, the national government has calculated that implementing no climate-resilience measurements could lead to expected climate damage between 77.5 and 173.6 billion Euros up until 2050 (Rijksoverheid, n.d).

To mitigate the calculated damage, policymakers currently pay increasing attention to making neighborhoods climate-resilient when designing new parts of the city and redeveloping existing neighborhoods (Metropoolregio Amsterdam, 2021; Gemeente Utrecht, n.d). Nevertheless, making existing neighborhoods climate-resilient is perceived as more complex than inventing resilience measurements for new development and construction. This can be explained by the fact that with existing neighborhoods climate measurements should be adjusted to the local context and its already existing urban structure. Instead, with new built neighborhoods these measurements can be integrating in advance on the drawing board (Rędzińska & Piotrkowska, 2020).

Despite these contextual differences, one issue remains rather important for climate resilience in cities: green spaces. Green spaces can increase an area's resilience because they can deal with extreme changes in precipitation and temperature (Foster, Lowe & Winkelman, 2011). According to the Amsterdam municipality, green spaces are important when stimulating the city's climate resilience (Gemeente Amsterdam, n.d.). Moreover, during the Covid-19 pandemic, it became clear how important green spaces are for the well-being of urban residents (Pamukcu-Albers et al., 2021). However, the number of urban green spaces in Amsterdam is decreasing fast. Moreover, parks and nature have not kept pace with the city's increasing population and housing growth (Van Zoelen, 2021).

It could be questioned if both the policy goals of densifying the city and increasing climate resilience can go hand in hand. Compact and dense-structured environments are more vulnerable to the effects of climate change and, for example, can cause urban heat islands because of their high degree of sealed infrastructure (Balikçi et al.,2021; Eichhorn et al., 2021). Studies have shown that natural surfaces in the city are largely being replaced by sealed covers and buildings (Hagen et al., 2020). If the construction of new residential areas takes place in spaces that used to be green, it can be assumed that the densification process will go at the expense of climate resilience. Therefore, integrating climate solutions into the city while accommodating more people seems challenging (Sweco, 2020). According to Mendel Giezen, an urban planner at the University of Amsterdam, “the craving for more greenery clashes with 'densification policy.’ A green city is sustainable, and a compact city is sustainable, but we have to accept that realizing both is very difficult” (Van Zoelen, 2021).

Despite the debate, Amsterdam's municipality is convinced that densification is needed to fulfill the enormous need for new dwellings. Since Amsterdam is originally densely built, policymakers see that densification is primarily possible in the peripheral parts of the city: Amsterdam North, Southeast, and New-West (Gemeente Amsterdam, n.d.). Especially the post-war area, ‘the Western Garden Cities’ in Amsterdam New-West, has been densified in the past and will be densified further in the future. Due to their relatively high amounts of open space, these neighborhoods are seen as places with a high potential for densification. This is referred to as ‘fill in potential’ (freely translated from the Dutch word ‘inbrei-potentieel’ (Mens, 2020). After World War II, the neighborhoods of the Western Garden Cities were built with modernist principles. By the motto of ‘light, air, and space,’ widely set up housing blocks with many open green spaces were realized (Rijksdienst van Cultureel Erfgoed, 2016).

On the one hand, the Western Garden Cities originally contained high amounts of open and green infrastructure, which are greatly important for climate resilience. On the other hand, the Western Garden Cities are currently being redeveloped and densified. Therefore, they provide highly interesting characteristics to explore how densification and climate resilience goals are being aligned in redeveloping a Dutch post-war neighborhood.

Research aim and research questions

This thesis aims to explain possible conflicts between two fundamental policy goals: densifying the city to fulfill the enormous demand for affordable housing and making the city climate-resilient to respond to possible future (climate-related) shocks and stresses. Moreover, it aims to picture both the already implemented as the envisioned governance mechanisms to improve these conflicts. To do so, this report addresses the following research question:

In which way are densification and climate resilience goals being aligned in redeveloping post-war neighborhoods?

To answer this research question, the following sub-questions we developed:

- *Which particular conflicts between densification and climate resilience can be identified?*

- *Which governance mechanisms are currently implemented to increase the alignment of densification and climate resilience?*

- *Which governance mechanisms could improve the alignment of densifying and climate resilience?*

Societal relevance

Dutch cities are experiencing a tremendous housing shortage (Couzy, 2021). The Dutch government has stated that before the end of 2030, at least one million houses should be constructed to comply with the increasing demand for dwellings (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, 2021). Since all Dutch municipalities need to contribute to this target, densifying seems like one of the main strategies for the more urban municipalities.

Furthermore, climate resiliency is an issue that has been gaining more and more priority on the political agenda. Dutch governmental organizations agree upon the fact that climate change is happening and is irreversible. Therefore, besides mitigating these changes, adaptive measurements should be undertaken to increase the climate resilience of the Netherlands. Increasing the resilience of urban areas is perceived as a more challenging issue than in more rural areas. Cities are highly populated, densely built, and contain high amounts of valuable infrastructure. Therefore, they are more vulnerable to the effects of climate change (Uittenbroek, 2016).

It could be argued that densification and climate resilience are highly relevant topics in the current urban political arena. Both concepts can be classified as strategies that attempt to pursue sustainable urban development. While compact cities decrease transport and CO2 emissions, resilient cities focus on preparing and adapting to environmental changes. Nevertheless, both phenomena ask for a different type of land-use planning: an open structure versus a compact structure. This seeming contradiction and the urgency to act upon both phenomena make this research highly societal relevant, especially when considering how this theoretical paradox is translated into real-life planning practice.

Scientific relevance

In addition to societal relevance, this research also contributes to the scientific debate. For decades, there has been an academic debate on planning for a compact or climate-adaptive / resilient city. Starting in 2005, Neuman (2005) stated that 'the compact city paradox' would form a severe issue when aiming to create compact cities. Nowadays, this debate is still highly relevant. Where densification seems to decrease greenhouse gas emissions due to fewer traffic flows, it could be assumed that this urban form positively influences the climate mitigation of the city.

Nevertheless, it is questionable to what extent the compact city contributes to climate resilience and adaptability (Williams et al., 2010). A recent study has shown that densification processes in Amsterdam and Brussels directly cause the decreasing green spaces in both cities (Balikçi et al.,2021). The authors speak of a severe conflict between densification and greening and argue that without meaningful planning principles, the number of green spaces will drastically decrease due to densification processes. Nevertheless, there is still a lack of explicit agreement about the

general conflicts that arise if both urban densification and urban greening are fostered, as these conflicts are not absolute but depend on the scale or context (Madureira & Monteiro, 2021). Nonetheless, Balikçi et al. (2021) argue that the empirical studies in the compact city debate have been limited. Primarily case studies have not been conducted widely. Therefore, using the case of Amsterdam, this study aims to highlight how both interests of the debate are considered in planning practice of such a case study.

Strikingly, in most comparative literature, an emphasis is put on urban green space and its relation to densification. Scientific research on the relationship between climate resilience and densification has been conducted to a lesser extent. Therefore, this research addresses the concept of climate resilience and its relation to densification. Still, it is acknowledged that urban green spaces play a significant role in this context.

Besides that, the ongoing debate also primarily focused on inner-city areas and omitted suburban areas (Williams et al., 2010). Therefore, this research aims to contribute to that debate by shedding light on the suburban neighborhoods of Amsterdam. Amsterdam can be perceived as a representative city of the compact city model due to its centralized solid planning governance (Balikçi et al., 2021). However, the Western Garden Cities do not fit this perspective since these neighborhoods are the opposite of compactness. Instead, focusing on these particular suburban post-war neighborhoods, known for their open urban form and high amounts of greenery, will bring a new and refreshing perspective to the debate.

Structure of the thesis

This structure of this master thesis consists of a sequence of various chapters, each representing an essential aspect of executing proper academic research.

First, the introduction chapter defines the problem statement of this thesis. After that, it introduces the research questions and sub questions. At last, the societal and scientific relevance are elaborated.

Second, the theoretical framework chapter discusses all the relevant academic literature to this research. Beginning, the concepts of climate resilience and climate adaptation are deliberated. This paragraph is followed by the role of green infrastructure for the concept of climate resilience. After that, the concepts of the compact city and densification are discussed. The following paragraph compares the compact city with the resilient city. Finally, an assessment framework to align densification and climate resilience is proposed.

Third, the methodology chapter discusses the research methods used for this study. This chapter covers the research strategy and the consideration to use a case study, Moreover, it discusses the data collection and data analysis. At last, the trustworthiness and ethics of this research are detailed.

Fourth, the results chapter discusses all the empirical results that have been obtained in this research. At first, it provides the reader with an elaborate background on the case study. Second, an elaboration is given on the current policy targets regarding densification and climate resilience in Amsterdam. Following, the possible conflicts between both policy goals in the researched case study are discussed. After that, both the currently implemented governance mechanisms and envisioned governance strategies for improving the alignment are elaborated. These subjects are

discussed by referring to the assessment framework earlier introduced in the theoretical framework.

Fifth, the discussion chapter elaborates on the empirical results of this research in light formulated research questions and analytical lenses used for this study.

Sixth, the conclusion chapter closes this thesis. It summarizes the key findings of this study, puts these findings in perspective to the academic debate and gives recommendations for both further research and planning practice.

2. Theoretical Framework

Climate resilience and climate adaptation

According to the IPCC (Intergovernmental Panel on Climate Change), climate resilience is the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change (Tyler & Moench, 2012). More recent studies revised this definition and stated that climate resilience is based on three parameters: resistance, recovery, and adaptability (Chen et al., 2020). First of all, resistance refers to the capacity of an area and its inhabitants to resist shocks and stresses. This capacity can be increased by realizing protective measures such as dikes to become more resistant to possible floods. Second, recovery concerns the capacity to absorb and recover from the shocks and stresses of environmental changes. The extent of recovery depends on, for example, policies in urban planning or the degree of crisis management when a climate disaster occurs. At last, adaptability addresses the capacity to adapt to changing circumstances and, most importantly, transform over time (Folke et al., 2010).

Notable is that this last parameter shows similarity with the term 'climate adaptation.' The IPCC defines climate adaptation as 'the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities (IPCC, 2012). According to Bahadur et al. (2010), climate resilience parallels the climate adaptation approach. However, there is a remaining research gap on their conceptual overlaps. As a result, there is a dissent in academic literature on the relationship between both concepts. One strand believes that adaptation and adaptive capacity specify a system's ability to be resilient to disturbances. In contrast, another strand argues that adaptation can be seen as a component of resilience that relates to 'learning' by systems in response to disturbances (Bahadur et al., 2010).

Despite the controversy on the conceptual overlap of the concepts, it is a fact that in the context of preparing and adapting to climate risks, the term climate adaptation is more widely used than climate resilience, especially when looking at Dutch policy (Gemeente Amsterdam, 2020). However, when using the definition of climate adaptation, there is a strong focus on discrete measures to adapt to future climate risks that are merely based on prediction to avoid the negative impacts of climate change. This specific 'predict and prevent' approach has been criticized due to its lack of ability to deal with climatic surprises and uncertainties. Moreover, the adaptation approach neglects the role of learning and governance as essential aspects of ongoing climate-adaptive management (Tyler & Moench, 2012).

In contrast, the concept of climate resilience does not only focus on adapting to future problems. Instead, it focuses on building resilience. As it is argued by Tyler & Moench (2012), 'an approach based on resilience encourages practitioners to consider innovation and change to aid recovery from stresses and shocks that may or may not be predictable. Due to the comprehensiveness of the resilience approach compared to the adaptation approach, it is chosen to use the resilience concept for this thesis thesis. However, since the resilience approach is practically not incorporated in Dutch policy, and many policymakers are not familiar with the term, climate adaptation is a term that is being used in the data gathering for this research. Therefore, in this thesis, climate resilience and climate adaptation will be perceived as similar terms with the same meaning and goal.

Now that the definition of climate resilience is clearly stated, it can be questioned how a climate-resilient city can be defined. A climate-resilient city is defined as a city that has the capacity to

withstand climate change stresses, respond effectively to climate-related hazards, and recover quickly from residual negative impacts (Henstra, 2012). In short, climate-resilient cities can resist, recover and adapt to future shocks and stresses. As a result, a climate-resilient city acts to prepare for and respond to unexpected crises (Pamukcu-Albers et al., 2021). Moreover, the OECD (The Organization for Economic Co-operation and Development) argues that climate resilience must be understood as a multi-dimensional complex capacity to enlarge cities' field of action.

However, as argued by Jabareen (2013), developing a resilience framework that applies to all cities worldwide is daunting due to its extraordinary complexity and diversity. In addition, it is concluded that the concept of (urban) climate resilience exists in a wide variety of interpretations, as each study focuses on a different set of components of cities and their urban systems (Jabareen, 2013). Despite the lack of agreement on the concept of climate resilience, scientific research agrees on one critical aspect of making cities more climate-resilient: the importance of green infrastructure (Tauhid, 2018; Zuniga-Teran et al., 2020; Pamukcu-Albers et al., 2021).

The role of green infrastructures in climate resilience

Urban green infrastructures provide urban spaces with the capacity to withstand climate change-induced stresses (Pamukcu-Albers et al., 2021). Therefore, green infrastructures are crucial in making cities climate resilient. Green infrastructures can be defined as 'networks of natural and semi-natural areas planned at a strategic level with other environmental elements, designed and managed in such a way as to provide a wide spectrum of ecosystems' (Sturiale & Scuderi, 2019). Green infrastructures are for instance parkland, forests, wetlands, greenbelts, or floodways, but also smaller-scale green spaces such as green roofs, alleys, and streets in and around cities. Opposite to green infrastructures are gray infrastructures. Gray infrastructures are defined as 'a connected network of infrastructure that supports the provision of shelter, water, waste, energy, and transportation services'. Various studies have shown that the traditional gray infrastructural systems do not have enough power to withstand the impacts of climate change. For example: due to climate change, more heavy rainfall is expected. Sewages are not prepared for these high amounts of water and eventually overflow more regularly. It is suggested that nature-based solutions, for instance, the use of green infrastructures, are needed to complement the functioning of the gray infrastructure in order to increase the climate resilience of cities (Zuniga-Teran et al., 2020). Various studies have shown that replacing sealed areas for green infrastructure positively impacts urban climate resilience (Foster et al., 2011; Hagen et al., 2021).

Green infrastructure can be beneficial to climate resilience in multiple ways. First of all, green infrastructures support the management of flood risks. As a result of rising temperatures, the frequency and intensity of storms will increase drastically. Green infrastructures can absorb excessive rainfall more easily than sealed areas and contribute to processing higher amounts of water. Moreover, green infrastructures can lessen the volume of stormwater and so protect the city's floodplain functions (Tauhid, 2018). Figure 1 stresses the correlation between water runoff and the imperviousness of the surface (Sundberg, 2019).

Second, green infrastructures can build resilience to possible droughts. Due to the rising temperatures of climate change, water shortages can occur. Green infrastructures have the capability to store water easily. For example, by refilling the groundwater reserves, cities can be relieved of possible water stress (Tauhid, 2018).

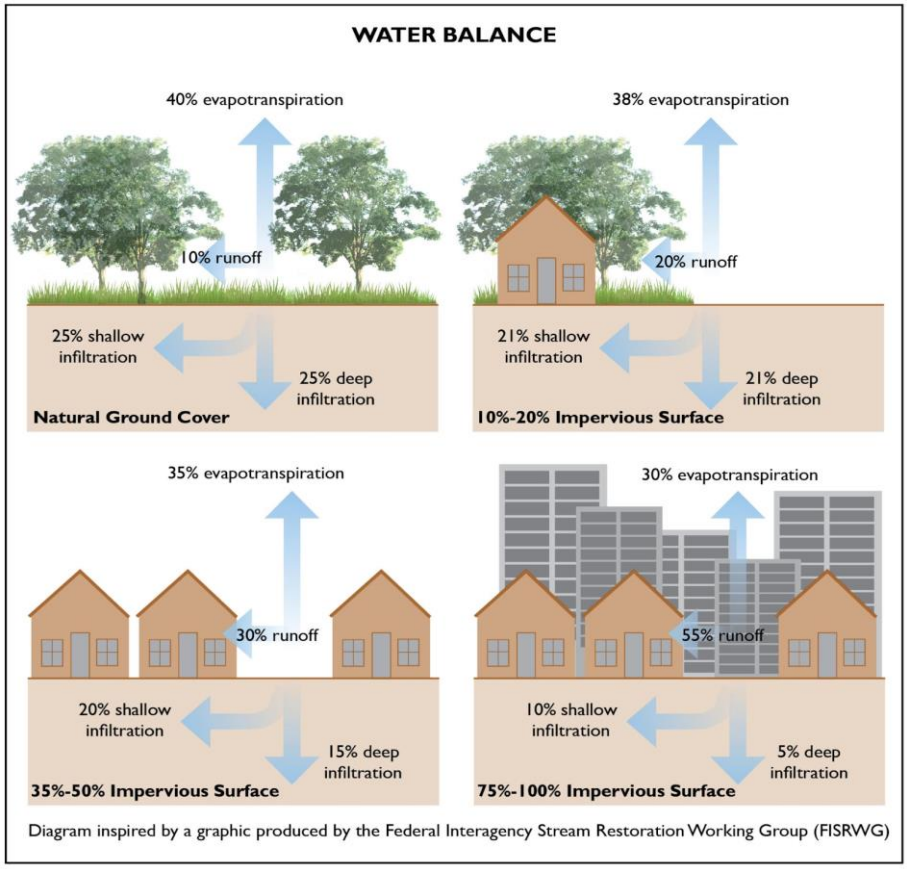

Figure 1: Water balance with different impervious surfaces (Sundberg, 2019)

Third, green infrastructures reduce urban heat stress, also known as the urban heat island effect. The urban heat island effect is a problem that occurs when land is covered with dense concentrations of sealed infrastructures such as buildings, pavements, and streets. Due to the darkness of these infrastructures, they absorb and retain heat much stronger than lighter-colored surfaces. As a result, sealed urban areas experience much higher temperatures during the summer than, for example surrounding rural green areas. Green infrastructures are expected to reduce the urban heat island effect since they deflect solar radiation, create shading possibilities, and release moisture into the atmosphere (Tauhid, 2018). Elaboratively, street tree canopies can be of great value in shading pedestrian spaces, whereas it has been proven that broadleaf trees are most cooling on hot summer days (Pamukcu-Albers et al., 2021).

At last, various studies have shown that green infrastructures, specifically green walls or roofs, can lower the demand for energy needs. Natural elements such as trees or other vegetation can lower the urban air temperature in and around properties. Resultingly, buildings need less energy to cool the construction and create a comfortable temperature (Tauhid, 2018; Pamukcu-Albers et al., 2021).

Conceivably, green infrastructures positively impact all three parameters of climate resilience: resistance, recovery, and adaptability (Chen et al., 2020). Moreover, green infrastructures are crucial in providing ecosystem services such as recreational spaces and biodiversity (Hagen et al., 2021). Ecosystem services are defined as all the benefits that wildlife or ecosystems provide to people. In order to realize resilient cities, the value of urban ecosystem services, and thus green infrastructures, should be incorporated into planning and governance (McPhearson et al., 2014).

Hence, it could be argued that green infrastructures can be perceived as an element with a major influence when looking at the climate resilience of a city (Foster et al., 2011). However, there remains uncertainty about how much and to what extent green infrastructures enhance urban climate resilience (Zuniga-Teran et al., 2020). Nevertheless, the unsealing of gray concrete offers serious potential regarding resilience on the streetscape level (Hagen et al., 2021).

It should, however, also be said that increasing the amount of green infrastructure is not effortless, as it addresses multiple urban issues and stakeholders. Besides the administrative, technical, and legal barriers, Hagen et al. (2021) argue that there is also a missing awareness of the importance of green infrastructures. Acknowledging the various benefits green infrastructures can offer is vital to enhance urban climate resilience successfully (Tauhid, 2018).

Urban densification and the compact city

In the last couple of decades, urban areas have proliferated. To navigate this growth sustainably, the concept of urban densification has arisen. Urban densification is a planning strategy introduced in Western countries in the '90s of the twentieth century (Skovbro, 2002). Urban densification can be understood as using land more intensively. This can be related to either population or dwellings (Demski et al., 2020). Due to the enormous pressure on the housing market in fast-growing cities, densification became rapidly accepted as a necessity (Teller, 2021). Nonetheless, a difference exists between 'hard' and 'soft' densification. Hard densification is known as a process that can be the result of planning practices that focus on promoting large-scale (re)developments that have a significant impact on urban form. On the contrary, soft densification is referred to as densification that occurs incrementally through small developments over a larger period (Bibby et al., 2020). Both hard and soft densification (or intensification) can exist out of (1) infill: the development of new houses in areas that have not been built up before, (2) newly developed buildings that replace lower-density buildings, or (3) transformations: revitalizations of tenantless properties (Balikçi et al., 2021).

The phenomenon of urban densification is tightly linked to the theory of the compact city, one of the leading paradigms in sustainable urbanism (Bibri et al., 2020). A compact city is a spatial form characterized by its physical compactness, high-density development, mixed land use, and well-equipped public transport (OECD, 2012; Haaland & Van Den Bosch, 2015; Balikçi et al., 2021). The compact city poses to halter urban sprawl and knows various benefits: the compact city is more energy-efficient, makes investments in public spaces more viable, ensures the preservation of surrounding agricultural and natural lands, stimulates social diversity and promotes more community-oriented social patterns (Nabielek, 2012; Neuman, 2005). When looking at Dutch urban areas, especially the preservation of agricultural land and natural areas is one of the most critical arguments since most Dutch cities are surrounded by natural areas that are to be maintained (Van Zoelen, 2021). Because of the compact city's various advantages, local governments often assume that a compact model is the best urban form to counteract negative environmental and societal externalities (Balikçi et al., 2021).

Where the compact city seems sustainable at first sight, it could be questioned how sustainable a compact, densified urban form is. In the 'compact city paradox' formulated by Neuman (2005), it is stated that compactness has advantages but also causes overloads of traffic, nuisance, and pollution. Eventually, these disadvantages will decrease the livability of an area. Moreover, and most important to this research, compact cities often lack sufficient green infrastructure. Here, the green infrastructures outside the city, such as green belts, are not considered. While advocates of the compact city emphasize that building the built environment more compactly allows for more

green space, most scientific research shows the opposite (Nabielek, 2012; Russo & Cirella, 2018). As argued before, green infrastructures are of significant importance for human beings for the sake of the ecosystem services they provide (Artmann et al., 2019). It is argued that, especially in compact cities, the low proportions of greenery cause a scarcity of ecosystem services and perhaps even deteriorate the resilience of an area (Haaland & Van Den Bosch, 2015; Artmann et al., 2019). The latter argument will be further discussed in the following section.

The compact city vs. the climate-resilient city

Both compact and resilient cities plead to be sustainable solutions for the city's future. While the concept of the compact city has been a dominant paradigm in sustainable urbanism for decades, the concept of climate resilience has only gained recognition in the last couple of years. However, various studies have shown that these two concepts might conflict since possible land-use changes such as densification seem disconnected from desirable urban green space policies (Balikçi et al., 2021).

Formerly, it was argued that the compact city positively influenced green infrastructures since green spaces beyond the urban edge would be conserved. However, this paradigm overlooked that green spaces inside the city would decrease due to densification processes. The ideality to constrain urban sprawl by building denser influences the amount of space that remains available for green infrastructures such as parks and trees (Lin et al., 2015). Moreover, it has been argued that urban green infrastructures are under severe pressure due to densification processes in various cities (Erlwein et al., 2023). In fact, densification, mainly infill development, has been seen as the primary cause of urban green infrastructure removal since they affect the quantity, connectivity, accessibility, size, and quality of green spaces (Balikçi et al., 2021).

Densification processes, such as urban infill development, demand compact land use, while climate resilience or adaptation policies ask for the preservation and creation of open spaces (Eichhorn et al., 2021). Resultantly, the ideal urban landform for either compact or climate-resilient cities differs, as has been visualized in figure 2 (Eichhorn et al., 2021). Consequently, developing a general land-use-based solution that will benefit the city's densification and climate resilience is challenging. As the study of Eichhorn et al. (2021) provides rich findings on the relationship between climate change adaptation and urban infill development, it will further be discussed in the last part of this theoretical framework.

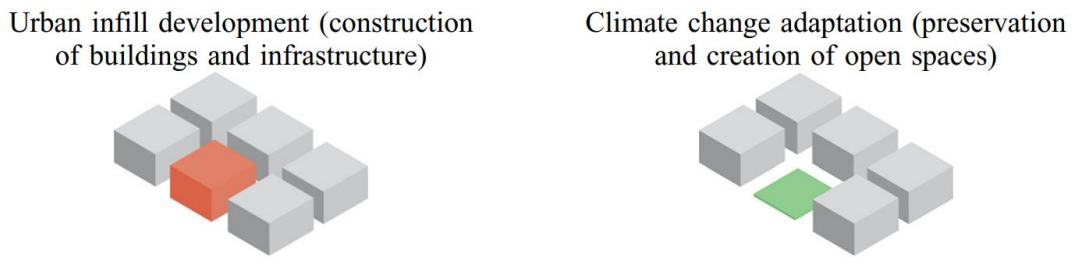

Figure 2: Differences in urban forms (Eichhorn et al., 2021).

A recent study shows that Amsterdam and Brussels simultaneously experienced an increase in urban density and a decrease in urban green space in the last couple of years (Balikçi et al., 2021). According to the authors of this study, the increase in density can be seen as a direct cause of green space loss. Remarkably, the reduction of urban green space was much higher in Brussels than in Amsterdam. Various governance-related arguments can explain this difference. First of all,

the higher degree of municipal land ownership in Amsterdam ensures that urban green spaces are being developed or retained, even in high-price areas. Second, the level of centralization is a crucial aspect. Amsterdam's more centralized governance structure results in a more coordinated citywide policy. Contrastingly, Brussels municipal structure is more decentralized. Here, the institutional fragmentation constrains green space development as “plans many times get lost in bureaucratic processes” (Balikçi et al., 2021). Finally, there is the issue of horizontal institutional fragmentation. The municipality of Amsterdam deals with both urban green spaces and urban development within the same municipal department, whereas in Brussels, the issues are assigned to separate departments (Balikçi et al., 2021).

Nonetheless, the debate between compact and resilient cities is not only about the literal loss of urban green spaces. The effects of densification processes also have more profound consequences for climate resilience, as higher densities can introduce new fragilities that reduce resilience (Teller, 2021). Building more densely can, for instance, decrease wind flow, affecting the city's cooling. Moreover, densification can decrease the options for water retention and infiltration (Jabareen, 2013). As it is argued by Eichhorn et al (2021), land-use planning promoting densification (using open spaces for the construction of buildings) and climate resilience (preserving open spaces) both have various advantages and disadvantages.

On the one hand, densification offers cities more efficient settlement structures, higher efficiency in social and technical infrastructures, and a higher degree of trips made by foot, bicycle, or public transport. Moreover, it relieves possible land-use conflicts in the outskirts. On the other hand, densification increases inner-city land-use conflicts due to space limitations, boosts social challenges such as gentrification and segregation, increases exposure to traffic noise and pollution, and, most importantly to this research, increases the vulnerability to climate change (Eichhorn et al., 2021).

On the other hand, land-use planning promoting climate resilience decreases the vulnerability to climate change due to its ability to cope with heat stress and flooding. Moreover, it stimulates urban citizens’ access to urban green spaces for recreational purposes. However, this kind of land-use planning also promotes building activities in the outskirts, possibly affecting the city's more extensive nature reserves. Furthermore, it increases traffic flow toward the city center (Erlwein et al., 2023).

It should be said that the disbalance as mentioned above in land use between densification and resilience is mainly researched in Asian and Australian cities (Haaland & Van Den Bosch, 2015). Only in the last couple of years, the relationship between both phenomena has been researched in European cities. In addition, the focus of previous scientific research has also mainly focused on inner urban areas. Williams et al. (2010) argue that the compact city debate omits the suburban areas, while in most developed countries, the suburban regions contain the majority of residential buildings and thus citizens. Consequently, the suburban areas are the places where most of people will experience the effects of climate change.

Therefore, Williams et al. (2010) plead to recognize the suburbs in this debate, and see them as an important part of the solution when aiming to create sustainable cities. The authors recommend to research densification's effects on climate resilience in more suburban areas. Moreover, the authors argue that minor adaptations in peripheral parts of the city can already tremendously impact the city’s resilience. For instance, installing ponds and domestic rainwater systems, planting more greenery, such as trees, to increase shading, and bettering the drainage systems of homes can all have an impact.

Nevertheless, other studies argue that these small interventions to interweave green and gray infrastructure usually lack the scale of impact to seriously oppose or compensate for the number of green spaces lost due to densification processes (Balikçi et al., 2021). Despite this disagreement, academic literature agrees that densification requires diligent regulation and monitoring by urban planners to promote resilience and reduce fragility (Teller, 2021).

Aligning densification and climate resilience: an assessment framework

Due to the conflicting nature of the relationship between densification and climate resilience, it could be argued that there is a remaining deficiency in constructing decisive and clear visions when operationalizing compact and climate-resilient cities (Artmann et al., 2019). Nevertheless, researchers are becoming increasingly conscious of the value of pursuing both objectives (Madureira & Monteiro, 2021). Still, the study of Madureira en Monteiro (2021) also indicates a lack of a clear academic consensus regarding the compatibilities and conflicts that can emerge while promoting the goals of urban densification and climate resilience. Consequently, it is argued that there currently is no comprehensive or standard approach when solving possible conflicts between densification and climate resilience (Eichhorn et al., 2021). Nevertheless, a governance framework that could assess the nexus between densification and climate governance would be highly beneficial to this research.

Despite the ambiguity of a standard approach, various studies aim to map which policy approaches would be most successful when striving for a better alignment of densification and climate resilience. Some studies seek a balance between aspects of a compact city and a climate-resilient city (Artmann et al., 2019), while others aim to explore which aspects of both concepts overlap.

Here, the research of Eichhorn et al. (2021) proposes an assessment framework that aims to give a comprehensive overview of which governance settings minimize conflicts between densification and climate goals. Furthermore, it aims to align these different policies and seek possible synergies. As this thesis aims to find the nexus between densification and climate governance, it closely resembles the research aim of Eichhorn et al. (2021): to resolve the potential spatial and environmental conflicts between densification and climate policy. Therefore, the proposed assessment framework by Eichhorn et al. (2021) is perceived as a highly relevant and appropriate framework to assess the gathered empirical data for the research of this thesis.

Accordingly, the framework proposed by Eichhorn et al. (2021) will be used in this research to measure to what extent policies regarding densification and climate resilience are aligned in the Western Garden Cities in Amsterdam. Using this framework, this study does not focus on technical solutions but rather on the improvement of governance structures in order to align densification and climate resilience. In addition, this thesis aims to elaborate on the work of Eichhorn et al. (2021) and shed light on the Dutch context of paradox.

Figure 3 shows a visualization of the assessment framework as proposed by Eichhorn et al. (2021). The authors identify three aspects of governance that could be integrated into a heuristic analysis to find possible synergies between both policy fields. Here, the selected aspects that shape the framework have been based on a body of literature on urban climate governance articles related to densification issues (Aylett, 2015; Burch, 2010). Each of these aspects play an essential role in finding the nexus between densification and climate policy. To clarify the meaning and importance of these three aspects concerning this particular research, they will be further elaborated on:

<u>Instruments</u>

First of all, the aspect of 'instruments' looks at the measurements taken to align both policy fields. As it is argued by Eichhorn et al. (2021), the content of densification and climate policies often show remarkable similarities. To overcome this overlap, overarching instruments that cover both topics are perceived as a critical element in the process of aligning densification with climate policy. Here, the creation and application of integrated concepts for implementing urban planning measures are mentioned as a reoccurring example in multiple studies (Eichhorn et al., 2021).

Within this aspect, two pillars can be differentiated: analytical tools and policy- and planning instruments. Whereas the analytical, more technical tools are being developed by policymakers to measure, map, and assess the influence of densification on urban climate, the policy- and planning instruments are created to encourage the synergetic alignment of both the policy goals (Eichhorn et al., 2021).

Regarding the analytical tools, the empirical results of Eichhorn et al. (2021) stress that a detailed database for climate change prediction is in need. These databases would have the purpose to both measure the impact of change in the built environment and projecting possible impacts of long periods of heat or heavy rainfall. A variety of other academic literature confirms that having such a database is of essential value for aligning densification and climate policy (Rosenberger et al., 2021; Vuckovic et al., 2019).

Concerning the policy and planning instruments, Eichhorn et al. (2021) emphasize the essence of planning legislations and incentives that steer urban developments in a beneficial direction for both policy fields (Eichhorn et al., 2021). Erlwein et al. (2023) argue that rules and regulations can strengthen social and environmental goals over economic interests. Therefore, policy- and planning instruments are determinate when striving for a better nexus between densification and climate policy.

Organization

Second, 'organization' describes how policy implementation is organized. This aspect emphasizes the administrative organization of the departments that with both themes. Here, it is argued that densification and climate change policy are frequently interdepartmental taken care of, necessitating a high degree of collaboration. By looking at the organizational structure within a case, it can become apparent if the themes of densification and climate are integrated or discussed separately. Here, it is for example interesting to look if new overarching organizational structures are founded to address both topics at once, or if existing organizational structures will remain and improve their collaboration.

The organizational aspect can be analyzed by looking at internal and external organizational structures. Internal structure refers to the cooperation between departments, whereas external refers to the exchange with external knowledge sources or other stakeholders such as universities.

The internal organization of a governmental structure can enormously differ between cities or regions, also if they show considerable similarity at first sight (Hofstad et al., 2022). The earlier discussed study by Balikçi et al. (2021) serves as a great example, as tremendous differences in internal structure between Amsterdam and Brussels were observed. As these organizational differences are mirrored in how the cities design institutions and perform leadership within the whole of governance (Hofstad et al., 2022), the internal organization of a governmental body is of significant value for the alignment of densification and climate resilience.

Also, the impact of external knowledge sources has a profound meaning when striving for a successful alignment of densification and climate policy (Hjerpe et al., 2020). Involving external organizations by 'forming climate action committees, task forces, partnerships' or developing 'science parks, climate business networks, and urban living labs' can add significant value when running tests or pilots to smoothen the alignment of densification and climate resilience (Hofstad et al., 2022). In addition, the research of Erlwein et al. (2023) accentuates the critical impact that, for example, advisory committees can have to foster interaction between relevant actors and cross-sectoral thinking.

Interaction

At last, 'interaction' between the various actors involved in urban planning is addressed as a relevant governance aspect when aligning densification with climate policy. Due to the variety of actors involved and affected by the development and implementation of climatic and densification policies, it is essential to observe to what extent these actors are involved (Eichhorn et al., 2021).

Here, another differentiation can be made. On the one hand, communication refers to informing residents about appropriate densification or climate adaptation issues. It is argued that proper communication could make the public aware of the interrelatedness of the topics. On the other hand, participation relates to the direct exchange of information with stakeholders to learn from their external suggestions and input. Whereas communication is a one-way information exchange, participation is two-way (Eichhorn et al., 2021).

In academic literature, especially the role of participation is perceived as meaningful. Participation enables municipalities to collect spatially precise and context-specific data. Gathering this context-depending data can favor the alignment of densification with climate on a more local scale (Erlwein et al., 2023). These local findings can be influential in drawing general conclusions.

Figure 3: An assessment framework for aligning densification and climate policy (own work).

3. Methodology

This chapter elaborates on the methods used for this particular research. First of all, the research strategy will be discussed. Second, the investigated case study will be described, followed by the data collection and analysis. At last, the validity and ethics of the research will be discussed.

Research strategy

The research conducted in this study has a qualitative approach. Qualitative research enables detailed and in-depth exploration of the researched phenomenon (Bryman, 2016). In this research, qualitative methods will be used to explore and understand how densification and climate resilience policies relate. With this qualitative approach, a combination of various research methods, referred to as triangulation (Bryman, 2016), will be utilized. Here, the possible answers to the research question will be triangulated. Triangulation will enhance the credibility of the research and so increase the accuracy of the research.

Moreover, various research methods enable the researcher to create a more representative image of the researched phenomena. Furthermore, comparative research in this particular field has shown that a combination of interviews and a document analysis has been beneficial in identifying the most critical interactions between the governance aspects considered (Eichhorn et al., 2021). In addition, in this thesis, existing theories will be tested, indicating the deductive nature of the research (Bryman, 2016).

The research design chosen for this study is a case study. A case study offers the advantage that certain phenomena, in this case, climate resilience and densification, can be investigated in much detail (Bryman, 2016). Here, in detail refers to gathering in-depth data to eventually create a representative and complete picture of reality. This detailed scope emphasizes the heuristic value of single case studies. Contrastingly, quantitative research strategies usually study a higher population, but lack in their detailed analysis. This research aims to obtain as much detailed information as possible about climate resilience and densification policies in Amsterdam to conclude how they relate to each other in practice.

Case study

A case study is a qualitative research method in which one specific place is examined and analyzed profoundly (Bryman, 2016). In addition, a case study explores real-life, contemporary phenomena by collecting and analyzing in-depth data involving various sources of information (Creswell & Poth, 2016). There are multiple sorts of case studies. For this research, a single case study design has been chosen. A single case study is mainly selected when the particular case is known to be critical, extreme, representative, or longitudinal (Yin, 2003).

For this research, various criteria have been set to select a relevant case. This kind of selection is known as purposely sampling on a non-probabilistic basis. Purposive sampling seeks no generalization or randomness but aims to sample in a well-informed manner to maximize the chances of observing the phenomena of interest as well as possible (Serra et al., 2018). The following conditions have been set up to select a case for this particular research:

- The concerned municipality has formulated city-wide policies regarding climate resilience (or adaptation) and densification.

- The concerned municipality has serious densification plans for this particular neighborhood,
- The particular neighborhood has already densified in the last couple of years,
- The particular area contains a high potential for climate resilience, which in practice comes down to having high amounts of green (and blue) infrastructure,

Here, the Western Garden Cities, a cluster of 5 post-war neighborhoods in Amsterdam New-West, has been selected as the case to be investigated. The argumentation of this choice is based on the previously formulated criteria. On the one hand, the Western Garden Cities initially contain high amounts of green infrastructure, which, as mentioned in the theoretical framework, are proven to have a highly beneficial impact on climate resilience within cities. On the other hand, due to the open land-use character of these post-war neighborhoods, they offer severe possibilities for densification. This densification already took place on a serious scale in the past but will enlarge even more in the future (Jager, 2019). Moreover, as argued in the scientific relevance of this research, the relationship between densification and climate resilience has not been researched profoundly in suburban areas. Therefore, the Western Garden Cities case study can contribute to knowledge-building in the current debate. At last, the municipality of Amsterdam has published various policy documents where both subjects are seriously mentioned.

Since this particular region contains highly interesting characteristics for both phenomena, this case offers ideal conditions to explore thoroughly how policies regarding these issues relate to each other. Moreover, this case study research is explorative since the aim is not to generalize but to explore how densification and climate resilience policies relate to each other in practice (Flyvbjerg, 2006). Therefore, this study also aims to contribute to the knowledge-building in the ongoing scientific debate.

However, it should be noted that the selection of this case study is somewhat different from the selected case studies in Eichhorn et al. (2021). The cases in the study of Eichhorn et al. (2021) were preselected on the criteria of having experience in deliberately integrating both policy fields. Meeting this criterion, the chosen case studies were highly differentiated on other characteristics such as city size, geographical location, and population growth.

However, the case chosen for this study has been selected on its interesting physical characteristics and its potential to align densification and climate resilience. Moreover, not an entire city has been selected but rather a specific region (the Western Garden Cities). Nonetheless, the comprehensive and simplified framework of Eichhorn et al. (2021) ensures that a proper comparison between their city-wide cases and this region-wide case can be made.

A more thorough description of the history and future plan-making of the Western Garden Cities can be found in the introduction of the result chapter.

Data collection

In this research, a combination of document analysis and semi-structured interviews will form the data collection used to draw conclusions and answer the research questions. The following figure gives an overview of the data collection methods concerning each sub-question:

Subquestion:	Method:	Data:	Data source:
Which particular conflicts between densification and climate resilience can be identified?	- Document analysis - Interviews	- Relevant policy documents - Transcripts	- Municipality of Amsterdam - Interviewees (experts)
Which governance mechanisms are currently implemented to increase the alignment of densification and climate resilience?	- Document analysis - Interviews	- Relevant policy documents - Transcripts	- Municipality of Amsterdam - Interviewees (experts)
Which governance mechanisms could improve the alignment of densifying and climate resilience?	- Document analysis - Interviews	- Relevant policy documents - Transcripts	- Municipality of Amsterdam - Interviewees (experts)

Figure 4: Visualization of the data collection (own work).

Document analysis

First of all, a thorough document analysis has been conducted. A document analysis involves finding, selecting, examining, and eventually interpreting relevant documents (Wagenaar, 2014). Here, various governmental documents regarding climate resilience and densification will be analyzed. Since considerable time and effort are put into producing policy documents, they can be perceived as a precious data source concerning the research phenomena. The purpose of conducting a document analysis is to objectively assess what climate resilience and densification policies entail and learn how both policies are implemented in the city planning of Amsterdam.

Since the case study of the Western Garden Cities is situated in Amsterdam, all of the documents that are being analyzed are withdrawn from data sources of the municipality of Amsterdam. Figure 5 provides an overview of the analyzed documents. This list consists of Dutch policy reports and visions for the future. Some documents primarily focus on either densification or climate resilience, whereas others discuss them both. All the documents were obtained from governmental websites where they were publicly published.

Title	Author	Publication date	Pages
Course 2025	Municipality of Amsterdam	April 2016	79
Structural Vision 2040	Municipality of Amsterdam	February 2011	328
Strategy Climate Adaptation	Municipality of Amsterdam	February 2020	51
Execution Agenda Climate Adaptation	Municipality of Amsterdam	April 2021	107
Environmental Vision 2050	Municipality of Amsterdam	July 2021	276

Figure 5: Overview of the analyzed policy documents for this research (own work).

Semi-structured interviews

In addition to the document analysis, in-depth semi-structured interviews have been conducted with numerous stakeholders. The term semi-structured refers to the fact that the interviews have been conducted using an item list (or interview guide). This item list provided the most critical subjects regarding this research to ensure that all the topics were discussed. The list has been used as a guideline throughout the interviews to ensure the consistency of the themes that had to be discussed. Moreover, this semi-structured design allowed the interviewee to mention new topics that, for example, were not part of the item list. In addition, the questions were formulated open-ended to establish an explorative character that allowed going more into detail (Kumar, 2014).

To ensure that the case study was correctly examined, interviewees must have measured up to one of the following conditions:

- the interviewee has expertise in either climate resilience or densification processes,
- the interviewee is involved with the redevelopment plans of the case study being researched,
- the interviewee has been involved with writing one or more policy documents mentioned in figure 5.

By setting up these conditions, the validity of the research is secured (Bryman, 2016). When experts lived up to these conditions, they were approached by making use of 'convenience sampling.' Convenience sampling is defined as a sampling process where respondents are selected by their accessibility and proximity (Bryman, 2016). This strategy aims to reach out to experts with profound knowledge of the subject and can provide complementary information besides the policy documents. Moreover, snowball sampling was used as interviewees were asked if they knew other relevant experts after the interview.

All the interviews were individually conducted. This means that they took place online or physically in a one-by-one setting. To ensure that both the interviewer and interviewee could entirely focus on the content, the interviewee was asked for permission to record the interview. Later on, all the recorded interviews were transcribed (Bryman, 2016). Furthermore, all the interviewees agreed on the fact that their given information could be used for this research. The experts' names have been anonymized to safeguard the interviewees' privacy. Hence, interviewees are referred to their profession.

At last, it is important to mention that all the interviews were conducted in Dutch as all interviewees were Dutch. This has been done to overcome vocabulary obstacles since people prefer to talk in their native languages. Therefore, all the information utilized from the interview transcripts has been personally translated to make them useful for the report. Dutch transcripts of the interviews can be provided on request. The following figure provides the list of experts that have been interviewed.

Number	Expertise	Date	Length (minutes)
1	Architectural historian specialized on the Western Garden Cities	10-05-2022	26:10
2	Expert on resilient and liveable neighborhoods	10-05-2022	40.21
3	Commercial urban planner / architect working on the Western Garden Cities	16-05-2022	58.03
4	Academic researcher on densification related to the number of green spaces	18-05-2022	32.33
5	Project developer Eigen Haard (housing corporation in the Western Garden Cities)	18-05-2022	48.01
6	Commercial urban planner working on post-war neighborhoods	23-05-2022	50.55
7	Commercial landscape architect working on the Western Garden Cities	01-06-2022	59.30
8	Head of planning department at the municipality of Amsterdam	06-06-2022	38.10
9	Chief designer at planning and sustainability department of the municipality of Amsterdam	21-06-2022	47.59
10	Team leader spatial design West-side at the municipality of Amsterdam	11-08-2022	55.05
11	Program Manager Climate Adaptation at the municipality of Amsterdam	02-09-2022	42.30

Figure 6: List of the interviewed experts (own work).

Data analysis

The data that has been collected in this research has been analyzed by making use of qualitative content analysis. Qualitative content analysis systematically analyzes a series of texts, which can be written, spoken, or visual (Lacy et al., 2015). By making use of coding, this data analysis method identifies specific themes or patterns. Moreover, it enables researchers to gain a subjective but scientific understanding of social reality (Hsieh & Shannon, 2005). In this research, written (policy documents) and spoken (interviews) texts have been analyzed.

The qualitative content analysis of this research has been set up by using both inductive and deductive reasoning for the coding process. This is referred to as directed content analysis (Zhang & Wildemuth, 2009): Initially, existing theories are coded with this approach. Following, when all

the data is collected, the researcher can create new codes that emerge from the raw collected data (Hsieh & Shannon, 2005).

For this research, the first round of data coding has been based on the aspects of the assessment framework of Eichhorn et al. (2021). Thus, these codes were already determined before executing the interviews. Since the framework of Eichhorn et al. (2021) forms the structure of the result chapters, it is vital to code on the elements of this framework. As these codes are based on existing theories of previous research, deductive reasoning is applied (Zhang & Wildemuth, 2009).

Second, a round of inductive coding has been conducted. Here, themes emerged from the careful examination of the collected raw data. Recurring themes or concepts that did not fit one of the codes established in the first coding round were adjoined. Coding on raw data instead of coding on previous studies or theories explains the inductive nature of this second round of coding (Zhang & Wildemuth, 2009). Figure 7 shows the coding rounds used in this qualitative content analysis.

The qualitative content analysis of this research has been conducted using an Excel document. The X-axes of the table showed a variety of themes, while the Y-axes displayed the author: a respondent or policy document. Here, paraphrases of documents or interview quotes were systematically placed underneath the relevant theme and their authors.

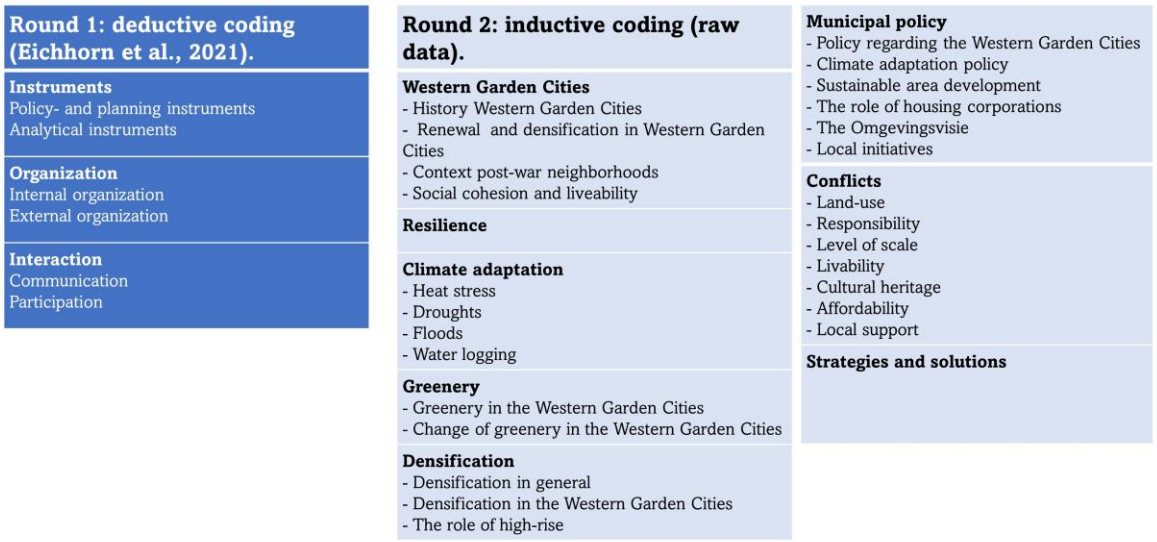

Figure 7: The coding scheme used in this research (own work).

Trustworthiness and ethics

To conclude this methodological chapter, the validation and ethical issues of this research will be discussed.

Trustworthiness and credibility

In conventional positivist research, the following criteria are crucial when determining the trustworthiness of research: validity, reliability, and objectivity. Nevertheless, qualitative content analysis is an interpretative method that differs from conventional research in its 'fundamental

assumptions, research purposes, and inference processes' (Zhang & Wildemuth, 2009). Therefore, four other criteria more suitable for interpretative research are proposed: credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Most important here is to mention the security of credibility: the representation of the real world in this study (Bryman, 2016). As mentioned earlier, the credibility of this research will be guaranteed by using triangulation: the use of at least two data sources, methods, theoretical perspectives, or analytical methods within the same particular research (Thurmond, 2001). Since this research uses both document analysis and semi-structured interviews, credibility is assured in the best possible way. Furthermore, long-term involvement in the field increases the credibility of this study (Lincoln & Guba, 1985). The flaws of the trustworthiness of this study will be elaborated on in the conclusion of this report.

Ethics and positionality

To conduct ethically responsible research, it is first of great importance to inform respondents in advance about the research procedures. To guarantee their privacy, names, addresses, and other personal data will be anonymized except when respondents agree to publish their personal data (Bryman, 2016). Besides that, permission to record the interviews, and refer to the interviewee's quotes, has been asked for.

In addition, the positionality of the researcher is crucial. Positionality is the practice of a researcher representing his or her position concerning the study (Qin, 2016). The researcher's positionality in this report is defined as an unbiased observer (Bryman, 2016). Nevertheless, by participating in interviews and asking critical questions, the researcher also influences the outcomes to a certain extent. However, by elaborating on the choices made and stressing the flaws of this research in the conclusion, the researcher aims to be as transparent as possible.

4. Results

This chapter elaborates upon the main findings of the research conducted for this thesis. First, an introduction to the details of the case study will be given. This introduction emphasizes the historical background of the case study and gives more insight into the area's unique characteristics.

Second, a thorough analysis on the current policy targets of the municipality of Amsterdam will be conducted. By doing so, it becomes clear which policy and regulatory framework is currently valid in the studied case for this research.

The third paragraph discusses the particular conflicts mentioned in the several conducted interviews in this research. Here, the first subquestion, 'Which particular conflicts between densification and climate resilience can be identified?' will be answered.

Fourth, the second subquestion 'Which governance mechanisms are currently implemented to increase the alignment of densification and climate resilience?' will be answered. This question will be answered using the assessment framework of Eichhorn et al. (2021). Utilizing the framework's three governance-related pillars (instruments, organization, and interaction), an overview of the already implemented governance mechanisms regarding the case study will be provided.

At last, the third subquestion 'Which governance mechanisms could improve the alignment of densifying and climate resilience?' will be answered. Again, using the assessment framework of Eichhorn et al. (2021), this time, the unimplemented but envisioned governance mechanisms for improving the alignment between densification and climate resilience will be discussed.

Case study introduction

Historical background of the Western Garden Cities

From 1865 to 1923, the population size of Amsterdam almost tripled from 265.000 to nearly 700.000 inhabitants (Oudenampsen, 2013). As the city could not handle this tremendous growth, the living conditions in the city became deplorable. Inadequate sanitary conditions combined with little space made the inner city unlivable, especially for the lower-income groups migrating to the city. As a response to the urban problems, the city of Amsterdam concluded it needed two things: a new housing policy and a spatial plan to expand. With the introduction of the Housing Act in 1901, that first need was settled. In this act, the government of the Netherlands started regulating the housing market. Furthermore, prerequisites were set up to limit the number of residents per building and improve the hygienic circumstances. As a matter of fact, the presence of green space was included as a requirement in newly developed neighborhoods since it was argued that this would also improve the hygiene of the city and result in higher well-being of urban residents (Oudenampsen, 2013).

The second need, a plan to expand, was developed during the '20s and '30s of the previous century. As a result, in 1934, a general expansion plan of Amsterdam, the AUP (Algemeen Uitbreidings Plan), was published. The AUP can be seen as a landmark in modern urban planning. This is because it aspired to plan the city on a large scale in a centralized way by using proper scientific research instead of letting the city grow organically. This plan entailed various city elaborations, for example, on the South and North side of the city. The majority of development

plans of the AUP would, however, take place in the Western part of the city, which from that moment on would be referred to as the Western Garden Cities (Westelijke Tuinsteden). The Western Garden Cities were a conjunction of five newly developed neighborhoods: Slotermeer, Geuzenveld, Slotervaart, Overtoomse Veld, and Osdorp.

The first construction plans for the Western Garden Cities were made in 1935, but World War II delayed the building plans. After the war, a more rationalized and condensed version of the Western Garden Cities was realized (Oudenampsen, 2013). Starting with Slotermeer in 1951, within 15 years, all five neighborhoods were being built and finished. Figure 8 shows the years of plan development and realization per neighborhood.

	Plan development	Build
Slotermeer	1935 – 1939; 1949 – 1955	1951 – 1965
Geuzenveld	1951 – 1953	1953 – 1965
Slotervaart	1952 – 1954	1954 – 1965
Overtoomse Veld	1954	1955 – 1965
Osdorp	1955 – 1958	1957 – 1965

Figure 8: Timeline of the development of the Western Garden Cities (Van Eesteren Museum, n.d).

As stated by the plan supervisor, Cornelis van Eesteren of the AUP, the inner city of Amsterdam was overcrowded and dirty. Moreover, he argued that the old city planning principles with closed building blocks and continuous street walls were obsolete and needed change (Rijksdienst voor het Cultureel Erfgoed, 2016). A radical new city planning was in need. Inspired by international modernistic initiatives, such as the CIAM (Congrès Internationaux d'Architecture Moderne), a new style of developing cities was created: 'the new building' ('het Nieuwe Bouwen') (Havinga et al., 2019). In contradiction to the closed housing blocks of the old city, this new city-planning design focused on an open and spacious subdivision of both public and private space (see figure 9). The credo 'light, air, and space' was a leading paradigm. Whereas 'the new building' merely inspired the architecture of the Western Garden Cities, the urban planning design of the area was highly comparable to another upcoming movement at the time: 'the Garden City movement.'

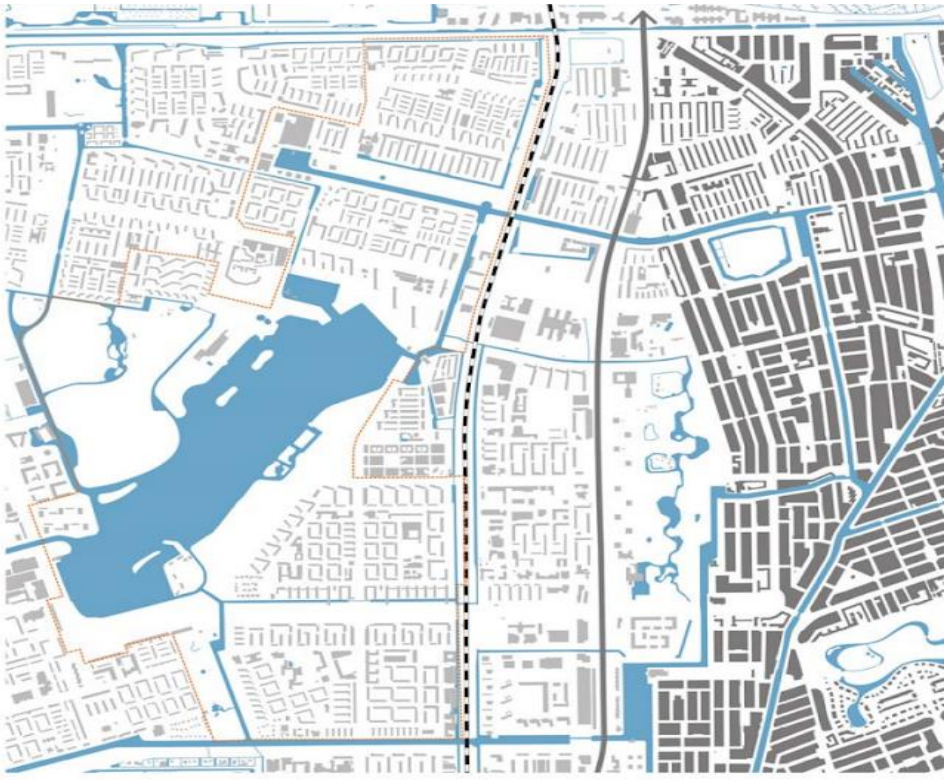

Figure 9: The difference between the 'pre-modern' closed housing blocks on the right side of the arrow and the modern, open, and divided housing blocks on the right side; the Western Garden Cities (Rijksdienst voor het Cultureel Erfgoed, 2016).

The Western Garden Cities as part of a bigger movement

The development of the Western Garden Cities can, to some extent, be considered part of a bigger shift in building neighborhoods: 'the Garden City movement.' The Garden City itself is a concept that Ebenezer Howard founded in the early 1900s. The principles of this concept eventually formed the basis of the Garden City Movement. When the Garden City concept was created, the most common way of city development was haphazard and spontaneous development by private developers (Oudenampsen, 2013). Subsequently, the Garden City Movement had a tremendous worldwide impact on city planning since it was the first movement that pleaded for integrated and central city planning.

A Garden City can be described as a satellite city of a bigger city with a maximum number of 32.000 inhabitants. According to Howard, the Garden City was a thriving living environment because it combined the benefits of both the urban and the rural. Moreover, the Garden City movement formed a solution to the urban crisis at the time: migration to the city resulted in an unhealthy and overpriced urban living environment. In contrast, an ideal Garden City would be out of reach of this misery since it was merely self-sufficient (Howard, 1898). Having its own industry and the proximity of the labor made it possible for people to avoid the disadvantages of the polluted inner city. In addition, a sizable green belt surrounding the Garden City allowed residents to live near nature. Howard's ideology was based upon having the best of both worlds: the amenities of the big city and the rhythm and tranquility of a rural community. This ideal is visualized in figure 10. Here, the 'town-country' represents the benefits of both the town and the country.

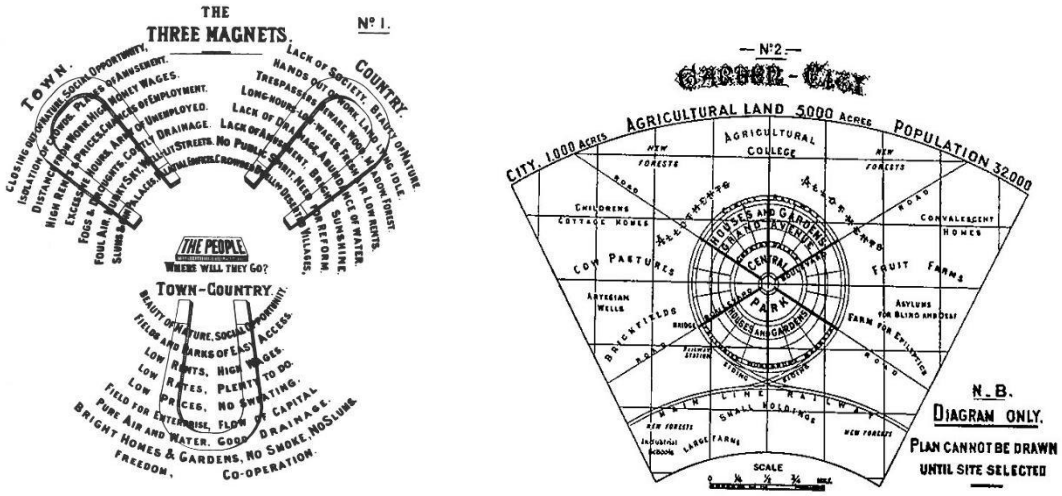

Figure 10a: The three magnets of Howard (Howard, 1898), Figure 10b: A sketch of the garden city (Howard, 1898).

Besides having purely design-related ideals, Howard also strived for communal ownership of the Garden Cities: the city's ownership in the hands of its residents. Land was held in common ownership using a company that would lease parcels to tenants. The paid rents were put directly into a fund for maintaining a local welfare state (Livesey, 2011; Oudenampsen, 2013). In fact, most of Howard's efforts were put into elaborating these administrative ideologies instead of focusing on urban planning and design (Howard, 1898; Livesey, 2011). Still, the extraordinary planning made Howard's Garden City famous.

At the beginning of the 20th century, Howard created two Garden Cities around the city of London: Letchworth and Welwyn Garden City. Although Howard's ideology was fully implemented in these two cities, his ideas were never realized to a full extent on a large scale. Nevertheless, his ideology to build clean and healthy neighborhoods outside the city led to various Garden-City-inspired suburbs. Furthermore, the Garden City movement eventually also led to the New Town movement, which derived its ideology from Howard's principles (Vernet & Coste, 2017).

It could, however, be questioned to what extent Howard's ideals were also implemented in the Western Garden Cities in Amsterdam. Cornelis van Eesteren, the chief of planning of the Western Garden Cities, certainly was inspired by Howard's ideas. In fact, he used Howard's book 'Garden Cities of To-Morrow (1898) as a guideline in his lectures and papers to introduce the concept of the Garden City as an instrument for realizing urban communities in rural environments (Oudenampsen, 2013). Moreover, the sizable amount of green space in the Western Garden Cities can be seen as a mere result of the great impact that Ebenezer Howard had on urban planning at the time. However, it is debatable to what extent the Western Garden Cities can be perceived as a 'proper' Garden City (Van Rooijen, 1990). It is, for instance, notable that Howard's ideas on communal ownership and use and appropriation of space were absent in Van Eesteren's top-down elaboration plans for Amsterdam (Oudenampsen, 2013).

Furthermore, the AUP of Van Eesteren lacked a clear vision of how all the open green space would be used by residents and, more importantly, how it would create social interaction. According to critics at the time, Van Eesteren adopted various elements of the Garden City, but his plans lacked the social scope that was so important to Howard. Therefore, it could be concluded that the

Western Garden Cities were not 'literal incarnations' of the Garden Cities as invented by Howard (Oudenampsen, 2013). Nonetheless, it is undoubtedly that the ideology of the Garden City greatly impacted the theories and practices used in the realization of the Western Garden Cities and the AUP in general.

Redevelopment of the Western Garden Cities

After the realization of the Western Garden Cities, during the 50's and '60s of the previous century, the neighborhoods seemed to be an enjoyable living environment for urban residents that wanted to escape the fuss and noise of the urban center. The Western Garden Cities formed a paragon of the new living: houses with light, fresh air, and surrounded by greenery (Mens, 2020). However, soon after the area was inhabited, it became criticized on mainly one aspect: social cohesion. Critical city-planning colleagues already mentioned the absence of places for social interaction and the lack of a 'sense of place' during the plan-making stage (Oudenampsen, 2013). The lack of social cohesion and increasing crime rates due to less social order make residents feel unsafe.

Moreover, the built environment was deteriorating faster than expected. Consequently, the residents of Western Garden City were soon after its realization already moving out of the area (Mens, 2020). Having its peak of critique during the '90s of the previous century, a change in socio-cultural dynamics started to create a declining appreciation of the neighborhoods (Rijksdienst voor het Cultureel Erfgoed, 2016). As a result, approximately sixty years after the realization of the Western Garden Cities, the municipality of Amsterdam had to make the neighborhoods the object of drastic renewal operations (Interviewee 1, May 2022).

In 2001 the city of Amsterdam laid out a plan that at the time was referred to as the 'largest renewal in the world': the demolition of 13,300 post-war dwellings was to make place for the building of 24,300 new buildings (Havinga et al., 2019). As it was assumed, these new plans would upgrade the neighborhood's quality and regain its status as a popular suburb of Amsterdam. Nevertheless, these excessive demolishment plans were disrupted due to the rise of the economic crisis around 2008. At the same time, Havinga et al. (2019) argue that a particular paradigm shift occurred. Where most of the city initially favored demolishing and rebuilding these neighborhoods, the Western Garden Cities suddenly gained more revaluation. Important in this process was the choice of the Dutch government in 2011 to assign some parts of the Western Garden Cities as post-war areas with a special cultural-historical meaning to the Netherlands (Rijksdienst voor het Cultureel Erfgoed, n.d). Eventually, many dwellings have not been torn down due to their cultural-historical value.

Over the years, it became more important to let the developments go hand-in-hand with preserving the unique characteristics of the area and built environment (Rijksdienst voor het Cultureel Erfgoed, n.d; Mens, 2020). Resultantly, demolishment plants were mainly put aside, whereas renovation and refurbishment of the existing housing stock became a relevant issue in the renewal process. Until 2016 only 7000 buildings had been demolished instead of the initially planned 13,000. Moreover, up until 2016, only 9500 houses have been newly built, whereas in 2001, it was planned to build 24.300 new homes (Havinga et al., 2019). Still, until 2021, 25.312 dwellings have been built, renovated, or transformed into a residence in the Western Garden Cities, indicating the enormous scale of the renewal operation. In comparison, this same amount of residences can be found in the Netherlands' biggest VINEX-neighborhood, 'Leidsche Rijn' (De Hoog & De Wit, 2022).

Since demolishment is no longer the primary strategy, densification has become more critical (Interviewee 1, May 2022). Densification has been most intense around the 'Ringzone,' the area

around the highway and railway that divides the Western Garden Cities from the old city. From 2000 to 2021, 12.000 new dwellings were built in this area, which densified the area by 72% (De Hoog & De Wit, 2022).

Currently, it could be said that the renewal is halfway (Interviewee 1, May 2022). All the neighborhoods marked as 'phase 1' or 'phase 2' are practically completed. That being said, neighborhoods marked as 'phase 3' should undergo their renewal. This concerns the so-called 'Roëlbuurten' (Coupernusbuurt, Dichtersbuurt & Van Deysselbuurt) in Slotermeer and the Wildemanbuurt in Osdorp (De Hoog & De Wit, 2022). Respectively, the municipality of Amsterdam currently collaborates with housing corporations on densifying the remaining neighborhoods.

The urban planning characteristics of Western Garden Cities

Earlier in this thesis, it is already explained why the Western Garden Cities form such an insightful case for this research. The fact that the area has a high potential for climate resilience due to its high amount of green and blue infrastructure, combined with the thorough densification plans, ensures that the case covers both aspects of the research question. However, to understand what governance strategies could benefit both densification and climate resilience, it is essential to understand the urban planning context of this area. According to the Cultural Heritage Agency of the Netherlands, the Western Garden Cities contain three highly distinctive characteristics that define the area and distinguish it from other neighborhoods. The first two characteristics will be elaborated more in debt.

- Repetition of building blocks and the alternation of high- and low-rise buildings according to the urban planning principles of 'the new building,'

- hierarchical design of both the infrastructure and green structure with associated planting profiles and,

- the balance between the built and unbuilt environment (Rijksdienst voor het Cultureel Erfgoed, 2016).

The repetition of building blocks and alternation of high- and low-rise buildings can be seen as a radical response to the traditional building style at the time in the Netherlands. The traditional housing blocks in Amsterdam used to have a 'closed' character due to their stone walls along the street, also known as 'rue-corridors' (Mens, 2017). Van Eesteren wanted to eliminate this closed character. Instead, open building blocks that alternated high- and low-rise buildings were designed.

For low-rise buildings, van Eesteren used the principle of courtyard allotment. In this courtyard allotment, rows of hooked housing blocks were built around carefully laid-out courtyards (Mepschen, 2012). The typology of these low-rise neighborhoods mainly consisted of row houses and duplex houses (Havinga et al., 2017).

For high-rise neighborhoods, strip allotment was being used. Here, porch flats were placed in the open landscape. Whereas in courtyard allotment, the greenery was found inside the blocks, in strip allotment, the flats were surrounded by green (Mepschen, 2012). These porch flats, also known as slab blocks with point access, form the most dominant housing typology in the Western Garden Cities (see figure 11). A total of 142 building blocks with approximately 21.700 dwellings in the Western Garden Cities comprise this typology (Havinga et al., 2017). These slab blocks

represent modern architecture and are made of bricks or industrialized construction systems. Moreover, the appearance of the slabs can be described as sober and studious (Havinga et al., 2017).

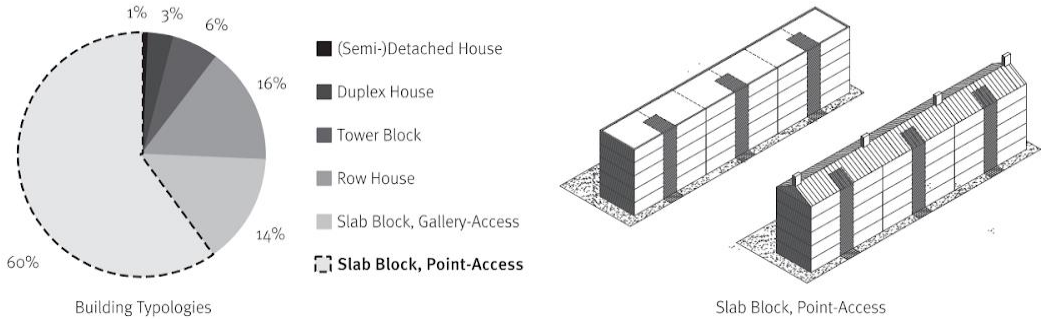

Figure 11: housing types in the Western Garden Cities (Havinga et al., 2017)

The second characteristic, the hierarchical design of both the infrastructure and green structure, is one of the most controversial characteristics of the Western Garden Cities. During the construction of the neighborhoods, the high number of greeneries was used as a trump card to attract new residents. During the current redevelopment of the area, the greenery is merely seen as a problem due to its high amount, anonymity, and insecurity (Feddes, 2011). However, green infrastructure has been a crucial element in the well-thought-out development plans of the Western Garden Cities. Van Eesteren hierarchically designed the green space (see figure 12): from the landscape to the park, to the park strip, to the green strip, to the courtyard to eventually reach someone's front- or backyard (Rijksdienst voor het Cultureel Erfgoed, n.d; (Interviewee 1, May 2022)

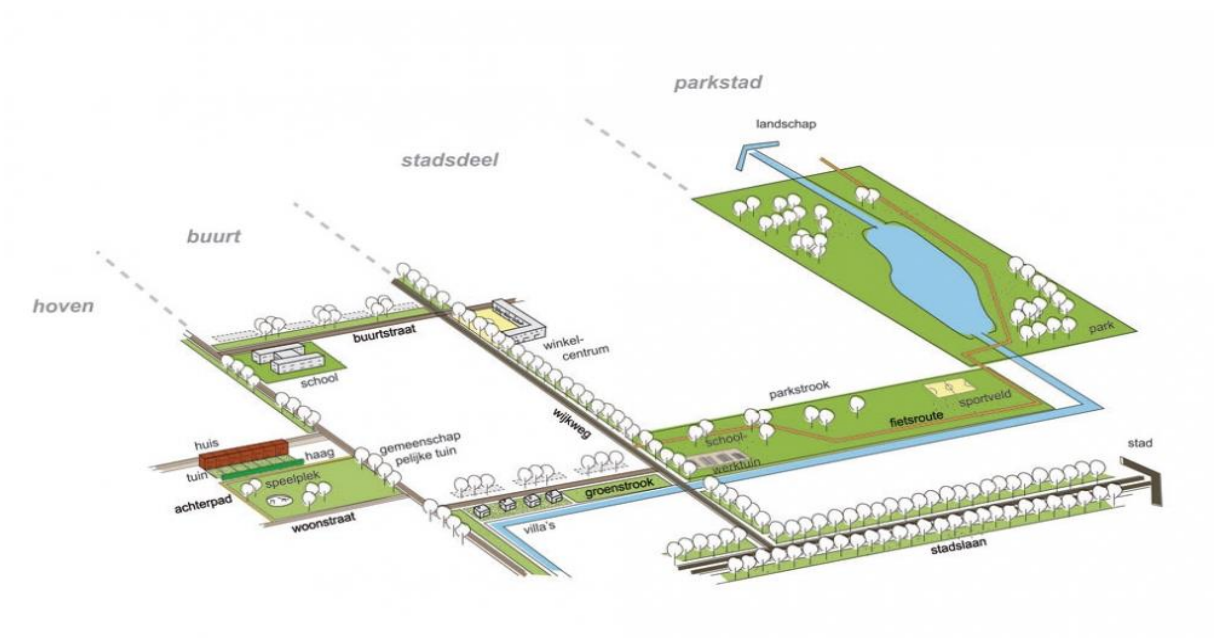

Figure 12: the hierarchical green structure of the Western Garden Cities. Translated from left to right: courtyards, neighborhoods, the city district, park city (Feddes, 2011).

Policy targets regarding densification and climate resilience.

To map the policy and regulatory circumstances of the Western Garden Cities in Amsterdam, a thorough policy documents analysis has been conducted. Here, a variety of municipal policy documents has been analyzed. These policy documents are listed in the methodology chapter. First, this chapter summarizes Amsterdam's general policy targets and ambitions for densification and climate resilience. Second, the specific targets and ambitions of the Western Garden Cities will be discussed. At last, a short reflection upon these policy targets will be shared.

Densification: policy targets and ambitions

In 2011 the municipality of Amsterdam published the 'Structural Vision 2040' ('Structuurvisie Amsterdam 2040') (Gemeente Amsterdam, 2011). This document entailed the ambitions and tasks for the city's spatial development in the coming 30 years. The Structural Vision 2040 was one of the first municipal documents that promoted densification strategies on a large scale: 'Because space in the city is scarce, we have to densify. Densification is however not an aim in itself; it must not go at the expense of the quality of housing and the living environment' (Gemeente Amsterdam, 2011). In the Structural Vision, the municipality of Amsterdam aimed to build 70.000 homes by 2040. By realizing approximately 2300 houses per year, this target could be reached. Elaborating on this goal, in 2016, the municipality published the 'Course 2025' ('Koers 2025'). In contrast to the long-term Structuurvisie, this document aimed to provide short-term plans considering the urban planning of the built environment.

Also, in the Course 2025, densification seemed to be the most emphasized strategy for building the aimed 70.000 homes by 2040. The Course 2025 argued that 'careful densification' could help achieve this target (Gemeente Amsterdam, 2016). Here, (careful) densification was defined as the better use or intensification of existing urban areas. Moreover, densification strategies aimed to achieve more excellent urban quality for diverse populations and income groups and to improve their quality of life (Gemeente Amsterdam, 2016).

However, the most thorough and elaborate densification plans are made in the 'Environmental Vision Amsterdam 2050' ('Omgevingsvisie Amsterdam 2050') (Gemeente Amsterdam, 2021). The Environmental Vision is a long-term vision of the future spatial development of the city. Each municipality in the Netherlands should draw up an Environmental Vision in the context of the upcoming Environmental Act. One of the most striking goals set in the Environmental Vision is the number of residences that should be realized by 2050. In contrast with the 70.000 aimed houses by 2040 in the Structural Vision, the Environmental Vision pleads for building 150.000 homes by 2050. This can be seen as a remarkable goal compared to the Structural Vision since it doubles the number of housing units while only widening the timespan for ten years.

The Environmental Vision of Amsterdam is divided into five chapters, including the chapter 'grow within our borders.' In this chapter, it is clearly described how the municipality of Amsterdam envisages densification in its city. With the strategy to grow within its borders, the municipality demonstrates its will to urbanize compactly. It is argued that building more dense means that the landscape outside the city will keep unaffected, travel distances will become shorter, and the city can deal efficiently with infrastructure and transport. Moreover, it is again clearly emphasized that physical growth and densification of the existing city are not a goal in itself but, that they serve as a tool for gaining more, or at least sufficient, support for social facilities and public transport.

In addition, it is argued that 'human size' and the quality of the public space are the main priority when densifying certain areas in the city. Moreover, the municipality demands that new densifying

projects be intertwined with the existing (built) environment to ensure cohesion between the old and new (Gemeente Amsterdam, 2021).

In order to integrate the new construction with the existing built environment as correctly as possible, the Environmental Vision distinguishes four different types of neighborhoods that will all undergo densification in the coming 30 years (see figure 13):

Sheltered city neighborhoods (luwe stadsbuurten) are characterized by low densities with limited non-residential functions. In contrast, the amount of green infrastructure is relatively high.

Mixed city neighborhoods (gemengde stadsbuurten) are described as neighborhoods with a high percentage of non-residential functions. Compared to sheltered city neighborhoods, mixed city neighborhoods contain green infrastructures to a lesser degree. More importantly, the scale is smaller: the greenery is mainly found within streets and small local parks.

Metropolitan neighborhoods (hoogstedelijke buurten) provide even more space for non-residential functions. These spaces are provided due to the higher densities handled for residential areas.

Metropolitan centers (hoogstedelijke centra) are areas with relatively high density, mainly caused by building more high-rise. Besides residential functions, these areas merely provide the city with work-related functions.

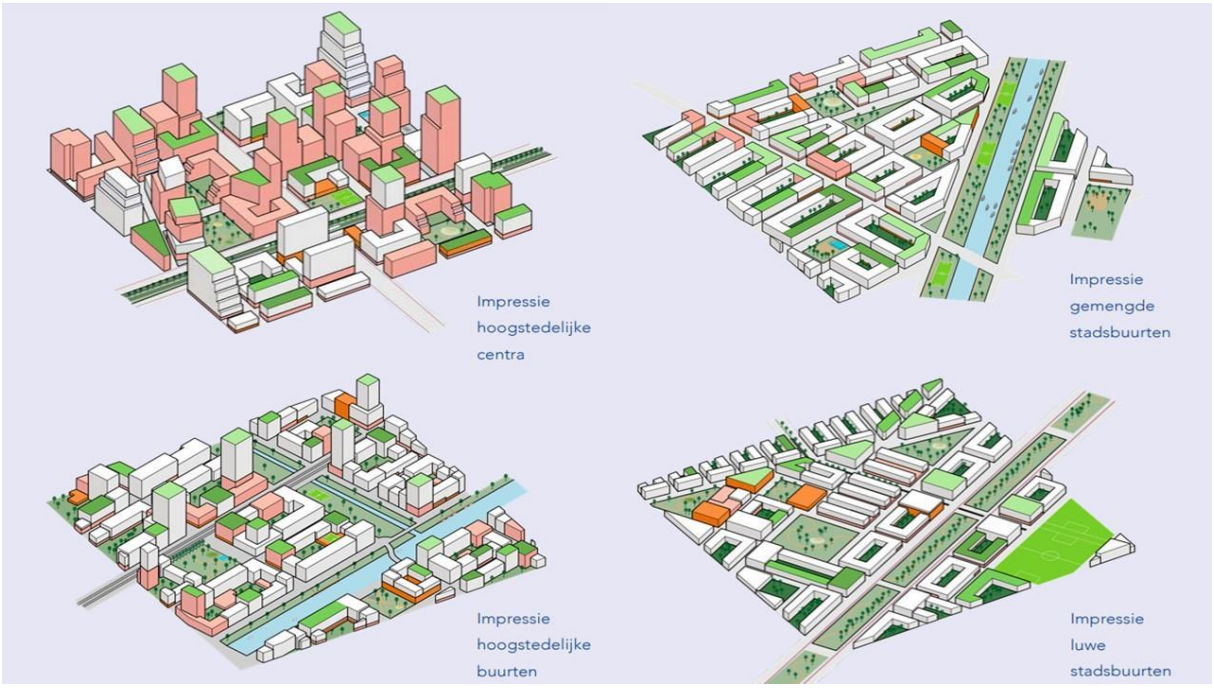

Figure 13: Four types of density in Amsterdam (Gemeente Amsterdam, 2021).

In addition to these four distinguished neighborhood types, the Environmental Vision also proposes various urban places that are most appealing for densification processes. First of all, densification should merely take place in easily accessible places. High densities and concentrations of works and facilities will, for example, be located around public transport nodes to increase their accessibility. Second, a great opportunity for densification lies in transformation areas, where unilateral low densities should make way for mixed living and working in high densities. Third, post-war neighborhoods play an essential role in densifying the city.

Outstanding in the vision on densification is the emphasis on 'post-war neighborhoods.' Together with business parks, these neighborhoods are the urban land types with the most densification potential, according to the municipality (Gemeente Amsterdam, 2021). According to the Environmental Vision, post-war neighborhoods can be perceived as sheltered city neighborhoods. It is accentuated that in these post-war neighborhoods, the municipality tries to guard 'the alternation between quiet residential streets and lively city streets and squares.'

Furthermore, policymakers of the Environmental Vision argue that it is possible to densify within post-war neighborhoods without large-scale demolition of the existing housing stock. By densifying beside existing rail- or highway infrastructure or beside existing main streets and avenues, it is possible to preserve the properties of the post-war neighborhood. Most importantly, it is argued that densification, earlier referred to as a tool instead of a goal, contributes to a thriving network of public facilities and transport in the area. According to the Environmental Vision, as a result, both the social security and accessibility of the post-war neighborhoods will increase (Gemeente Amsterdam, 2021).

Climate resilience: policy targets and ambitions

Whereas scientific literature mostly agrees on the fact that 'climate resilience' is a more comprehensive and holistic term rather than 'climate adaptation' (Tyler & Moench, 2012), the governmental organizations within the Netherlands still prefer to use the term 'climate adaptation. As a result, the municipality of Amsterdam does not have any clear targets or ambitions regarding climate resiliency. The word 'resilience' (in Dutch 'veerkracht') is only found twice in the 276-page counting document of the Environmental Vision 2050. As a matter of fact, both times the words are used in a more general context instead of climate-related. Accordingly, resilience is still used as a catch-all-term (Interviewee 2, May 2022)

By way of contrast, the municipality of Amsterdam published various documents regarding climate adaptation. Starting in February 2020, the municipality published the 'Strategy Climate Adaptation Amsterdam' ('Strategie Klimaatadaptatie Amsterdam'). This document strives to outline a specific strategy for making the city of Amsterdam climate-adaptive to a maximal extent. As it is argued, the consequences of climate change have been experienced more and more over the last couple of years. With this document, the municipality attempts to create a first assessment of the risks and tasks concerning climate change. Here, four climate-adaptive-related themes are centralized: heat, drought, water nuisance, and floods. For each theme, ambitions are formulated. Generally, the aim is to become more resistant to climatic threats and avoid climatic damage and nuisance to the city (Gemeente Amsterdam, 2020).

To reach these goals, the Strategy Climate Adaptation provides the city with various 'required actions per climate theme.' For instance: focusing on materials that do not receive heat radiation, accelerating the approach of strengthening locations with an increased risk of damage, and increasing the consciousness of policymakers of the importance of this theme (Gemeente Amsterdam, 2020). However, these required actions are not legally required and remain on a rather ambitious level.

In 2021 the municipality of Amsterdam published the 'Execution Agenda Climate Adaptation' (Uitvoeringsagenda Klimaatadaptatie). In addition to the Strategy Climate Adaptation of 2020, this document provided more elaborate propositions and solutions for executing the proposed goals on various levels of scale: the building, street, neighborhood, city, national, and international. Here, various possible actions, referred to as 'guidelines', are proposed to increase the climate adaptability of the city. For instance: 'Disconnecting the rain downpipe and letting it culminate in

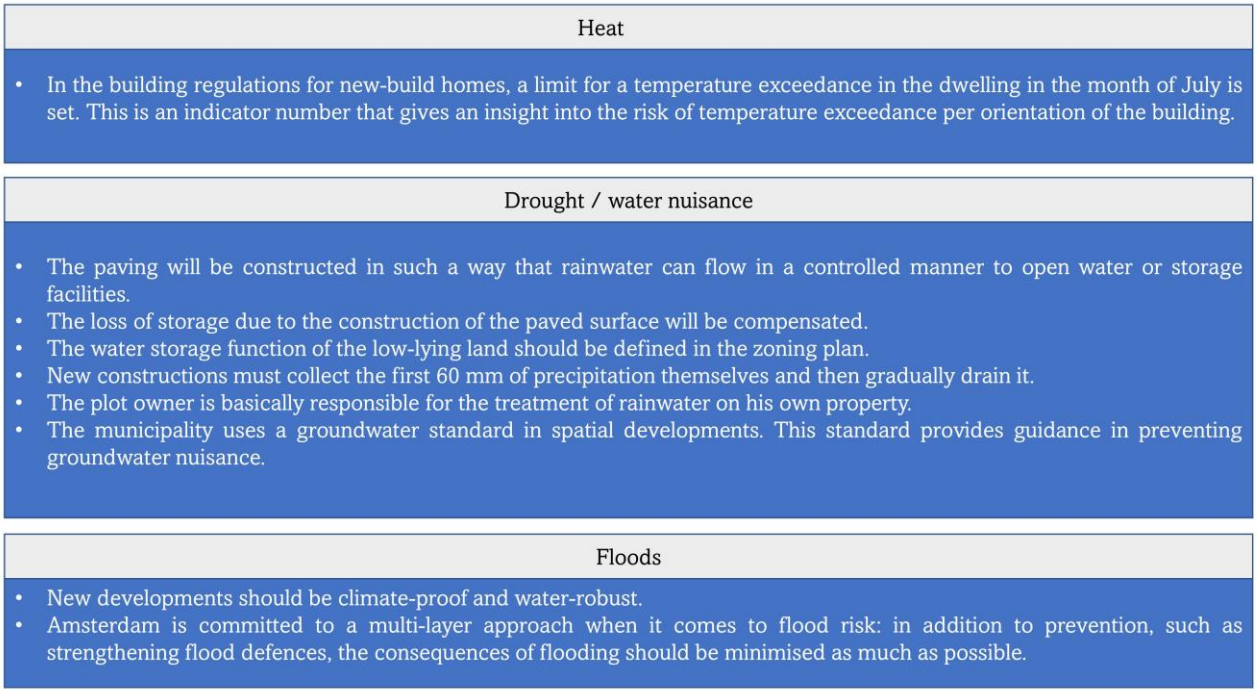

Figure 14: Summary of the most relevant standards of climate adaptation in Amsterdam (Gemeente Amsterdam, 2021).

the garden, a rain barrel, pond or infiltration crate' (house level) or 'creating cooling spots by realizing more parks, swimming areas and rainwater ponds' (street level). Again, these guidelines have no legal meaning (Gemeente Amsterdam, 2021).

However, besides the abundance of proposed guidelines, several 'standards' are also mentioned. These standards are binding and should always be considered in new city developments. Figure 14 summarizes the most essential standards regarding area development currently valid in the municipality of Amsterdam.

As all standards mentioned in figure 14 are considered a 'standard' in the Execution Agenda Climate Adaptation, a clear differentiation can be made between standards that are evidently executable, such as the 60 mm precipitation norm, and other standards that remain somewhat ambiguous such as 'new developments should be climate-proof and water robust.'

The 60 mm standard and most other water standards are rooted in the 'Rainwater Ordinance' ('Hemelwaterverordening'). This legal regulation states that a newly built house can cope with a 60 mm/hour downpour without damaging other houses or infrastructures. In practice, this means that a water storage facility needs a minimum capacity of 60 liters per m2 (Amsterdam Rainproof, 2022).

In addition to the already applied standards, the Execution Agenda Climate Adaptation also proposes multiple potential standards. These standards are considered to be valid in the future. These proposed standards can be found in the policy document itself.

Summarizing, it could be concluded that various targets have been translated into valid standards and norms, especially for issues regarding water drainage. However, the standards remain somewhat limited for the other climate adaptation themes.

Densification and climate resilience plans concerning the Western Garden Cities

Regarding densification, the Environmental Vision Amsterdam 2050 clearly describes the visions and building targets the municipality wants to achieve by 2050. Here, post-war neighborhoods play a crucial role. Since the Western Garden Cities are a cluster of various post-war neighborhoods, it could be argued that previous paragraph already discussed the particular densification goals for the Western Garden Cities to a certain extent.

Nevertheless, the Environmental Vision offers a more detailed chapter focusing on Amsterdam New West, covering the Western Garden Cities. This chapter emphasizes a few subjects that should be considered when particularly densifying in Amsterdam New-West.

First of all, the presence and conservation of greenery in New West is a point of attention. As argued in this chapter, Amsterdam New-West has a pleasant variety of urban and quiet places. What characterizes the city district is the coherence between the built environment and green infrastructure. Here, the central lake (the Sloterplas) and the surrounding park are seen as the center of this coherence. The municipality wants to use this strong coherence and let it play a central role in the renewal of the district (Gemeente Amsterdam, 2021). To let densification go hand in hand with the green character of the district, the municipality aims to invest in the Sloterplas and its surrounding parks, but also in the greenery within the neighborhoods and streets. Moreover, promised investments in the ground layers will ensure the livability of the trees in the area.

The second point of attention is livability. The municipality of Amsterdam acknowledges that improving social cohesion and livability is challenging. Nevertheless, it is argued that densifying and renewing neighborhoods in New West can again be a valuable tool in this process. It is mentioned that adding a wider variety of housing types will be of great value for the district's livability. A greater variety of housing types would allow local residents to make a residential career within the same neighborhood. It is argued that densification, combined with a more substantial level of public services and transport, will increase livability in the Western Garden Cities.

At last, accessibility forms a point of attention. Densification should go hand in hand with improving the transportation network within the district, but more importantly, with the city center. The city aims to improve the pedestrian and cycling connections but also connect New-West better to the public transport system of Amsterdam (Gemeente Amsterdam, 2021).

Concerning climate resilience or adaptation, no particular plans for the Western Garden Cities can be found. The program manager of climate adaptation of the Amsterdam municipality states that the lack of regional policy documents concerning climate resilience or adaptation is entirely evident due to the early phase policy of climate adaptation is currently in:

"*I would say climate adaptation policy is still in its early stages. As I said, we just (2 years ago) drew up a Climate Adaptation Strategy. We are taking the first steps to include climate adaptation in everything. However, we also know that much more is needed for a total climate adaptive perspective. We are just getting started"* (Interviewee 11, September 2022).

Reflection on policy targets and conclusion

For densification, the policy targets are exact with clear, quantifiable targets: the municipality of Amsterdam wants to build 150.000 new homes by 2050 within their municipal borders. This

densification should always fit the local context and preferably occur beside important infrastructure nodes or in less dense urban environments such as transformation areas or post-war neighborhoods (Gemeente Amsterdam, 2021). In contrast to the clear policy targets for densification, the policy targets for climate resilience or adaptation are much more indeterminate. Currently, real executable targets for area development are only set for water drainage and nuisance.

Conflicts between densification and climate resilience.

This chapter will answer the first subquestion, 'Which particular conflicts between densification and climate resilience can be identified?'. Multiple conflicts between densification and climate resilience/adaptation arose during the expert interviews. The most important conflicts are the land-use conflict, the scaling conflict, the responsibility conflict, the livability and socio-economical conflict, and the cultural heritage conflict.

Land-use conflict

As disclosed in the theoretical framework, the most significant conflict between densification and climate goals is land use (Balikçi et al., 2021; Bibri et al., 2021; Williams et al., 2010). On the one hand, optimal land use circumstances for densification purposes would consist of urban infill development. Here, the construction of buildings and infrastructure on any possible open land space would be ideal. On the other hand, optimal land use for climate resilience/adaptation would consist of preserving and creating open spaces (Eichhorn et al., 2021). Also, when conducting the interviews, this land-use conflict often arose. Land use was even defined as the most critical trade-off/conflict when simultaneously striving for densification and climate resilience (Interviewee 4, May 2022). For example, an interviewed project developer at 'Eigen Haard,' the most dominant housing corporation within all the neighborhoods of the Western Garden Cities, defines the land-use issue as follows:

"*Within the Dichtersbuurt, we are planning to densify up to 800 dwellings which is a duplication of the current amount. With however zero preconditions we could maybe even triple that amount. In fact, we do have preconditions that limit us from building more. Climate adaptation is such a precondition which is currently very important*" (Interviewee 5, May 2022).

Another striking example that demonstrates the conflict between densification and climate resilience in the Western Garden Cities is the Eendrachtsparkbuurt. In this neighborhood, two housing corporations own the majority of the housing stock. In 2007, one of them (Stadgenoot) decided to renew and densify their part of the neighborhood. However, the other housing corporation agreed to preserve the authentic dwellings. As follows, the renewed part of the Eendrachtsparkbuurt obtained a new urban planning grid, whereas the other part of the neighborhood remained its original and typical courtyard allotment (Interviewee 7, June 2022). Figure 15 shows the tremendous difference in the ability to deal with heat stress. While the authentic part of the neighborhood reached a perceived temperature of 40 degrees Celsius on 1st July 2015 (black circle), the renewed and densified average reached a temperature of 46 degrees (red circle) (Gemeente Amsterdam, n.d, e). This example illustrates a densified area's inability to cope with heat stress, one of the most relevant factors of climate resilience in the Netherlands.

Concludingly, real-life practice in the Western Garden Cities shows that replacing an open and green courtyard allotment for a more densified street grid makes an enormous difference in climate resilience (Interviewee 7, June 2022). This observation is however not only seen in the

Western Garden Cities. Also in the post-war neighborhood Kanaleneiland, Utrecht, multiple new construction neighborhoods experienced a higher heat stress than the original building blocks (Interviewee 6, May 2022). Besides the item of heat stress, also water nuisance is mentioned:

"Besides heat, you can also collect water much better in open courts than in a densified situation. In those open courtyards, you can introduce wadis and disconnect downspouts. That works much better there than in a densified situation" (Interviewee 7, June 2022).

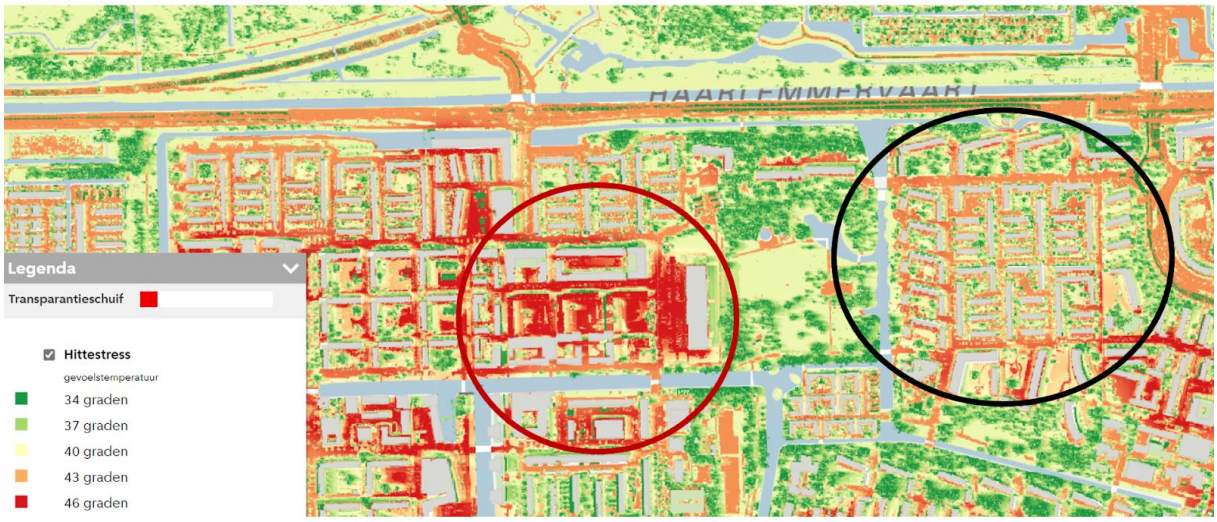

Figure 15: Differences in the ability to cope with heat stress between authentic and renewed parts of the neighborhood (maps.amsterdam.nl)

As densification declines the possibilities for successful climate resilience and vice versa, a land-use conflict occurs.

In addition to land use as a general conflict, parking can be seen as a vital sub-conflict. In many interviews, parking capacity in neighborhoods was mentioned as a conflicting issue with climate resilience. As it is argued, adding more dwellings through densification processes results in more parking spaces and more mobility movements (Interviewee 5, May 2022). In the Western Garden Cities, many surfaces are still designated as sealed parking spaces. As mentioned in the theoretical framework, sealed areas have no water infiltration capacity. Moreover, they sustain more heat on hot summer days than on natural surfaces (Tauhid, 2018). The project developer of Eigen Haard stresses the conflict as follows:

"*Built-up parking often needs a parking deck. In my view, retaining a plot empty is often best for climate adaptation. You can, however, add plants to the deck or make a garden on top of it to enhance climate adaptation. Nonetheless, that is often expensive, and besides, you don't keep the full ground*" (Interviewee 5, May 2022).

Adding greenery to parking decks seems to benefit densification and climate resilience in the first place. However, other interviewees assess it as a false solution:

"Sometimes these parking facilities contain a (sedem) green roof, but I see that more as 'window-dressing" (Interviewee 3, May 2022).

Scaling conflict

Elaborating on the previous conflict, the variety in scale levels to address both issues is another conflict mentioned in the conducted interviews. Whereas densification plans are made in detail on multiple scale levels for climate resilience or adaptation, these plans merely get specific on only much lower levels of scale. Consequently, a more regional or more extensive scope for climate resilience is missing. As a result, densification and climate policy seem to conflict due to scaling differences.

In the document analysis of this study, it became clear that for densification, city-wide policy documents such as the 'Structural Vision 2040' and 'Environmental Vision 2050' stress the importance of densification in the city. Moreover, they clearly define which particular areas are most suitable for these densification processes. Besides this city-wide scope, also the regional scope is discussed. Consequently, for the Western Garden Cities, a thorough consideration had been on where to densify, and which aspects mattered the most regarding the local context. At last, in collaboration with housing corporations and developers a densification plan for a certain neighborhood was elaborated (Interviewee 5, May 2022). Consequently, densification plans in Amsterdam are developed in a very precise manner on all possible levels of scale.

In contrast, the previous chapter of this result section clarified that climate resilience plans remain vague and non-binding on higher scale levels. Nevertheless, it appeared that on a housing level scale, various measurements currently have legal status. The recent introduction of the 'Rainwater Ordinance' is a noteworthy example of a binding climate resilience measurement implemented on the building level. Still, elaborate plans on higher scale levels are missing and not yet developed for climate resilience. This focus on the building level is explained by the fact that these measurements can be implemented most easily:

"In terms of water collection, we can have the most impact with measurements that can be integrated into new buildings. Smartly collecting rainwater on the roof, then draining it off again, etc. We can steer most effortlessly on these kinds of interventions. Contrary, the surrounding area is very often 'the way it is.' It is much harder to change that structure completely" (Interviewee 9, June 2022).

Nevertheless, the consideration to focus on the building level instead of also taking into account the broader environment is highly criticized by non-municipal workers:

"*The current integration of climate adaptation is just ticking boxes. It is policies being tested, but nobody looks at the bigger picture. For example, a municipal official specialized in trees sits at our table to discuss the preservation of trees. That is very important, but nobody looks at the integral. So the question 'how many trees should we keep or not' is completely different from 'how do we design this neighborhood to be climate-adaptive?'. Of course, there is steering towards climate adaptation policy, but it's mostly bothering with ticking boxes instead of asking how it can be as climate-adaptive as possible, with as little maintenance as possible*" (Interviewee 3, May 2022).

According to the chief designer at the planning & sustainability department of the municipality of Amsterdam, the municipality is aware of the absence of this broader scope. However, adapting climate resilience measures to local circumstances is considered to be challenging:

"*On the one hand, the entire climate adaptation paradigm asks for action on a large scale. On the other hand, the city of Amsterdam grows in transformation areas where we are much more dependent on various local factors. This makes it difficult to direct climate adaptation on a larger scale. Within the municipality, we feel this tension … In redeveloping areas we are changing the neighborhood piece by piece. Here, our*

designers mainly focus on the building level. For example, they particularly focus on roof water drainage and how they can make buildings more climate adaptive. They do this very successfully, but there is a certain lack to look at the issue of climate adaptation in an integral and a more area-wide way instead of focusing on especially buildings" (Interviewee 9, June 2022).

The current absence of a more extensive scope is also emphasized by an academic researcher on densification related to green spaces:

"*I have the idea that we do not have a clear vision on how we comprehensively want to address climate adaptation on a city-wide level. There is a deficiency in clear directions, and we lack an overview of the big picture. Municipalities and project developers can be proud of the small stamp of the park that they have developed. However, they do not remember which greenery probably has disappeared in the neighborhood due to that same renewal*" (Interviewee 4, May 2022).

The relevance of this problem, also concerning the Western Garden Cities, is confirmed by the team leader of spatial design in the Western Garden Cities. As he argues, the city of Amsterdam has gained too less experience on a larger scale. Especially in New West, there is a call for making decisions on a regional level instead of focusing only on the areas undergoing renewal (Interviewee 10, August 2022).

Figure 16 visualizes the various levels of scale in this conflict.

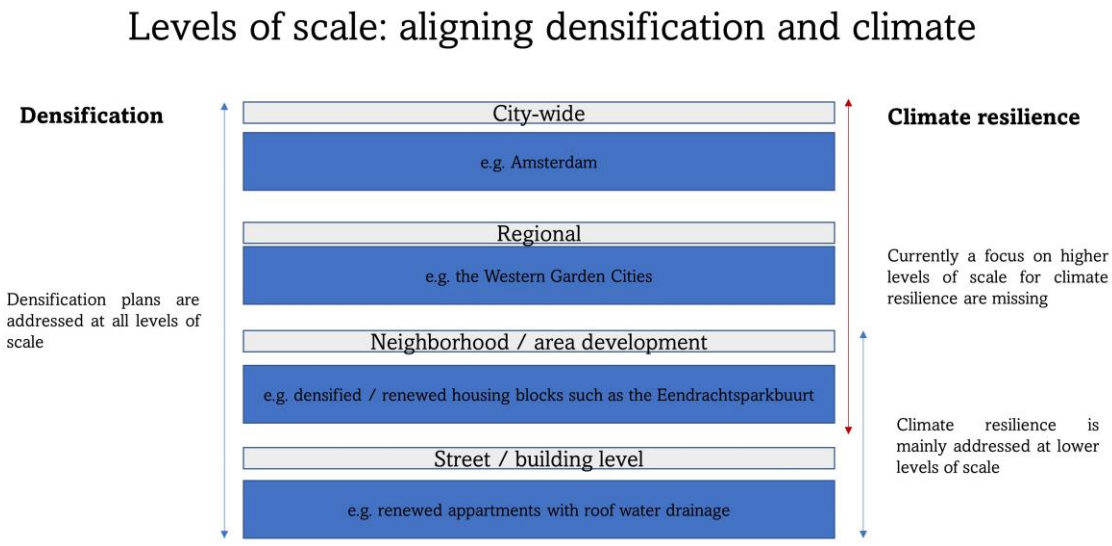

Figure 16: Multiple levels of scale in urban planning in Amsterdam (own work).

Responsibility conflict

Following up on the previous conflict, various interviewees raised the lack of responsibility appropriated to improve climate resilience or adaptation. Which parties and stakeholders should feel responsible for climate-related issues? For densification processes, the responsible stakeholders are easily identifiable: municipalities, housing corporations, and project developers.

In contrast with densification processes, it remains unclear who is going to pay for climate resilience measurements:

"*With a green roof it makes sense who pays, but with public green spaces it is questionable who will pay for it and maintain it. Moreover, various departments within the municipality deal with this item, which makes it even more difficult*" (Interviewee 4, May 2022).

If the responsible stakeholders for climate resilience measurements are unknown, aligning densification with climate becomes challenging. According to an urban planner working on post-war neighborhoods in Utrecht, this imbalance in responsibility for climatic measurements also has to do with potential revenues:

"*There is simply a lot to earn in the (re)development of properties. If you look, for example, at Overvecht* (a post-war neighborhood in Utrecht) *a lot needs to be done to improve the public space to make it climate resilient, but that is much less attractive financially"* (Interviewee 6, May 2022).

Hence, greenery is usually perceived as a 'cost item' (Interviewee 4, May 2022). Besides the costs of greenery, maintenance is another critical item that withholds stakeholders from investing in green infrastructure. As it is argued, greenery can have enormous potential when fostering climate resilience, but if the maintenance is lacking or is being ignored, the power of greenery becomes worthless (Interviewee 3, May 2022).

For example, the idea of 'green buildings' is discussed. While it is acknowledged that this is a relevant topic in urban planning, the issue of maintenance quickly arises:

"Considering green buildings, it is important to mention that we want to make affordable housing all over the city. Nevertheless, that still always becomes rather expensive, especially if it becomes green and lots of management is needed. That is where many initiatives get stranded" (Interviewee 9, June 2022).

A municipal planner underlined that climate-resilience interventions only could work if all involved parties thoroughly consider maintenance. As an example, the 'Mercatorbad' was given. This outdoor swimming pool on the other side of the ring road A10 was built in 2006, with lots of outdoor vegetation growing on the building. However, this vegetation was not adequately maintained, and nowadays it is a "*kind of burlap, black facade that just warms up instead of cooling the surrounding environments*" (Interviewee 9, June 2022). In addition, housing corporation Eigen Haard addresses the maintenance issue by emphasizing the discrepancy between public space and service fees:

"*Currently, we are responsible for maintaining lots of public green spaces in Western Garden Cities. It is our property, but also a public area, so we are not allowed to charge service fees for that maintenance. Only if it is an enclosed green space that is only accessible to residents, we are allowed to charge service costs. We would like to see that change and give the responsibility to the municipality in the future*" (Interviewee 5, May 2022).

Livability and the socio-economic conflict

Densification and climate policy merely seem to clash regarding land use considerations. However, in various interviews, the aspect of livability was mentioned as a possible underlying conflict about the research case of the Western Garden Cities. In the previous chapter, it became clear that livability plays an important role in the area's redevelopment. In the Environmental Vision 2050, it has been argued that densification strategies in the Western Garden Cities are being

used as tools to increase livability in the neighborhoods (Gemeente Amsterdam, 2021). This attempt to increase the livability in the area finds its origin in the 90s of the previous century. Back then, most public spaces in the Western Garden Cities were often experienced as unsafe places with a lack of social cohesion (Rijksdienst voor het Cultureel Erfgoed, 2016).

According to an interviewed landscape architect, the Western Garden Cities have been made 'safer' in the last couple of years. In order to create more social safety, the municipality has been steering towards more openness in the landscape. As the landscape architect argues, this aim for livability and social safety has had its impact on the climate resilience of the city district:

"*As it aimed to make the Western Garden Cities safer, the 'dense' and more dark greenery present in the courts has now been replaced by 'more open' greenery. Various big poplars have been removed. That has of course had its impact on climate-related issues such as heat management. Old and big trees have more cooling impact than a few small ones*" (Interviewee 3, May 2022).

This example shows that steering towards the improvement of livability and social safety in the Western Garden Cities, to some extent, can conflict with climate resilience. The climate-adaptive strength of the Western Garden Cities clashes with the socio-economic strength that is aimed for (Interviewee 8, June 2022). Nevertheless, various interviewees emphasize the importance of improving the socio-economic status in the Western Garden Cities and their preference for livability rather than climate resilience or adaptation (Interviewee 2, May 2022).

"*Climate adaptation is essential and should be integrated into our everyday life as much as possible. However, it should not go at the expense of socio-economic dynamics. I think that the primacy of urban development lies in socioeconomic dynamics. Especially in the Western Garden Cities, this theme is very important*" (Interviewee 8, June 2022).

In addition to this socioeconomic dynamic argument, multiple non-municipal interviewees underline the fact that there is a municipal prepossession that prefers to address densification over climate resilience in urban area development:

"*I certainly think that there are people who think about the coordination between densification and climate resilience, but foremost I think these people feel a sense of urgency to build houses. That really is the priority. If an area shows no real climate-adaptive bottlenecks, such as water nuisance, the urgency of something like green quickly fades into the background"* (Interviewee 4, May 2022).

Various municipal interviewees explain this lean towards densification because they aim to improve the socio-economic circumstances. Densification is seen as a valuable tool to reach this target. Moreover, the argument is given that adding more (climate resilience) regulations to the building process will slack the process of bettering the socio-economic circumstances in the Western Garden Cities:

"*I think it is questionable at all whether you can still ask a developer for more climate resilience measurements in the current market with the current prices. We are already asking for so many things and making so many extra-legal demands. I think there are limits to that. In Nieuw-West, I would lean more towards priority for that socio-economic part. So I would put more emphasis on that than on climate adaptation*" (Interviewee 10, August 2022).

Cultural heritage conflict

As indicated in the first result chapter, in 2011, the Western Garden Cities gained the status of a post-war area with a special cultural-historical meaning to the Netherlands (Rijksdienst voor het Cultureel Erfgoed, n.d). A report from 2016 highlights the major impact the Western Garden Cities have had on the urban development trend in the Netherlands (Rijksdienst voor het Cultureel Erfgoed, 2016). However, the cultural heritage status of this area complicates the redevelopment of the Western Garden Cities. Various interviewees considered cultural heritage a crucial conflicting issue in the Western Garden Cities due to the various limitations and restraints caused by severe cultural heritage norms. High cultural-historical values constrain the possibility of densifying, whereas areas with lower cultural-historical values are more apparent targets for redevelopment:

"*In a protected cityscape, for example, we will not densify. If something is really a monument or protected cityscape, it is a very policy-based choice not to densify those areas very intensively*" (Interviewee 10, August, 2022).

The local housing corporation verifies the difficulty of densifying in a highly appreciated cultural heritage area:

"*If we densify in the Western Garden Cities, we always have to retain the neighborhood's existing street-grid and urban design. If we could organize everything in our own way, we might also be able to show other qualities to their full advantage*" (Interviewee 5, May 2022).

The aspect of cultural heritage does not only have its impact on densification and the built environment. Also from a climate resilience perspective, the strict cultural heritage norms cause limitations as the AUP also knows a very thought-out structure for open and green spaces (Feddes, 2011). The hierarchy in the green infrastructure of the Western Garden Cities is also incorporated in the cultural heritage status of the neighborhoods and therefore needs to be maintained (Rijksdienst voor het Cultureel Erfgoed, 2016).

Various interviews with policymakers emphasize that holding on to this particular green hierarchy does not foster the area's climate resilience because of the greenery's abstractness. In interviews with policymakers, the green structure in the WTS was described as 'pretty rich within the courtyards, but in the parks, it is like a billiard cloth with sometimes a tree as a vertical element.' This minimalistic character of landscape planning is based on the AUP and therefore needs to be preserved as much as possible (De Hoog & De Wit, 2022). Yet, a climate resilience neighborhood benefits from higher densities of greenery (Tauhid, 2018; Pamukcu-Albers et al., 2021). Holding on to the aesthetic norms of the initial AUP landscape design can therefore be seen as a limiting factor for advocating climate resilience. Quoting the chief of planning & design of the municipality of Amsterdam:

"*In New West we are holding on to a weird designer idea to keep the greenery as abstract as possible. In Amsterdam Southeast, for example, a neighborhood initiative is working on food forests and increasing biodiversity. That ecological richness is of major importance to climate resilience and does really have an impact. However, it does not go hand in hand with the neighborhood's original language and historical ideology. We could question how important cultural heritage should be if we really want to foster climate resilience*" (Interviewee 9, June 2022).

Based on the conducted interviews, the importance attached to the cultural-historical character of the Western Garden Cities is a controversial issue within the municipality of Amsterdam. One

strand of policymakers attaches serious value to the cultural and historical heritage of the post-war neighborhoods. They appreciate the protected monuments and cityscapes and maintain a conservative attitude towards urban redevelopment plans that are not in line with the language of the AUP (Interviewee 10, August 2022). Another strand of municipal policymakers is however of the opinion that AUP should be revised:

"*Of course, there are a few beautiful buildings that should be preserved, but the trend that large areas are rapidly being designated as cultural heritage is crazy. It means that we will have an over-dimensioning of the greenery with strip allotment and separation of functions. If we eliminate that, we could densify to a much bigger extent*" (Interviewee 8, June 2022).

Concludingly, it could be said that the importance of cultural heritage in this area plays an essential role in the redevelopment plans. It is, however, not an aspect that causes a particular conflict between densification and climate resilience. In fact, cultural heritage itself conflicts with both densification and climate resilience goals. Moreover, cultural heritage issues hinder aligning the policy goals of densification and climate resilience. Nevertheless, it should be said that this particular conflict is local since not all post-war neighborhoods in the Netherlands contain this unique cultural heritage status.

Reflection

This chapter aimed to answer the first research question, "Which particular conflicts between densification and climate resilience can be identified?". Looking at the case of the Western Garden Cities five conflicts were identified. In this case, these conflicts can be perceived as critical challenges that must be considered when governing the nexus between densification and climate resilience. Putting these conflicts in perspective of the framework of Eichhorn et al. (2021), it could be argued that the conflicts touch upon all three parameters of the assessment framework when aligning densification with climate resilience. However, the applicability of an aspect differs per conflict.

While, for example, the scaling conflict clearly addresses inadequate governance instruments, the responsibility conflict addresses the issue of a lacking interaction between the municipality and other stakeholders on who is responsible. Moreover, the cultural heritage conflict highlights an internal organization issue, as not all municipal employees share the same opinion on the value of cultural heritage in the Western Garden Cities. The next paragraph of this results chapter elaborates on these three aspects.

Figure 17 gives an overview of the most relevant aspects of each conflict.

	Instruments	Organization	Interaction
Land-use conflict	√	√	√
Scaling conflict	√		
Responsibility conflict			√
Livability and socio-economic conflict			√
Cultural heritage conflict	√	√	

Figure 17: the multiple identified conflicts linked with the most relevant aspect of governance they address (own work).

Implemented governance mechanisms.

This chapter will answer the second subquestion, 'Which governance mechanisms are currently implemented to increase the alignment of densification and climate resilience?'. Hence, this chapter emphasizes the already implemented governance mechanisms that attempt to align densification and climate resilience in Amsterdam. The assessment framework proposed by Eichhorn et al. (2021) will be utilized here. This framework aims to provide an integrated and heuristic view of which aspects need to align densification and climate policy by using three key aspects: instruments, organization, and interaction.

Instruments

As described in the theoretical framework of this thesis, the aspect of instruments looks at the measures that have been taken to align the policy fields of densification and climate resilience. Here, a differentiation can be made between analytical tools and policy- and planning instruments. Analytical tools are used by municipalities to measure, map and assess the influence of densification on urban climate. In contrast, policy- and planning instruments are designed to encourage aligning both policy goals (Eichhorn et al., 2021).

Looking at the case of the Western Garden Cities in Amsterdam, multiple relevant instruments are implemented that are already having an impact in aligning densification and climate resilience policies.

Policy- and planning instruments

The Environmental Vision can be seen as one of the most crucial policy- and planning instruments currently implemented and fosters the alignment of densification and climate resilience in Amsterdam. As mentioned in section 4.2, the Environmental Vision is a vision for the upcoming

30 years of the future spatial development of the city (Gemeente Amsterdam, 2021). According to various interviewees, this vision cultivates the alignment of densification and climate resilience to a 'legal extent':

"*We have been coordinating these two elements (densification and climate resilience) for some time, but now it is a statutory requirement. The Environmental Vision is really a legal product that was adopted six months ago. Since then, we have really had to stick to it. If we don't, we will be summoned*" (Interviewee 8, June 2022).

Nevertheless, it remains rather unclear which consequences will follow if the ambitions of the Environmental Vision will not be followed. As a result, it could be questioned to what extent densification and climate resilience will be aligned in real-life planning practice. Moreover, the Environmental Vision is a reasonably large-scale instrument that prevails on city-scale ambitions instead of focusing on particular city districts or neighborhoods.

However, a local elaboration of the Environmental Vision for the Western Garden Cities is being developed. According to municipal interviewees, the upcoming policy document 'Strategical Framework New West' ('Strategisch Kader Nieuw West') will play a crucial role in making integral urban planning choices in the city district of New West. As it is argued, the local scale of this new policy document enables the city district to decide which areas will have a more 'climate resilience scope.' In contrast, other areas will have a rather focus on densification (Interviewee 10, August 2022).

Analytical tools

Besides the Environmental Vision as a policy- and planning instrument, the municipality of Amsterdam also possesses various analytical instruments. Here two instruments are most important: the Puccini method (Gemeente Amsterdam, 2018) and the 'integral design method of public space' ('integrale ontwerpmethode publieke ruimte') (Gemeente Amsterdam, 2020). The Puccini method is an integral guideline for the 'qualitatively good, physical design of all Amsterdam public space.' The integral design method of public space has the same purpose but is also used nationally. While both the Puccini method and the integral design method of public space are not instruments that actively endeavor a better alignment of densification and climate, they do attempt to create an indispensable and integral approach for designing the public space (Interviewee 11, September 2022). Here, both the built environment and the natural environment are defined. For example, the 'Puccini-method green' has recently been added to the method. Here, it is detailed which kind of greenery is needed for which particular area (see figure 18). Moreover, these tools greatly emphasize climate-resistant design solutions such as wadis. (Interviewee 3, May 2022).

	Bomen	Loof- en naaldbos	Bosplantsoen	Grove sierheesters	Fijne sierheesters	Struik- en perkrozen	Hagen	Vaste planten	Bolgewas (bot. of sier)	Wissel- en perkplanten	Bloembakken	Speelweide	Gras / gazon	Ruw gras	Bloemrijkgras	Fruitbomen	Water/oeverplanten	Ruigte	Rietland
Groengebieden																			
Stadsparken	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	X	V
Bossen	V	V	V	V	X	X	X	X	V	X	X	V	V	V	V	V	V	V	V
Recreatiegebieden	V	V	V	V	X	X	V	V	V	X	X	V	V	V	V	V	V	V	V
Ecologische verbindingszones	V	V	V	V	X	X	X	X	V	X	X	X	V	V	V	X	V	V	V
Wijk - en buurtgroen																			
Buurt- en wijkparken	V	X	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	X	X
Plantsoenen	V	X	X	V	V	V	X	V	V	X	X	X	V	X	V	V	X	X	X
Historische groen	V	X	V	V	V	V	V	V	V	V	V	V	V	X	X	V	V	X	X
Pleinen	V	X	X	X	X	X	V	V	V	V	V	X	V	X	X	V	X	X	X
Schoolpleinen	V	X	V	X	V	X	V	V	V	X	V	V	V	X	X	V	X	X	X
Postzegelparkjes	V	X	X	V	V	V	V	V	V	V	V	X	V	X	V	V	X	X	X
Straten	V	X	X	X	V	X	V	V	V	X	V	X	V	X	V	V	X	X	X
Lanen	V	X	X	V	X	X	X	V	V	X	X	X	V	V	V	X	X	X	X
Grachten	V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Oevers	V	V	V	V	X	X	X	V	V	X	X	X	V	V	V	X	V	V	V
Bermen	V	V	V	X	X	X	X	V	V	X	X	X	V	V	V	V	X	V	X
Wadi	V	X	V	V	V	X	X	V	V	X	X	X	V	V	V	V	V	V	V
Groene trambanen	V	X	X	X	X	X	V	V	V	X	X	X	V	X	V	X	X	X	X
Bedrijfsterreinen	V	X	V	V	V	X	X	X	V	X	X	X	V	V	V	V	V	V	V
Kantoorgebieden	V	X	V	V	V	X	X	V	V	X	V	X	V	V	V	V	V	X	V
Sportparken	V	X	V	V	V	X	V	V	V	X	X	V	V	V	V	V	V	X	V
Natuurspeelplekken	V	V	V	X	X	X	X	V	V	X	X	V	V	V	V	V	V	V	V
V = toepasbaar X = niet toepassen																			

Tabel 1: Streefbeeld in relatie tot gebruik van groentypen

Figure 18: The 'Puccini method green' addresses which greenery is needed where (Gemeente Amsterdam, 2018).

Organization

The organizational aspect of the assessment framework proposed by Eichhorn et al. (2021) describes how the municipal implementation of both policy goals is actually organized. A separation can be made between internal and external organizational structures. On the one hand, internal organizational structures refer to the cooperation between departments. Here, the organizational positioning of densification and climate resilience is explored. On the other hand, the external organizational structure refers to exchanging knowledge with external sources such as consultants or universities.

Internal organization

In the municipality of Amsterdam, the department 'Space & Sustainability' ('Ruimte & Duurzaamheid') is responsible for most issues regarding densification and climate resilience. In 2015, the former 'Service for Urban Planning' ('Dienst Ruimtelijke Ordening') changed its name to Space & Sustainability, emphasizing the role of sustainability in urban planning (Interviewee 8, June 2022). The present department consists of 600 employees: from urban planners to landscape architects and from archeologists to ecologists (Gemeente Amsterdam, n.d -d).

Within the department Space & Sustainability, various teams operate on multiple subthemes. One of the most important teams in aligning densification and climate resilience is the team 'sustainable area development' ('duurzame gebiedsontwikkeling'). According to the head of the planning department, this team was founded a few years ago in order to advise big municipal project teams on how to get their projects climate-neutral and climate-adaptive (Interviewee 9, June 2022). Currently, in each municipal urban planning project, at least one team member of sustainable area development joins the project team from the beginning till the end. The representative of the team

outlines the directions in order to ensure that the development will take place in a sustainable manner and climate resilience issues will be secured. According to one of the chief designers at Space & Sustainability, this is a significant contrast with a few years ago when the main focus was building new dwellings, and sustainability was later taken care of. Moreover, the interdisciplinarity of this team is emphasized:

"*Sustainable area development is really molded into a big team that deals with the integral approach of housing and sustainability. That team includes urban planners, but also biologists, for instance*" (Interviewee 8, June 2022).

According to municipal interviewees, the team sustainable area development plays an important part in aligning densification policy with climate policies. However, the team is also being criticized by non-municipal experts. As it is argued, the team sustainable area development mainly works on large-scale and completely new developments in the city and lacks experience in existing neighborhoods such as the Western Garden Cities:

"*When I compare it with IJburg, it seems like it was all better coordinated there from the start. Perhaps this is also because the redevelopment of the Western Garden Cities started 15 years ago and the issue of climate resilience was less urgent then. … Besides that, there are simply too few municipal officials involved in the Western Garden Cities working on these issues. They are all working on IJburg, Southeast or the Northern IJ banks. There, a whole team of landscapers is working on it, with all the rules, everything has been thought out; there should be a park here, there should be that. Here, I am lucky if there is one person from the municipality at the table*" (Interviewee 3, May 2022).

The critique of the lacking aligned vision in existing neighborhoods is acknowledged by municipal experts. However, here the incremental development of the Western Garden Cities is seen as the most important cause:

"*I must say that with large-scale projects such as Havenstad and IJburg, we really manage to do everything much more integrally because we can think out the whole thing in one go. In contrast, I think we have much less expertise in thinking integrally in already existing areas like the Western Garden Cities, where we change the urban environment step by step*" (Interviewee 9, June 2022).

External organization

In addition, Amsterdam's municipality also uses external stakeholders to improve the integral governance of climate and densification. Besides having the team sustainable area development, each urban planning project team is assisted by external advisors (Interviewee 10, August 2022). In multiple interviews, it is emphasized that these consultants are mainly essential because they can advise in the search for a 'successful climate adaptation policy':

"I must say that climate adaptation is really an evolving field. We are still searching how to unroll climate adaptation successfully. We know everything must be done, but how should we do it? That is something we are still really discovering" (Interviewee 9, June 2022).

Here, the role of external consultants is significant. The municipal team leader of spatial design in the Western part of Amsterdam emphasizes that these consultants are mainly hired to improve the needed 'basic climate knowledge' of municipal project employees. While the urban planning knowledge, and thus the knowledge on densification, is there, a basic understanding of sustainability principles such as climate adaptation is currently missing in the skill set of municipal employees:

"*Especially the public space designers and urban planners should have some basic knowledge of climate adaptation. There currently is a great potential to improve this. If we do not improve this, it will always remain in the sleeve of the consultant. The point is that climate adaptation should be approached as a general awareness: like road safety or social cohesion. Currently, the climatic knowledge of a municipal employees is depending on whether they for example already worked with the theme in comparable project, or whether they are interested in sustainability*" (Interviewee 10, August 2022).

Interaction

The third part of governance relates to the degree of interaction between the involved stakeholders. The involvement of players is crucial since numerous external actors are affected by the creation and use of climate adaptation and urban infill initiatives. A differentiation can be made between communication and participation as interaction tools. Whereas communication is a one-way information broadcast, with participation, the input of stakeholders is incorporated into policy choices (Eichhorn et al., 2021).

Regarding communication, Amsterdam's municipality actively tries to communicate which policy choices are being made for the coming decades to its citizens. The list of policy documents in the methodology chapter of this report shows a share of these communication tools. Moreover, the website maps.amsterdam.nl provides local citizens with detailed information about the potential climate adaptation risks of the entire city (see figure 14). By providing this map, the municipality of Amsterdam deliberately communicates the impacts of climate change to its citizens. However, this map aims to map and measure climate adaptation risks rather than assess the influence of densification on urban climate.

Based on the interviews, in the Western Garden Cities, the participatory involvement of local citizens and other stakeholders in the decision-making process has been sporadic in the past but is increasing. It was for example mentioned that a small, redeveloped neighborhood in the Western Garden Cities collaborated with the municipality to excavate a lawn that caused water nuisance (Interviewee 3, May 2022).

In addition, in the document analysis, the subject of participation has been highlighted multiple times. For example, in the 'Execution Agenda Climate Adaptation,' it is stated that the municipality of Amsterdam involved 403 city residents in finding bottom-up solutions with regard to climate adaptation (Gemeente Amsterdam, 2021 April). Also, the Environmental Vision 2050 emphasizes the vital role that participation will play in the area development of the city in the coming years (Gemeente Amsterdam, 2021 July). Yet, in none of the conducted interviews, it is mentioned that the municipality of Amsterdam currently attempts to create awareness or ask local citizens to participate when it comes to aligning densification and climate resilience.

However, the aspect of interaction is not only limited to the role of citizens. While the framework of Eichhorn et al. (2021) defines the aspect of interaction by emphasizing the communication and participation of citizens, other stakeholders apart from citizens are involved in the urban planning process.

Looking at the Western Garden Cities, for example, housing corporations are substantial stakeholders in the redevelopment process of the area. As most of the dwellings in the area are social housing and thus owned by housing corporations, their position as an essential stakeholder is unavoidable. In the interview with a project developer of those housing corporations, the collaboration with the municipality is underlined:

"I think the focus of our collaboration is very much on densification. I think we still work in such a way that we first look at how many houses we can put on a plot. … Once we have established that, the municipality gives climate adaptation as a precondition for our development" (Interviewee 4, May 2022).

Moreover, it is admitted that a housing corporation such as Eigen Haard currently does not have its own climate adaptation policy. Instead, it follows the preconditions and ground rules set by the municipality. In addition, it is recognized that there is currently no collaboration with other housing corporations in the neighborhood regarding climate resilience (Interviewee 4, May 2022).

Not only housing corporations struggle with the preconditions of the municipality. Also other important stakeholders such as project developers and commercial planners emphasize the agonizing way in which the aspect of interaction is organized:

"*These days, trees are almost sacred, as they should be preserved and planted in every redevelopment. However, I observe that in charming neighborhoods, trees are planted back quite sparsely, with little space. You see, the laws of good area development are not that complicated, but organizing this within a municipality in cooperation with developers and little budget is tightly difficult*" (Interviewee 3, May 2022).

Reflection

This chapter aimed to give a comprehensive overview of the currently implemented governance mechanisms that support the alignment of densification and climate resilience by looking at the aspects of instruments, organization, and interaction as proposed by Eichhorn et al. (2021). Presently, there is a noteworthy difference regarding the elaboration of these three elements in the Western Garden Cities and Amsterdam in general.

It could be said that the aspect of organization is mainly elaborated. With restructuring the department and creating a new team, a great effort is put into improving the internal organization. Regarding the external organization, a significant dependence on external consultants is observed.

For instruments, various instruments and tools exist that have a fostering impact on the alignment of densification and climate resilience. However, these instruments are not purposely created to encourage the alignment of densification and climate resilience, but they also address multiple other issues.

At last, interaction seems like the most undeveloped aspect, as the interaction with local citizens remains rather superficial. Moreover, interaction with other important stakeholders such as the housing corporations or developers is also somewhat limited as no initiatives to collaborate with these stakeholders to align densification with climate resilience were mentioned. Instead, the municipality provides these stakeholders with preconditions concerning climate resilience that need to be taken into account when densifying. Figure 19 shows an overview of the implemented governance strategies for aligning densification with Amsterdam's climate resilience.

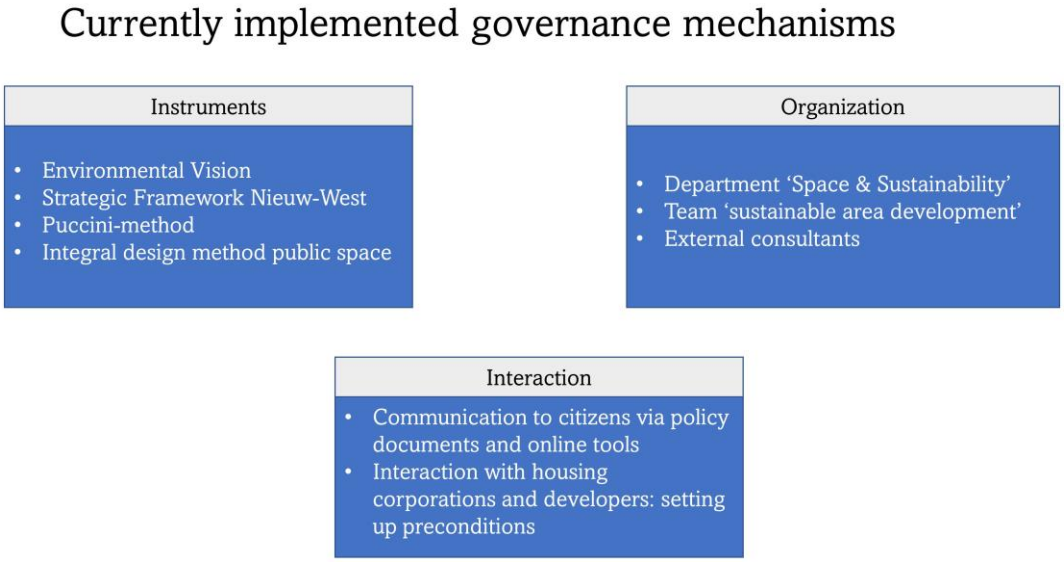

Figure 19: The status quo of alignment in Amsterdam, using the assessment framework of Eichhorn et al. (2021).

Improving the alignment: envisioned governance mechanisms.

This chapter will answer the third subquestion, 'Which governance mechanisms could improve the alignment of densifying and climate resilience?'. Elaborating on the previous chapter, this chapter emphasizes the non-existing but, in the interviews proposed governance mechanisms that could improve the alignment of densification and climate resilience in the future.

Instruments

When interviewees were asked how to improve the alignment of densification and climate resilience, almost all interviewees mentioned that the topic of climate resilience should be incorporated in an earlier phase. The project developer of Eigen Haard argues that currently, the first step of developing an area is to calculate how many dwellings can be built. In a later phase, when the building outlines are already made, themes such as sustainability, climate adaptation, and biodiversity are items that are being discussed (Interviewee 5, May 2022). Incorporating these themes in an early stage of area development can therefore enhance the nexus between densification and climate resilience.

In addition, it is argued that the current system of dealing with climate resilience consists too much of 'ticking the mandatory boxes.' Approaching climate resilience as a checklist issue results in a lack of integral climatic vision when designing, planning, and developing neighborhoods (Interviewee 6, May 2022).

As a proposed solution for the lack of integral climatic vision, it was suggested to create a policy instrument that made it compulsory to do a thorough climate analysis of the area that is about to

be (re)developed. Here, the topic of climate resilience will be outlined in the earliest phase instead of 'checking the climatic boxes' when most of the densification plans are already carved in stone:

"*I think it would be beneficial to start calculating at an earlier stage what effect, for example, heat stress has in an area. It would be good to develop a particular plan or tool to test that aspect in an early stage. From there, it is much easier to see what simple interventions could be implemented to improve the area's climate adaptation*" (Interviewee 5, May 2022).

Regarding the Western Garden Cities, a landscaping architect mentions that, for example, the Sloterplas (the central lake) should be incorporated into these integral climatic visions. As it is argued, this lake has an enormous cooling impact on the entire region that should not be ignored when fostering a better nexus between densification and climate resilience in the area (Interviewee 7, June 2022).

An instrument as described above can be perceived as both an analytical instrument (it measures and maps the potential climate change impact on areas that are to be densified) and a policy- and planning instrument, as it is mainly designed to foster the alignment of densification and climate resilience in the city. With such an instrument, the local climatic strengths and weaknesses can be identified.

Also, the program manager of climate adaptation at the municipality of Amsterdam agrees on the necessity of changing the current urban planning approach towards one that addresses the climatic issues first:

"*We should think about how climate change and the associated changing weather conditions affect our city, especially in areas where there is a densification challenge. We should first look at what consequences are visible and what this will mean for the places where we want to build. … Let's start with that, and then apply certain norms and standards by entering certain minimums that are needed for proper climate adaptation. But, most importantly, we need to start paying structural attention to analyzing those areas in an early phase*" (Interviewee 11, September 2022).

In addition to an instrument that analyzes an area on its climate resilience, the program manager of climate adaptation also refers to another potential instrument: introducing binding norms and standards for climate adaptation/resilience. Today, no binding regulations for climate resilience exist when areas are (re)developed. Yet, the formulation of these binding regulations is an issue that is currently on the national agenda. According to the municipal program manager of climate adaptation, this instrument will be highly beneficial for aligning densification and climate resilience (Interviewee 11, September 2022).

A regulation that, for instance, should be considered as becoming a standard is the mandatory implementation of green roofs. Multiple interviewees mention the critical role green roofs can play when striving for more dwellings and better climate resilience. However, the implementation of green roofs is currently not compulsory:

*"An incredible number of flat roofs are realized, but there is always a reason found why it is not possible to build a green roof on top of it: too heavy, too expensive, or difficult to manage. In my opinion, it should become compulsory, no matter what. There is much potential for green roofs, but currently, that potential is not being used" (*Interviewee 7, June 2022).

Complementary to more regulations is providing more subsidies for climate resilience. Currently, most projects only comply with the mandatory norms, so innovations or pilots are rare. According

to the project developer of Eigen Haard, funding for climate resilience can be perceived as a highly beneficial stimulus:

"*A subsidy would help projects run pilots and try things like wadis, for instance. That is not something standard. Buildings must, of course, be able to cope with heat stress, but extra things like wadis or roof gardens are not standard. If you want to realize these things more regularly, subsidies could help enormously*" (Interviewee 5, May 2022).

The fact that an exemplary implementation of climate resilience costs too much money for a project developer or housing corporation is a recurring issue in various interviews. As climate resilience measurements in the built environment are a relatively new phenomenon, the costs are relatively high (Interviewee 6, May 2022). An interviewed academic researcher emphasizes that innovations such as an underground water storage facility can enormously impact climate resilience. However, the question remains who is going to pay for it if currently no appropriate subsidies exist (Interviewee 4, May 2022). Even municipal employees underline that financial support from local governments should be incorporated into the municipal climate resilience strategy (Interviewee 10, August 2022).

Concludingly, according to the interviewees, financial support via subsidies or other incentives needs to be considered in future policymaking if climate resilience is to be treated as a severe issue. By doing so, the nexus between densification and climate resilience can be fostered.

Organization

In order to align densification with climate resilience with regard to the aspect of organization, multiple suggestions were implied by the interviewees. First of all, better internal collaboration is mentioned several times. Whereas the department Space and Sustainability seems to cover both the aspects of densification and climate, the internal collaboration within the department is criticized:

"*We are the Department of Space and Sustainability. You might think that we cover the entire package. In practice, I think we need to work together much better internally. The vision of 'sustainability' is completely different from the vision of 'space.' That's not a popular statement to make, but in my opinion, we could still grow much closer together*" (Interviewee 10, August 2022).

Offered as a solution for a better collaboration between the various sub-departments is developing the interdepartmental and intradepartmental exchange of knowledge. It is argued that a better understanding of work done in other departments, but also work done within the same department by other team members, can promote the desired integral view needed for a better alignment of densification and climate resilience. Moreover, it is argued that such an integral view will foresee which aspects matter the most to their context and thus should be prioritized (Interviewee 10, August 2022).

Besides sharing knowledge inter- and intradepartmental, it is also mentioned that all departments and teams must be involved from the beginning till the end of an area development. It is, for example, remarked that currently the landscaping team gets involved in a relatively late stage of development. As a result, the landscape and public space design need to be adjusted to the circumstances already shaped for the built environment (Interviewee 7, June 2022). Multiple interviewees emphasize the earlier involvement of these teams, so an integrative approach is guaranteed.

Elaborating on involving all teams simultaneously, the same argument is made for external experts. Here again, it is stressed that the timing of their draw-in is crucial:

"*If you have an expert join you in the preliminary stage to review the urban plan, that would help a lot. Let them see where the opportunities are and what could be improved. At that stage, you can actually still adjust things while not everything has been determined*" (Interviewee 5, May 2022).

With an early introduction of external experts, such as research institutions, possible conflicts between densification and climate can be mapped, interpreted, and assessed in a phase before densification numbers are already 'carved in stone' (Interviewee 7, June 2022). Moreover, the guidance and view of external experts in an early stage can also be seen as highly necessary if the basic knowledge of municipal employees on climate issues is currently flawed (Interviewee 9, June 2022).

Besides the early involvement of all actors, it is also argued that it is important that each internal team or external expert is not representing their own interest. Instead, it is accentuated that the external experts and municipality all sit around the table and collaboratively look at the bigger picture:

"*We can write out all the interests when a redevelopment takes place, but eventually not everything can be honored at the same time. I think it is important that all stakeholders should sit around the table and decide which trade-offs they are going to make, and collaboratively decide to leave certain aspects out of the plan*" (Interviewee 5, May 2022).

Overall, the interviewees foresee multiple changes in the organizational structure of Amsterdam to improve the alignment of densification and climate resilience. Here, sharing knowledge is essential in growing towards more interdisciplinarity. Even more critical is a restructuring in the timeline and role division of area development. According to the interviewees, creating an equal playing field for all intern and extern actors can have a beneficial impact on improving the nexus between densification and climate resilience.

Interaction

As described in the previous chapter, presently, the aspect of interaction primarily remains to communication: setting up ground rules for developers and housing corporations and informing its citizens about the future of their city. Even though the currently implemented governance mechanisms regarding interaction are reasonably poor, various suggestions are made by interviewees to increase that interaction with stakeholders, and thus improve the alignment of densification and climate resilience.

Beginning, better collaboration between the municipality, housing corporations, and other vital stakeholders is mentioned. Although this seems like an open door, it is emphasized that the municipality must stand down from its 'ivory tower' when creating policy guidelines. If the municipality considers densification and climate resilience equally important, and aims to address both issues, it is of great importance to let other stakeholders give input for what is needed to achieve this goal.

Moreover, it is argued that the interaction between government and housing corporations or commercial parties can be strengthened if a financial incentive is given to align their densification plans with climate resilience:

"Housing associations or developers often have the right intentions, but in the end, they only invest in something if it makes money or if they have to meet a certain standard" (Interviewee 4, May 2022).

A financial incentive will give housing corporations or developers more space to go beyond the mandatory standards and run for example pilots. The outcomes of these pilots can be evaluated with the municipality, which eventually will establish better collaboration between the multiple stakeholders.

When it comes to communication with residents, it is accentuated that a better translation from municipal policy to real-life practice is needed. In order to understand the importance of climate resilience, residents need to feel the urgency of the issue. According to the municipal program manager of climate adaptation, much more progress can be made in giving people the feeling that the topics of densification and climate resilience matter to their life. By structurally integrating these issues into the everyday life of people, this awareness can be achieved (Interviewee 11, September 2022). Also concerning the situation in the Western Garden Cities, it is emphasized that municipal communication regarding these topics can be improved:

"*Our policies are not easily understood, especially in low-educated areas like New West. … You have to be able to reach people to build support. In a hot summer like this, it is really not very difficult to explain the links to climate adaptation understandably. If you talk about heat problems, people understand the issue immediately. Indoor temperatures in all those 1950s flats are extremely high during the summer. Moreover, people can also see that trees are dying. However, people do not know that these trees die because of the poor infiltration layer. So I see we can progress in translating these issues*" (Interviewee 10, August 2022).

Translating complicated governance issues into real-life practice can also be done by participation instead of communication. Here, interviewees suggest that, for example, self-management and maintenance of the public space will create more consciousness and responsibility for climate issues. Vastly overgrown areas of public space are often called a mess, when in fact they are very valuable for water infiltration. If local stakeholders participate in the management of the spaces, the better understanding of the importance of this topic will increase (Interviewee 10, August 2022).

In fact, it is suggested to privatize more green spaces. It is argued that privatizing parts of the abundance of greenery will enhance people's relationship with their environment. Resultantly, greenery will be much better maintained and thus contribute to a more considerable extent to climate resilience:

"Because there is so much greenery in the Western Garden Cities, the management level is pretty basic. We sometimes discuss whether it is a good idea to privatize a part of these courtyards. Residents sometimes like that because it gives them more of a bond with it. The question is whether it is fair that some gardens then become private property and others do not. However, what it achieves is that those gardens are very well maintained and ecologically very rich. I think it would help a lot to make that greenery usable differently. So more private greenery and more relationship with private gardens and the pavements. That would make the greenery much more valuable" (Interviewee 9, June 2022).

Reflection

This chapter aimed to find governance mechanisms that could improve the alignment of densifying and climate resilience. Figure 20 shows an overview of the envisioned governance mechanisms that were suggested by the interviews with experts to improve the nexus between

both policies. Reflecting on these findings, it is remarkable that a great emphasis on the proposed solutions is related to enhancing the attention that should be paid to climate resilience. For instruments, introducing an integral vision is proposed as a relevant instrument to improve the nexus between densification and climate resilience. Moreover, mapping and assessing the climatic strengths and weaknesses in the earliest phase should be incorporated into this vision. Furthermore, the interdepartmental and intradepartmental exchange of knowledge within the municipality and the exchange of knowledge with other stakeholders is assumed to have a severe contribution when creating such a comprehensive vision. At last, it is expected that the awareness of this topic among local citizens can have a beneficial impact on governing the nexus between densification and climate resilience.

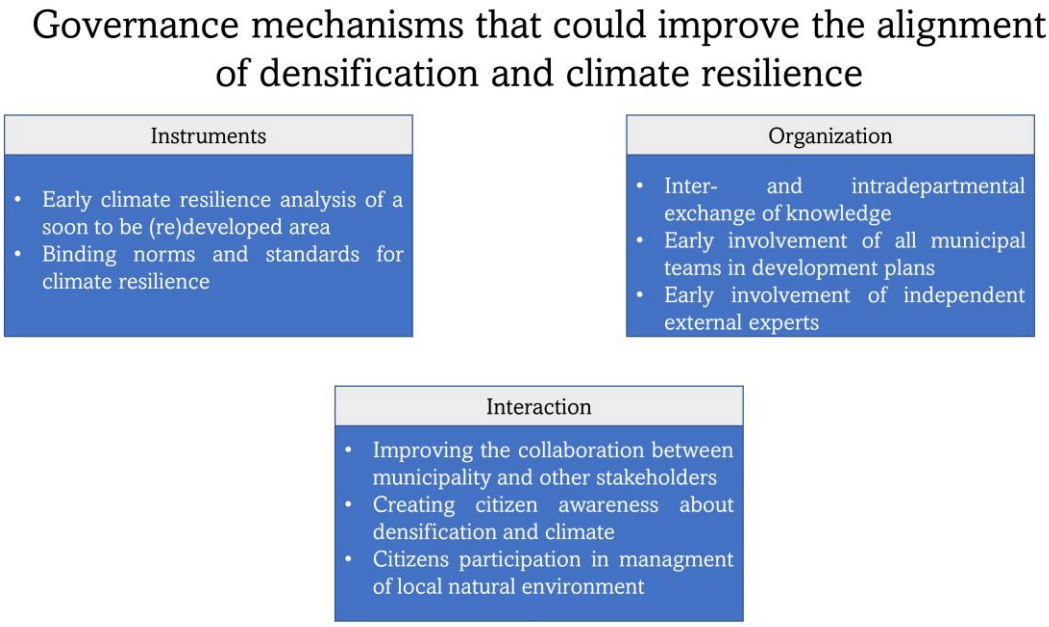

Figure 20: The envisioned governance mechanisms according to the gathered empirical data (own work).

5. Discussion

Before getting to the conclusion, this chapter elaborates on the empirical results of this research in light of the formulated research questions and the used analytical lens. When discussing the empirical results of this study, multiple noteworthy insights should be considered.

First of all, the amount of attention put in integrating the climate paradigm is striking. The scaling conflict already underlined the elaborate policy for densification on multiple levels, while the climate resilience policy is much less refined. This salient insight has an influential impact on the alignment of densification and climate resilience governance. Namely, it could be assumed that the climate paradigm is currently subordinate to the densification paradigm when looking at this case. However, it is crucial to consider the novelty of climate resilience policy here. Multiple interviewees emphasize that the role of climate resilience in planning policy practice is developing, and more time is needed to fully integrate it into planning practice (Interviewee 11, September 2022). More importantly, the urgency of climate resilience was not even taken into account when most parts of the Western Garden Cities were densified:

"*I think that the climate adaptation paradigm is just starting to take hold. Actually, I think that missing awareness a few years ago had caused the heat problems in the areas that are so densified. I must also honestly admit that when I collaborated on that Eendrachtsparkbuurt 20 years ago, I did not think about climate adaptation for a moment*" (Interviewee 7, June 2022).

Nevertheless, nowadays, more and more policies are being developed to integrate climate resilience into urban planning policy. Here, mandatory climate resilience norms are becoming more standard. For example, the recently introduced 'Rainwater Ordinance' is referred to a lot in this study since this is one of the first mandatory norms for climate resilience found in the case study of this research. Nevertheless, it could be questioned if this norm has a real influential meaning to climate resilience.

This can be explained by the fact that the 'Rainwater Ordinance' is only mandatory for new construction dwellings. As a result, in post-war neighborhoods like the Western Garden Cities, the newest densified areas have a better rain drainage capacity and thus a better climate resilience than the original areas or areas that are not yet redeveloped (Amsterdam Rainproof, 2022; Interviewee 4, May 2022). This results in a fragmented implementation of climate resilience measures since the renewal develops haphazardly around the area. Respectively, climate resilience is only incorporated in new developments, while the effects of climate change affect the whole region. Again, the calling for a broader scope arises.

Other instruments that should be discussed are The Environmental Vision and the to-be-published regional elaboration on the Environmental Vision (the Strategic Framework New West). These municipal instruments can be seen as an attempt to create an integral vision that pursues to align densification and climate resilience on a local and more area-wide scale. While these instruments are willing to address densification and climate resilience integrally, this intention can also be criticized.

If these instruments are, for example, compared with the instruments found in the study by Eichhorn et al. (2021), it could be argued that there is a significant difference: the instruments in Amsterdam are not intentionally designed to align both policies as they address multiple other issues. In contrast, the instruments found in the German cases of Eichhorn et al. (2021) are truly designed for the only purpose of fostering the alignment of densification and climate resilience.

For instance, in Cologne, Neuss, Soest, and Berlin instruments are developed that clearly highlight the possible effect that densification could have on certain areas 'climate sensitivity.' After this sensitivity is detected, visions for joint actions of different departments are developed. Another example can be found in the city of Neuss, where financial incentives are given to urban landowners if they decide to leave a part of their plot open to foster climate resilience (Eichhorn et al., 2021).

Concludingly, these kinds of instruments that deliberately purpose to foster the alignment of densification and climate are not found in the case study of this research. As a result, it could be assumed that they are not (yet) developed in the municipality of Amsterdam. Therefore, it could be questioned to what extent the currently implemented instruments in Amsterdam are truely impacting the alignment of both policy goals.

Yet, the last part of the result chapter showed that the interviewees foresee that other instruments can be implemented that potentially can have a more powerful impact on the alignment of both policies in Amsterdam: more binding norms and standards for climate resilience and the introduction of an early climate resilience analysis of a soon to be redeveloped area. Such an analysis shows a significant resemblance with the 'climate sensitivity scan' used in the German cities' studies by Eichhorn et al. (2021).

Also, regarding the aspect of organization, this case study showed interesting insights. While most German cities attempt to improve the cooperation between departments (Eichhorn et al., 2021), the municipality of Amsterdam created an integral and comprehensive department for better alignment of area development and climate. Here, it was addressed that a severe shift has taken place in the last couple of years when attempting to look at urban planning issues integrally. Besides the critique on the deployment of the team in newer parts of the city, the creation of the team sustainable area development is noteworthy. It shows the willingness of the municipality to look at sustainable area development integrally.

Nevertheless, it could be argued that the alignment of densification with climate resilience in Amsterdam is still highly dependent on external knowledge. While the municipality of Amsterdam aspires to become independent of external consultants, the result section showed that the knowledge of these consultants is currently much needed when striving for a better nexus between both policy goals in planning practice. Again, this dependency can be explained by the fact that the municipality is transitioning towards more climate-integral planning. While currently external knowledge is needed, the municipality aims to become self-reliant in addressing both issues integrally.

However, here, it should be noted that the 'transition argument' is not entirely credible. As climate change resilience or adaptation has been a recognized issue for multiple years, other cities have shown to incorporate it in their urban planning structure more extensively (Hallegatte et al., 2010; Hofstad & Torfing, 2017; Eichhorn et al., 2021)

Regarding interaction, it could be claimed that there currently is a certain interaction between the municipality and the other vital stakeholders in Amsterdam. However, this interaction merely takes place in the form of communication, as the municipality sets up rules and goals that need to be complied with by stakeholders such as housing corporations or developers. Nevertheless, it seems that translating these theoretical norms into real-life practice results in inconveniences. Multiple non-municipal stakeholders address that the incorporation of their input in approaching the alignment of both issues is currently absent. Considering this finding, it would be highly

beneficial to let non-municipal stakeholders have more voice in aligning densification and climate resilience.

As a matter of fact, the empirical data of this study showed that municipal stakeholders admitted the presently lacking knowledge of their municipal body, especially concerning the issue of climate resilience. Therefore, besides consulting external experts, the input of housing corporations or developers could have a meaningful influence when aspiring to expand this knowledge. Indeed, these stakeholders possess much local knowledge that could improve the alignment of densification and climate resilience in planning practice. Conversely, housing corporations and developers could also get more insight into the municipal organization's considerations.

At last, also the interaction with citizens should be contemplated. While the issue of aligning densification with climate resilience is a governance issue that addresses all urban residents, it is of considerable importance to involve them in finding solutions for these complex problems. Earlier studies have already shown that involving citizens in the process of aligning densification with climate resilience can be highly beneficial (Hardoy et al., 2019; Hagen et al., 2021). However, as the case study of this research showed that currently not much is interaction is implemented about aligning both issues, it can be stated that plenty of progress can be made with regard to this aspect.

Putting these considerations in perspective of the analytical lens used for this research, it could be argued that multiple governance mechanisms are already implemented in order to align densification with climate resilience in Amsterdam. However, much better representation of the climate resilience paradigm is needed when both policies are considered equally important.

Here, the head of the planning department at the municipality argues that Amsterdam should approach both issues by using the Pareto optimum. The Pareto optimum, or Pareto efficiency, is referred to as a circumstance in which no decision or allocation can be made that benefits one person or group without harming another (Buchanan, 1962):

"*We have to accommodate and optimize the growth and welfare of our city. Densification is an important tool for that. However, it should never go at the expense of climate resilience. We can keep growing, and keep improving our welfare until it reaches the point of harming climate resilience*" (Interviewee 10, August 2022)

Although the analogy of the interviewee does not one on one match the economic definition, it summarizes the essence of the proposed governance mechanisms for improving the alignment of densification and climate resilience: knowing and respecting the climatic boundaries when an area is considered to be densified.

6. Conclusion

Key findings

This research aims to give insight into the possible conflicts between two fundamental policy goals. On the one hand, densifying cities to fulfill the enormous demand for affordable housing and, on the other hand, making cities more climate-resilient to respond to possible climatic threats. In addition, it aimed to depict both the already implemented and envisioned governance mechanisms for these conflicts. To do so, this report tries to answer the following research question:

In which way are densification and climate resilience goals being aligned in redeveloping post-war neighborhoods?

First of all, multiple conflicts between densification and climate resilience were identified. Most relevant for the general debate were the conflicts regarding land use, level of scale, and responsibility. Moreover, also context-dependent conflicts arose. Here, the cultural heritage status of the Western Garden Cities and the emphasis put on improving the livability in the area appeared to conflict with a successful alignment of densification and climate resilience.

Second, various already implemented, but also envisioned governance mechanisms to improve the alignment of densification and climate resilience were highlighted. These mechanisms were disclosed using the assessment framework of Eichhorn et al. (2021), which consisted of three elements: instruments, organization, and interaction.

Applying this assessment framework to the case of the Western Garden Cities has led to the conclusion that the municipality of Amsterdam has been paying more and more attention to aligning both policy goals in the past couple of years. Although the municipality has not (yet) created instruments that have the pure intention to align densification with climate, such as effectuated in various cases in Eichhorn et al. (2021), the awareness of the conflicting policy targets is growing. Here, the restructuring of the municipal department 'Space and Sustainability' and the creation of the team 'sustainable area development' in the past couple of years are excellent examples that show the willingness to have an integral perspective on sustainable area development. Nevertheless, it is acknowledged that this integral perspective is mainly applied in developing entirely new neighborhoods that are to be designed from scratch. Regarding redevelopments of post-war neighborhoods, it is recognized that much more progress must be made to align densification with climate resilience.

The research conducted in the case study of this thesis, the Western Garden Cities in Amsterdam, confirms the latter statement. As the Western Garden Cities have been redeveloping for the past twenty years, a great emphasis has been put on densifying and increasing livability. In addition, the cultural heritage status of the neighborhoods restrains rapid developments in the area. Until the last couple of years, the climate resilience frame has never been decisive in the area's urban planning. As a result, many neighborhoods in the area have been densified without considering possible climatic consequences. However, as the topic's urgency is increasing, the paradigm in the Western Garden Cities of only building and creating livable neighborhoods is shifting towards a better focus on climate resilience.

Nonetheless, this shift mainly occurs on a low scale: housing units. Housing corporations and developers must tick several boxes to comply with the climate resilience standards. While the

mandatory norms are currently limited to only collecting a certain amount of rainwater per housing unit, a growing number of norms and standards are expected to be forthcoming.

Based on the empirical research, it could be concluded that the current focus of complying with norms on a housing level has a shortcoming: it lacks an integral vision on a higher scale level. Multiple reasons have explained the absence of this vision but is mainly justified by the incremental densification development of the Western Garden Cities.

While the densification process lasted for decades, climate resilience has only been incorporated into urban planning in the last few years. With measures such as the 'Rainwater Ordinance,' climate resilience is beginning to integrate into redeveloping the newest parts of the Western Garden Cities. However, earlier renewed neighborhoods did not comply with these norms. In fact, neighborhoods that were densified one or two decades ago appeared to be less heat-resistant than the existing post-war constructions.

As a result of a lacking integral regional vision, it could be concluded that the high amounts of greenery in the Western Garden Cities do not come into its own regarding climate resilience. Whereas the current densification process focuses on climate resilience measurements concerning the dwelling, the abundance of greenery in the broader environment is currently not incorporated in policy decisions.

While the Amsterdam municipality seems capable of integrating both goals in new-construction areas of the city, their approach seems to flaw in redeveloping areas. As a matter of fact, it appears that post-war neighborhoods like the Western Garden Cities are not prioritized when striving for a better alignment of densification and climate resilience.

To align densification and climate resilience goals in post-war neighborhoods, the topic of climate-resilience should be included in the earliest phases of area redevelopments. Therefore, an integral study on climate resilience and its relation to future densification plans would be highly favorable if both policy goals were considered equally important. This study should be conducted on a neighborhood and regional level to overcome neglecting the critical role of the area's many green and blue infrastructures. As the redevelopment of Western Garden Cities is only halfway through the process, it appears that plenty of time is left to create such a vision for future developments.

Even though climate resilience is a topic that should be incorporated in an early stage, the development of the Western Garden Cities also needs to be aligned with the identified local conflicts. It is of great importance that the socio-economic situation and livability in the area are retained or improved. Moreover, the area's cultural heritage status must be considered at any time. Again, an early integral vision could overcome conflicting issues.

Concludingly, the current status quo of only incorporating climate resilience in new construction neighborhoods on the housing scale needs to be revised. In order to align densification with climate resilience to a greater extent and reach the aforementioned Pareto optimum, a more extensive scope is in need. This more extensive scope does not only tick climatic boxes for new construction houses, but it structurally maps the climatic strengths and weaknesses of the area's new and existing environment. Moreover, the socio-cultural context of the area is kept in mind. However, as developing such an integral vision is quite challenging, various recommendations are given in the last part of this thesis.

Reflection of results in light of the academic debate

This paragraph aims to consider if the insights of this study are either in line or contradicting with other comparable academic literature. Moreover, it gives insights into what this study's results provide for the broader academic debate.

One of the main findings of this study is that an extensive regional scope is currently missing for climate resilience. Emphasizing the importance of a regional or local scope reoccurs in more comparative literature. Erlwein et al. (2023) conclude that planning guidelines and binding regulations can only be created if locally specific goals and visions are developed. Furthermore, Eichhorn et al. (2021) plead for a guiding framework within high-level strategies to harmonize the joint implementation of densification and climate resilience. The suggestion of such a framework shows a resemblance with an integral vision that has been suggested in the conclusions of this research. Again, it has been argued that such a vision should always intend to consider the local context. Moreover, Madureira en Monteiro (2021) argue that positive or negative interactions between urban densification and urban greening are never absolute. Instead, they depend on the scale and context.

In addition, Erlwein et al. (2023) emphasize the role of better cooperation between different administrative bodies and departments in governmental organizations. This argument is referred to more often in similar research (Balikçi et al., 2021; Hofstad et al., 2022). As it is argued, interdisciplinary collaboration is much needed if densification and climate resilience are aspired to be fostered (Erlwein et al., 2023). Again, this finding shows a significant parallel with the conclusions of this research.

Furthermore, the research of Erlwein et al. (2023) underlines the attention that should be paid to engaging with residents as they possess valuable local knowledge. Similarly, this thesis emphasized the role of raising local awareness. In fact, it argues that translating complicated governance issues into real-life practice is perceived as a vast but necessary challenge.

Even though the study of Erlwein et al. (2023) and this research show significant overlap, not all findings of this research are confirmed. As a matter of fact, the argument for expanding the financial stimulus for climate resilience is refuted. While Eichhorn et al. (2021) also emphasized the vital role of enlarging the financial resources for the alignment of both policy goals, Erlwein et al. (2023) argue that simply increasing financial resources will not be a sufficient measurement if it is not supported by public discourse and political will to address the alignment of densification and climate resilience.

Although this thesis' findings show remarkable parallels with comparable studies, it is good to highlight which unique lessons can be learned from this study for academic debates. In the introduction of this thesis, it became already clear that most comparative literature puts an emphasis on urban green space instead of climate resilience and its relation to densification. Resultantly, scientific research on the relationship between climate resilience and densification has been conducted to a lesser extent. By widening the scope from urban green spaces to the more comprehensive concept of climate resilience, it can be argued that this research sheds a new light on the debate.

Second, the findings of this study are relevant to the academic debate because they illuminate the presence of the suburban area. While the academic debates currently focus on climate resilience conflicting with compact inner cities, the suburban areas are neglected (Williams et al., 2010). Nevertheless, this study has demonstrated that the issue of aligning densification with climate

resilience is also highly relevant in more suburban parts of a city. However, this thesis has also shown that policymakers do not always feel the urgency to address this issue in suburban areas. In fact, it can be said that this study has shown that not only the suburban areas are omitted, but also existing neighborhood structures are ignored when aligning both issues. Concludingly, this research can be considered a guide mark, as it again widens the current scope of the academic debate.

Recommendations for further research

Limitations

While this thesis aimed to do research in the most proper academic way, limitations can never be avoided. The first limitation that should be considered is the research design of this thesis: a case study. While a case study can provide profound and in-depth insights into real-life phenomena, it lacks the ability to extrapolate the findings to a broader population (Bryman, 2016; Creswell & Poth, 2016). Since the Western Garden Cities have various determining unique characteristics, it can be considered an extreme case (Yin, 2003). Therefore, it should be taken into account that the chosen case is not a representative neighborhood of the city or country it is situated. Nonetheless, the extreme case study has proven its value as similar studies have omitted suburban areas in their research (Williams et al., 2010).

Second, a limitation that should be considered is one of the methods used: conducting interviews. As respondents present their own subjective vision of reality, it is possible that some may embellish the truth or supply false information (Morris, 2015). Especially for this research, this limitation is significantly critical. Since multiple interviewees were municipal employees working on the valid and current policies, it is possible that they were positively biased toward these policies. As a result, relatively optimistic and thus unrealistic pictures of reality could have been shaped.

Third, the qualitative content analysis used for this research can be criticized. This is mainly because this research method is sensitive to the subjective interpretations made by the researcher itself. As a result, a researcher bias lurks (Zhang & Wildemuth, 2009).

Fourth, the assessment framework of Eichhorn. (2021) can be considered as a limitation. As this framework mainly focuses on the municipal structure, it lacks the integral and comprehensive view that is aspired in the conclusions of this research. Admittedly, the municipality is the place where policies are made and, therefore, the most essential actor when aligning two policy goals.

However, the case study of Amsterdam has shown that other actors, such as housing corporations or developers, are also crucial in this process. Yet, these actors do not adequately fit the framework, as they do not fit the aspect of ‘external organization’, which focuses mainly on consultants or research institutes, or ‘interaction’, which mainly focuses on the role of citizens. As a result, by following the structure of this assessment framework, the critical role of these actors remains underexposed. In contrast, the study of Erlwein et al. (2023) emphasizes the role of other actors in their framework. However, this study was published after the empirical data of this research had already been collected.

Elaborating on these shortcomings, the chosen case study in perspective to the case studies of Eichhorn et al. (2021), should be discussed. In the result chapter, it became clear that the selected cases of Eichhorn et al. (2021) already have more concrete and crystalized governance

mechanisms when aligning both policy goals. This can be explained by the fact that Eichhorn et al. (2021) preselected 'best practices': cities that were already actively trying to align densification and climate resilience goals. In contrast, this study did not preselect on this determining characteristic. Consequently, this study mainly found governance mechanisms that indirectly benefit the alignment of densification and climate resilience. In contrast, Eichhorn et al. (2021) discovered various governance mechanisms with the explicit intention of a better alignment. Therefore, it could be argued that selecting the Western Garden Cities instead of Dutch cities that actively foster the alignment of densification and climate resilience (if there are any) has perhaps led to less striking or elaborated results for the academic debate.

Suggestions for further research

Elaborating on the limitations of this research, also multiple suggestions for further research can be given. First, future investigations on the alignment of densification and climate resilience could focus on other cases in the Netherlands. While the two most similar studies of this research have been conducted in Germany (Eichhorn et al., 2021; Erlwein et al., 2023), other comparable studies are conducted worldwide. However, the Netherlands is not well represented in these studies. As it was argued that the Western Garden Cities are not a representative case study, it is suggested to research other neighborhoods. For instance, new-construction neighborhoods in Amsterdam could be studied as, here, an integral approach is supposed to be applied more often. Moreover, a multiple-case study as conducted in Eichhorn. (2021), with various neighborhoods or cities covering the diverse urban planning landscape, can be highly beneficial if the alignment of both policy goals is to be researched on a more national scale. Such a multiple case study research can counter the lack of representativeness of a single case study.

Second, further research can focus on the technical perspective of aligning densification with climate resilience. This research mentioned various technical measures, such as rainwater or green roofs. Because this research focused on the governance perspective, these technical solutions were not in-depth elaborated. Therefore, studies researching technical opportunities when aligning densification and climate resilience can complement this study. Here, a focal point on regional opportunities is proposed instead of the already further-developed housing-scale solutions.

Moreover, specifically regarding the Western Garden Cities, in various interviews, it was mentioned that the ground layer in the Western Garden Cities currently has a negative impact on the climate resilience:

"*The Western Garden Cities have been flattened with a not very rich soil. In many places in the area, trees just don't grow very well. Nowadays, we are still stuck with that issue. If you were to enrich the soil there, the tree structure becomes much sturdier. Then, you can get more shade and have gains for both the heat stress and water collection*" (Interviewee 9, June 2022).

Hence, for this particular case study, a great opportunity lies in researching how this soil structure can be improved.

Recommendations for planning practice

Whereas the previous paragraph discussed multiple recommendations for further research, this paragraph intends to give a handful of recommendations for planning practice. While the first two recommendations specifically address the municipality of Amsterdam, the third and fourth are

less context-dependent and can be recognized as more general recommendations for planning practice:

- Before a comprehensive integral vision can be created, it is crucial to calculate an area's climatic strengths and weaknesses. A climate predicting model that maps the impact of densification plans on the climate sensitivity of a particular area, as is used in various cases in Eichhorn et al. (2021), is currently not present in the municipality of Amsterdam. Therefore, using or creating such a model that will always be used in the earliest stages of (re)development is recommended. When creating this model, the digital infrastructure of the climate adaptation maps of maps.amsterdam.nl can be used as a starting point.

- Second, it is recommended that the department 'Space & Sustainability' and especially the team 'sustainable area development' not predominantly work on new-construction neighborhoods. Climate resilience is an issue that regards every region, not only new-construction neighborhoods. Hence, it is suggested to also use their knowledge and expertise more frequently in existing areas of the city. Here, the difficulty of not being able to start from scratch should be seen as a challenge instead of an obstacle.

- Third, creating a financial incentive for climate resilience is recommended. If climate resilience is considered an important factor in future urban planning, developers and housing corporations should get the stimulus to take it seriously. Therefore, subsidies that encourage pilots or already developed interventions can be worthwhile. Admittedly, this should come also with public support and political will (Erlwein et al., 2023). Complementary, the number of binding norms and standards for climate resilience should expand. A combination of these incentives will conceivably enhance the climate resilience paradigm.

- Fourth, educating civilians on the relationship between densification and climate resilience is recommended. As the awareness of the issue is currently only present in the academic world, and to a lesser extent with the municipal officials, the relevancy of this paradox should be more recognized in the public debate. However, the researcher knows this recommendation has a political scope as not all political representatives consider the same urgency to either densification or climate resilience.

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