Storm Water Management and Environmental Justice in Cities

A case study analysis on storm water management and the operationalization of environmental justice

Shireen Baars

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Student
Shireen Baars (1003634)

Study Programme
Master Environmental Sciences, Wageningen University & Research

Chair group
Water Systems and Global Change Group (WSG)
WSG-80436

Supervisors
Dr. ir. B. (Bert) van Hove (Wageningen University & Research)
Dr. ir. K. (Karianne) de Bruin (Climate Adaptation Services)
L. (Line) Barkved (Norwegian Institute for Water Research)

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Abstract

One of the main consequences of climate change for cities will be the increase in heavy precipitation and an increase in intensity. As a result, urban flooding will occur more often due to the failing capacity of the traditional sewage system. Consequently, policymakers in cities will have to develop an integrated storm water management approach. This integration consists of increasing the adaptation capacity of the city through enhancing and increasing blue-green infrastructure, while maintaining a healthy living environment for urban citizens. Furthermore, within these policies there is a lack of acknowledging environmental justice (EJ). EJ is concerned with the distribution of environmental risks, the recognition of the versatility of participants and their communities, and the participation in the political decision-making processes that deal with the creation and management of environmental policy.

Through performing a case study analysis in the cities of Amsterdam and Copenhagen, information was gathered to understand in what way environmental justice is present and operationalized within decision-making processes in storm water management platforms. Results show that environmental justice is a known concept for policymakers, although only the distributional element is mostly perceived as a part of justice. Also, it shows that a difference in management form influences the presence of EJ in the SWM implementations. This results in the presence distributional and procedural justices within both case studies, while recognition is not. The lack of adequately addressing recognition justice can affect the quality of the blue-green infrastructure both cities advocate for and implement in their programmes.

List of abbreviations

Table 1 List of abbreviations used in this thesis

BGI	*Blue-Green Infrastructure*
EJ	*Environmental Justice*
ISWM	*Integrated Storm Water Management*
SWM	*Storm Water Management*
NBS	*Nature-Based Solutions*
NWW	*NewWaterWays*

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1 Introduction

1.1 Background

Climate change is the driver of an increase in heavy precipitation, and the intensity and frequency will increase even further in the future (Barbosa et al., 2012; Dhakal & Chevalier, 2016). Especially in the growing urban areas this will lead to complex challenges. Because of an increase in impermeable groundcover, only a little of the precipitation will infiltrate into the soil. As a result, urban flooding occurs due to an overload of pressure on the traditional sewage systems (Dhakal & Chevalier, 2016). Consequently, cities will have to develop another approach towards storm water management.

Until recently, SWM made only use of the traditional centralized sewer system that is aimed to drain storm water as quickly and efficiently as possible. The current conventional system has a limited capacity to cope with extreme rainfall. When this sewage system overflows, the polluted water runs off over land and is discharged into receiving water bodies without treatment (Burns et al., 2012; Dhakal & Chevalier, 2016). This causes degradation of the open water bodies and can affect the public health (Dhakal & Chevalier, 2016). A more integrated approach of storm water management by connecting technical aspects with increasing the liveability of a city can contribute to the urban sustainability, as research shows by Barbosa et al. (2012) on Integrated Storm Water Management (ISWM). Therefore, SWM has started to focus more on including ecological aspects, biodiversity, and landscape and water values. Furthermore, the inclusion of citizens' well-being and socio-economic aspects in SWM will help to reach these sustainable goals. This is argued by Bertrand-Krajewski (2020) in research on urban storm water management and the shift towards a multi-disciplinary management form.

1.2 Integrated approach

The consequence of this integrated SWM approach is that planning and policy makers are increasingly considering sustainability and the effects of climate change in their plans (Pearsall & Pierce, 2010). As a result, there are many definitions and concepts used in both the scientific field and in urban planning contexts to understand and operationalize the urban sustainability of a city. Urban sustainability can be described as the process of cities that are developing towards climate change adaptive cities, by mitigating the impacts of climate change resulting from for example drought, heat stress and extreme weather situations (Pearsall & Pierce, 2010). At the same time, an increase in densification and population growth puts even more pressure on these cities. The UN defines that, "democracy, respect for human rights, transparent, representative and accountable government and

administration in all sectors of society, as well as effective participation by civil society, are indispensable foundations for the realization of sustainable development", (UN, 1996). Research on the practicality and execution of urban sustainability shows that its actual implementation remains complex (Verma & Raghubanshi, 2018) due to the many different conceptual characteristics the term sustainability has. Its many definitions make it difficult to generalize the implementation of it. However, it is clear that realising sustainability must be accomplished by integrating aspects of society and environment.

1.3 Environmental Justice

This integration of society and environment is necessary for the operationalization of ISWM. One of the most important ways to achieve this integration is to enhance social aspects, such as community decision-making, equal distribution of sustainable implementations and financial equity related to these implementations (Agyeman et al., 2003). These social aspects can be understood through the concept of Environmental Justice (EJ). EJ is concerned with the distribution of environmental risks, the recognition of the versatility of participants and their communities, and the participation in the political decision-making processes that deal with the creation and management of environmental policy (Schlosberg, 2004).

The EJ movement originated in the United States in the 1980s due to the unequal distribution of environmental hazards, which especially affected people of colour (Anguelovski, 2015; Rigolon & Gibson, 2021). Nowadays, EJ is not only focused on the equal distribution of environmental hazards, but research also focuses on the involvement and equal representation of different people in decision-making and planning processes since the beginning of this century (Rigolon & Gibson, 2021; Schlosberg, 2004). EJ is considered as a crucial element for the transition to a sustainable city (de Vries et al., 2020), as shown in Figure 1.

Pearsall and Pierce (2010) argue that, "the key challenge in moving towards environmentally just urban landscapes lies in how notions of justice are operationalized in urban planning processes" p. 571. Therefore, there is a need to get a clear understanding of how municipalities and organizations concerned with storm water management are operating. And with that knowledge, solutions and recommendations can be made to understand how storm water management can be the most just, effective and sustainable.

Figure 1 Simplified transition process within policy towards a climate adaptive and just city

1.4 Problem statement

In cities, terms as sustainability, climate and liveability are key for policymakers. Many studies on governance and climate adaptation have found that sustainability has been put higher upon the agenda since the 21st century. However, the operationalization and execution of sustainability goals are not as successful yet. Municipalities consider environmental sustainability in their policy and strategy plans, but in many cases actual action seems too complex or eventually not executed (Pearsall & Pierce, 2010, 2016). Reasons for this are: governance barriers; socio-institutional barriers; organizational barriers; and administrative passivity (Dhakal & Chevalier, 2016). Furthermore, within these policies there is a lack of acknowledging environmental justice. This can be attributed to a lack of understanding about power-relations and how certain socio-political dynamics are set in a certain environment (Toxopeus et al., 2020). This indicates that not only the actual practical part of executing legislation and implementation on storm water management is important, but the process beforehand is crucial too. It is necessary to research the process of justice, as (Pearsall & Pierce, 2016) concluded in their research that dealt with the thorough implementation of EJ, and also the organizational structure of involved storm water platforms. Until now, only little research has been done to understand how different types of governance within SWM have an effect on dealing with environmental justice issues. Also, most research on EJ and climate adaption measures deal with the fair distribution of environmental risks, hazards and benefits, while EJ concerns itself with more than just the distributive aspect (de Vries et al., 2020; Mandarano & Meenar, 2017; Pearsall & Pierce, 2016). Therefore, a new perspective will be created by analysing different platforms focused on storm water management and their operationalization of EJ, from the planning phase to the decision-making phase.

1.5 Research objectives

The objective of this thesis is to analyze in what way environmental justice is operationalized during the planning and decision-making process of SWM platforms[1]. This thesis will fill the knowledge gap on environmental justice within storm water management platforms.

Several SWM platforms in The Netherlands and Denmark are studied, specifically Amsterdam Rainproof and the Cloudburst plan in Copenhagen. Hence, this thesis provides insight into how SWM is organized, and to which extent a governance form contributes to the inclusivity of environmental justice. It is important to note that this analysis is not a comparison between the two cities. Both

[1] A platform is the collective term used in this study. The reason for this is that the case studies consist of multiple stakeholders from public, private and NGO representatives – also called a multi-stakeholder platform in Integrated Water Management (IWM) (van Buuren & Warner, 2009).

cities provide information on two different approaches on the organization of SWM; hence this will broaden the knowledge of different policies addressing SWM and EJ and build upon current literature by Toxopeus et al. (2020), Anguelovski (2015) and Pearsall and Pierce (2016).

1.6 Research questions

The main research question is: In what way is environmental justice operationalized during decision-making processes within different Storm Water Management platforms?

Related sub-research questions are:

1. How is storm water management currently organized in Amsterdam and Copenhagen?
2. What forms of environmental justice (distributional, procedural and/or recognition) are present and operationalized within Storm Water Management platforms?
3. What characteristics of the organizational structure are considered to influence the implementation of environmental justice in SWM and in what way do they influence the outcome?
4. In what way can these influences be dealt with within SWM platforms (according to the people involved)?

1.7 Relevance

There is a transition needed for cities to adapt to the changing climate and growing population (Dhakal & Chevalier, 2016). Also, there is a need for a better understanding of how environmental justice operates while pursuing sustainability goals (Pearsall & Pierce, 2010, 2016; Rigolon & Gibson, 2021). Linked with this transition, more knowledge is needed on how to take EJ into account within policy. Research shows that citizen involvement and more equal participatory processes within blue-green infrastructure (BGI) implementation can benefit justice, which then contributes to the mitigation and adaptation towards climate change. However, the actual policy process to achieve this oftentimes remains unclear (Toxopeus et al., 2020). Therefore, understanding different forms of policy making and the operationalization of environmental justice within SWM will create a new perspective.

This research has been executed in light of the project of New Water Ways (NWW), a project that aims to identify barriers for a transition to a water-sensitive and climate-adapted society. NWW is primarily focused on Norway and derives information from the so-called 'learning cases': The Netherlands and Denmark. These countries both have made steps towards the transition of becoming water adaptive cities (New Water Ways, n.d.). Therefore, two case studies focused on

SWM from Amsterdam (Amsterdam Rainproof) and Copenhagen (Cloudburst Plan) are used. In addition, this study provides information relevant for other European cities.

1.8 Readers guide

This thesis is outlined as follows: Chapter 2 guides the reader along the theoretical concepts used in this thesis. Afterwards, Chapter 3 elaborates upon the research methodology. Information is given about how the interview questions are formulated from the research by Toxopeus et al. (2020). In Chapter 4, the results are provided according to the study areas. Also, the results of the interviews are explained according to the perception of justice and the distributional, procedural and recognition justice. In Chapter 5, the discussion, the findings are interpreted and describe the significance of the findings according to previous knowledge on the topic. Also, the relevance of these findings is explained. Then, in Chapter 6, conclusions are made and the main research question is answered. Finally, recommendations are provided for further research.

2 Theoretical background

This chapter will address the theory behind Environmental Justice, to understand the different domains of justice, their definitions and its operationalization for this thesis. Also, theory is explained on how the qualitative research is done in this thesis.

2.1 Concept of Environmental Justice

Environmental Justice is not only a topic for EJ activists who were defending themselves for equal health rights, but it has also become a topic for scholars (Rigolon & Gibson, 2021). Environmental justice was introduced in the US due to the dissatisfaction about environmental risks and hazards that mostly affected minorities and people of colour. Since the beginning of this century, a shift occurred that made EJ an interesting topic for researchers due to concerns on climate change. Research increased on climate adaptation and mitigation, however, the impacts of these implementations are not always distributed evenly across the population (Agyeman et al., 2003; Schlosberg, 2004). Next to even distribution, inclusion in planning and policymaking processes are part of the EJ discourse as well (de Vries et al., 2020; Pearsall & Pierce, 2010; Rigolon & Gibson, 2021).

For this study, based upon several EJ scholars and research, EJ is defined through three different main types of justice that are related to each other (Rigolon & Gibson, 2021; Toxopeus et al., 2020). Below an overview is shown in Table 2. Information is provided on the definition, an example of this definition and when each type is relevant during policy processes.

Distributional justice considers the equal distribution for access to green/blue amenities, but also the equal distribution of risks and benefits across space and society (Mabon, 2020; Rigolon & Gibson, 2021; Toxopeus et al., 2020). This means that not only physical distribution should be equal, but also that all citizens can benefit equally from sustainable projects in cities. However, research from Dale and Newman (2009) shows that sustainable development plans can actually enable green gentrification, pushing out people with lower socio-economic backgrounds and filling these neighborhoods with higher income and generally more white citizens, showing an adverse effect of equal distribution (Toxopeus et al., 2020).

Procedural justice involves the level and quality of the process in which decisions about an environmental issue are made. It depends on who is participating, who are represented or not, and what the different power-relations are within this process (Mabon, 2020; Toxopeus et al., 2020).

Interactional justice (also referred to as recognition justice) refers to the way different people with different nationalities, race or gender are recognized and their different needs are accounted for when organizing and implementing policy measures (Rigolon & Gibson, 2021; Toxopeus et al., 2020). This is crucial since new

urban implementations can disrupt existing favourable or much used spaces in local communities when not understanding the needs correctly, which also creates an adverse effect.

These definitions are used in this thesis to understand whether the different case studies are considering these elements of justice in their policy. The way the people involved in policymaking perceive EJ might influence the outcome of their work (Rigolon & Gibson, 2021).

Table 2 Types of justice within this study

Type of justice	Definition	Example	Timing in policy process
Distributional justice	The equal distribution of risks and benefits across space and society, and access to green/blue space.	The extent to the equal access each citizen has to green/blue space in the city.	After policy implementation
Procedural justice	The equity in the process and representation in which decisions about an environmental issue are made.	The extent to which justice is considered during decision-making processes, and whose voices are heard and acknowledged.	Before and during policy implementation
Interactional justice (also referred to as recognition justice)	The relation and recognition between the different people and groups who have an interest in an environmental issue.	The recognition what certain communities or groups need in their environment and fitting policy linked to that need.	Before policy implementation

2.2 Theory on Nature-Based Solutions and Environmental Justice

The article by Toxopeus et al. (2020) describes their research on how hybrid governance has an effect on the outcome of environmental justice within Nature-Based Solutions (NBS). Hybrid governance is described as a type of governance where policy makers work together with non-public actors such as businesses, citizens and NGOs (Toxopeus et al., 2020). Nature-Based Solutions are described as solutions that "are inspired and supported by nature, which are cost-effective and also provide environmental and social benefits to help build resilience." (Toxopeus et al., 2020).

The research by Toxopeus et al. (2020) also identified several case studies to analyze. The research then identified several themes that can act as an indicator

whether certain aspects of justice are accounted for. These themes are:

1. Public and private actors as well as their responsibilities with regard to the studied NBS intervention;
2. Motivation and the value they expect to capture to co-deliver this NBS;
3. Interaction between public and private actors (e.g. terms & conditions; contracts; sharing of responsibilities, risk & return) and
4. The specific conditions/circumstances that led to the involvement of non-governmental actors in the delivery of this NBS.

These themes all relate to one or more relevant justice type (distributional, procedural or recognition). In this way, the themes provide relevant questions and answers about one or more justice type and help the researcher to structure the data for each type.

The research resulted in recommendations on three topics. Firstly, for environmental justice to succeed within hybrid governance, there is a need for a transparent decision-making process on the distribution of costs and benefits. Secondly, making sure there is public control over the urban NBS and a combination of scientific expertise with bottom-up procedures helps to ensure current and future voices. These three elements will be kept in mind while analyzing the two case studies in this study. It is interesting to see whether case studies unrelated to U.S. specifics are similar or different in their justice outcomes.

3 Research design and methods

This chapter provides the methods that are used in this study to gather the data. This research assesses two case studies in Amsterdam and Copenhagen to understand whether and in which way EJ is incorporated in the policy of SWM. This is done through primary data collection and a qualitative data analysis.

3.1 Case studies

This study has conducted a case-study analysis of storm water management approaches and environmental justice in two cities in different countries: the programme of Rainproof Amsterdam in Amsterdam and the Cloudburst Management Plan set up in Copenhagen. A brief explanation on each case can be found in Table 3 below, including details on the organizational structure.

Table 3 Case studies in Amsterdam and Denmark

Country	Current situation	Structure
Amsterdam, The Netherlands	Programme Amsterdam Rainproof	Amsterdam Rainproof is a platform that activates and stimulates different stakeholders to create a more resilient city for dealing with extreme rainfall. Initiated by the municipality and Waternet (public company on drinking water supply).
Copenhagen, Denmark	Management plan Cloudburst	Cloudburst is a collaborative effort between planners, engineers, economists, citizens, utility providers, politicians, and investors to integrate Climate Adaptation within regulatory planning of the city. The plan is part of the strategy plan of the City of Copenhagen.

These two cities are chosen because they are presented in the project of NWW as examples to learn from on how to deal with SWM. Their approach is considered to be unique and innovative (NewWaterWays, 2020). Each city has had experience with extreme rainfall events, which resulted in the founding of each programme.

Both cities have similar climates and weather conditions classified as temperate oceanic climates (Rubel & Kottek, 2010). Differences in seasonal rainfall is are small and rainfall occurs all year round. Future climate projections show that extreme rainfall events will increase in frequency and intensity whether it is during summer or during winter (IPCC, 2021). Both cities are located close to the sea, Amsterdam at 0 meters above sea-level and Copenhagen at 10 meters above sea-level, and therefore prone to flooding due to sea-level rise (Bates et al., 2008; IPCC, 2021).

3.2 Methodological approach

The methodology and data collection consists of several steps following the four sub-research questions (SQs). Figure 2 is provided that shows the different research steps, which correspond to the four sub-research questions.

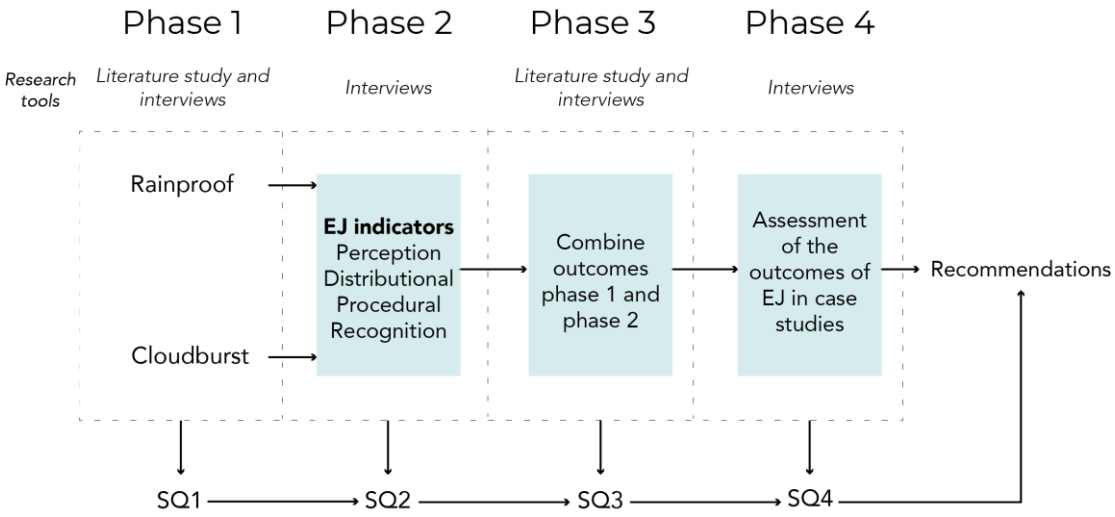

Figure 2 Research phases with the corresponding research tools and sub-research questions

SQ1 is answered through literature research via secondary data such as policy and strategy documents from the different case studies. Primary qualitative data provides supplementary data to increase understanding of the organizational structures. This is done through semi-structured interviews. The reason for performing semi-structured interviews is because it increases the validity of the research. The same questions are leading, however, it is important not to create a bias during the interview.

SQ2 is answered by analysis of the interviews. The research by Toxopeus et al. (2020) is an example on how to research the different types of justice and how these types can be operationalized. In their research, the focus was targeted at how hybrid governance affects the outcome of Environmental Justice in Nature-Based Solutions (NBS) approaches. Indicators are created to understand what form of justice was represented in each case.

The information for SQ3 is gathered through secondary data such as peer-reviewed literature on organizational structure related to SWM. The information found through SQ1 is contributing to answering SQ3.
SQ4 is leading during the semi-structured interviews. The semi-structured interviews are a key tool since they make unknown information emerge from the experts. Especially if it is information only known by people within organizations (O'Keeffe et al., 2015). The interviews provide information on how certain organizational obstacles are overcome, and in what way opportunities are taken.

3.3 Operationalization of theory

In this section details are provided on how the interview questions are derived from research and how the data has been analysed with the research methodology from Toxopeus et al. (2020).

The semi-structured interviews have been drafted following the research done by Toxopeus et al. (2020). The themes in Chapter 2 provided a guide to construct interview questions for the semi-structured interviews with each expert. Figure 3 is provided to show the themes, related questions and to which type of justice they are assigned. The four themes are placed in the grey boxes. Accordingly, two or more questions are formulated for the semi-structured interviews. In addition, each question is related to a type of justice in order to structure the results. For example, the first interview question in theme 1 relates to recognition justice shown in green. Distributional justice is presented in blue and procedural justice in yellow. A combination of two colors indicates that the question is related to two types of justice. In this similar structure, data from the interviews is coded for the final results.

Independent from the theoretical background by Toxopeus et al. (2020), extra interview questions were formulated on how justice is perceived by each expert. As indicated earlier, the way in which a certain concept is perceived can contribute to the application of it within policy making. This is done to understand whether there is a link between the perceptions of justice by each expert and the implementation of justice. Categorizing each expert's definition was done according to the key words that are related to each justice type, which can be found in Appendix 1. The interview guide that was used during the interviews can be found in Appendix 2.Appendix 1

The key words are identified through literature by Toxopeus et al. (2020), Rigolon and Gibson (2021) and Mabon (2020). These key words helped with the categorisation of arguments of justice mentioned by the experts.

Table 4 Key words per justice types

Type of justice	Key words
Distributional	Equal access; equal distribution; equal benefits; equal economic benefit;

	(green) gentrification.
Procedural	Participation; decision-making; representation; power-relations; responsibility; inclusion.
Recognition	Community/individual needs; Necessity; (local) community relations; accountability; capability.

Appendix 2

Semi-structured interview questions and corresponding research themes and domain of justice.

Theme nr.	Research theme	#	Interview question (IQ)	Domain of justice
0	Expert knowledge on EJ	1	Can you describe what you do within Rainproof/Cloudburst?	N.A.
		2	What does Environmental Justice mean to you?	N.A.
		3	According to their definition; have you ever experienced anything similar to what you just described during your work?	N.A.
1	The motivation and the value they expect to capture	4	What is your personal motivation to be involved in Rainproof/Cloudburst?	Recognition
		5	What is needed to achieve the final state of Rainproof/Cloudburst? When is it finished?	Distributional
		6	According to their answer; How can that be achieved?	Procedural
2	Who are the public and private actors as well as their responsibilities with regard to the studied intervention	7	With what types of people do you work with during projects connected to Rainproof/Cloudburst?	Procedural
		8	How are the responsibilities by each actor divided in regard to storm water management and the Cloudburst plan/Rainproof programme?	Procedural
3	Interaction between public and private actors	9	What is the motivation of the people you work with?	Procedural/ Recognition
		10	What is the most important element that you hear from people outside your organization that needs change?	Recognition
		11	How do you incorporate these changes?	Distributional/ Recognition
4	The specific conditions/circumstances that led to the involvement of non-governmental actors in the delivery of this intervention	12	How are people, outside of Rainproof/Cloudburst, involved and acquainted with projects?	Procedural
		13	Do you recognise a pattern in what people get acquainted with projects and who do not?	Procedural

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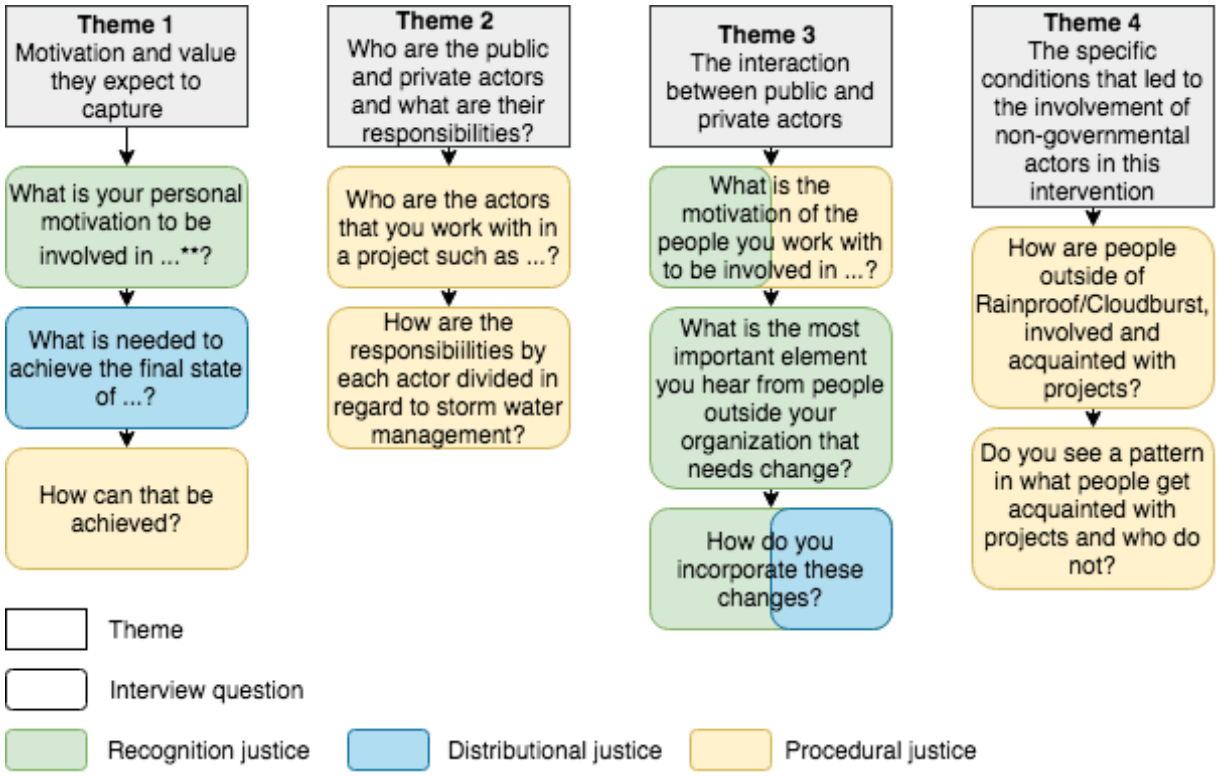

Figure 3 Themes by Toxopeus et al., 2020, and the derived interview questions per justice type

4 Results

This chapter provides the findings of the interviews and literature research on the four sub-research questions. First, the organizational structure and management approach of each city and corresponding case study is explained. This includes the administrative structure of water management, the approach and objective of each case study and the inclusion of EJ in their policy approach (SQ1 and SQ3). Secondly, the semi-structured interviews provided information on the types of justice currently present in the two case studies (SQ2). The interviews from Amsterdam Rainproof contained three experts involved in the origination of the platform and current implementation. Another expert from the municipality of Amsterdam provided information on the overall EJ strategy of the city. For the Cloudburst Plan, two interviewees that were involved during the initial establishment and realisation of the plan were interviewed. The interview results are interpreted through a coding analysis and the frequency of a justice related subject mentioned by each expert is presented in a table. Finally, the barriers related to the organizational structure of each case study are described; they are derived from the semi-structured interviews (SQ4) and categorised per case study.

4.1 Organizational Structure and Management

For the transition towards a water adaptive city, it is important to understand the current organizational structure of storm water management. Therefore, this paragraph provides information on the organizational and management structure of each city and case study (SQ1).

4.1.1 The Netherlands

The Netherlands' water management system is maintained through twenty-one different water boards, which are mostly aligned with the hydrological setting of the landscape (Mostert, 2020). The water boards are mostly responsible for the regional waters such as canals and river and overall sufficient water quantity and water quality levels. However, the responsibilities of managing, cleaning, collecting and producing clean water to the end-user are defined on regional and local levels. These responsibilities are adopted national legislation from e.g. the Water Act, the Spatial Planning Act and the Environmental Act (Dutch National Government, 2006; 2009). From these acts a Delta Programme, in 2015, was realised where it states that municipalities are responsible for their urban storm water management and planning issues. Included in this programme are policy tools on how to deal with storm water management (Rijksoverheid, 2015). Therefore, this can result in different approaches in water management by different municipalities (Dai et al.,

2017). Also, due to the increasing issues (e.g. flooding) that come with extreme rain events, municipalities have to work more closely with residents and their private property (Mees et al., 2013), as they are responsible for the collection and discharge of rainwater via their private gardens and rooftops.

4.1.2 Amsterdam Rainproof

Amsterdam Rainproof is the organizational body in Amsterdam that deals with storm water. The platform was initiated in 2011 when in Copenhagen an actual cloudburst of 150 mm happened and caused damage of nearly 1 billion euros (Rainproof, 2014). This was a wakeup call for Waternet, the drinking water supply company in Amsterdam, and the municipality. Waternet initiated a plan in collaboration with the city of Amsterdam, since Waternet is the organization that is responsible for dealing with rain- and storm water in public areas (Rainproof, 2014). The objectives of Rainproof are derived from the national water legislation such as the Delta programme, to maintain the desired water quality and quantity in the Netherlands and what is needed to adapt to the changing climate.

The collaboration between the municipality and Waternet resulted in an analysis that predicted what would happen in Amsterdam if the same amount of rain as in Copenhagen (in 2010 and 2011) would fall. This scenario analysis concluded that Amsterdam would encounter similar floods, with many places damaged or blocked due to high water levels and overflown sewers. This eventually resulted in the official start of Rainproof in 2014.

In Figure 4 this Copenhagen flood scenario is shown. This scenario indicates which areas are most vulnerable and therefore the most important to apply adaptation measures for.

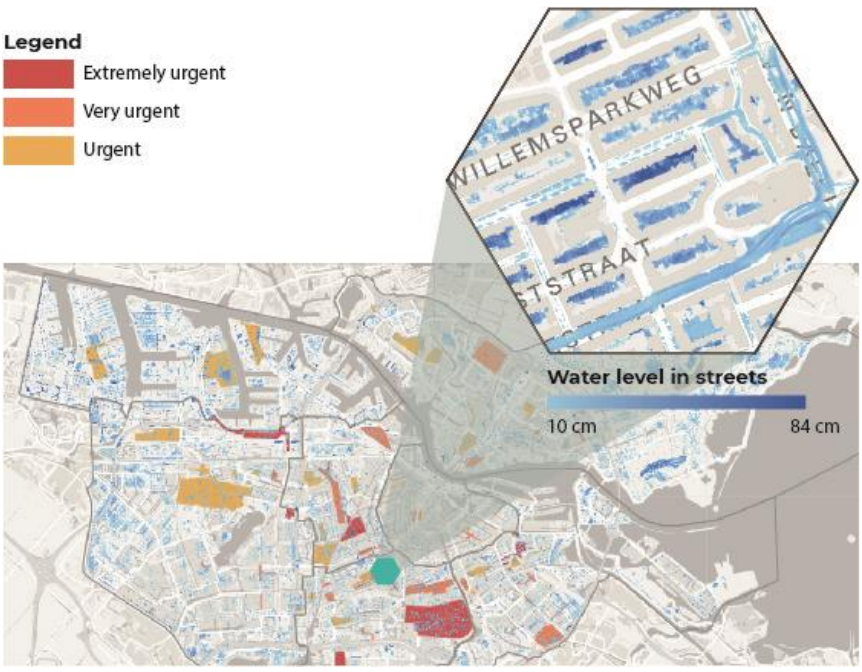

Figure 4 Areas most at risk, adapted from amsterdam.maps.nl

Amsterdam Rainproof is an online platform that uses its network as a guiding approach to make the city rainproof, as shown in Figure 5. Their partners are the local government, corporations, science institutes, real estate owners and the residents of Amsterdam. As mentioned, the initiative was set in motion by the drinking water company Waternet, but works independently from the municipality and Waternet. This helps Rainproof to organize itself in an unconventional way apart from governmental structures, and can consider different tactics from both top-down and bottom up together with residents (Naafs, 2016).

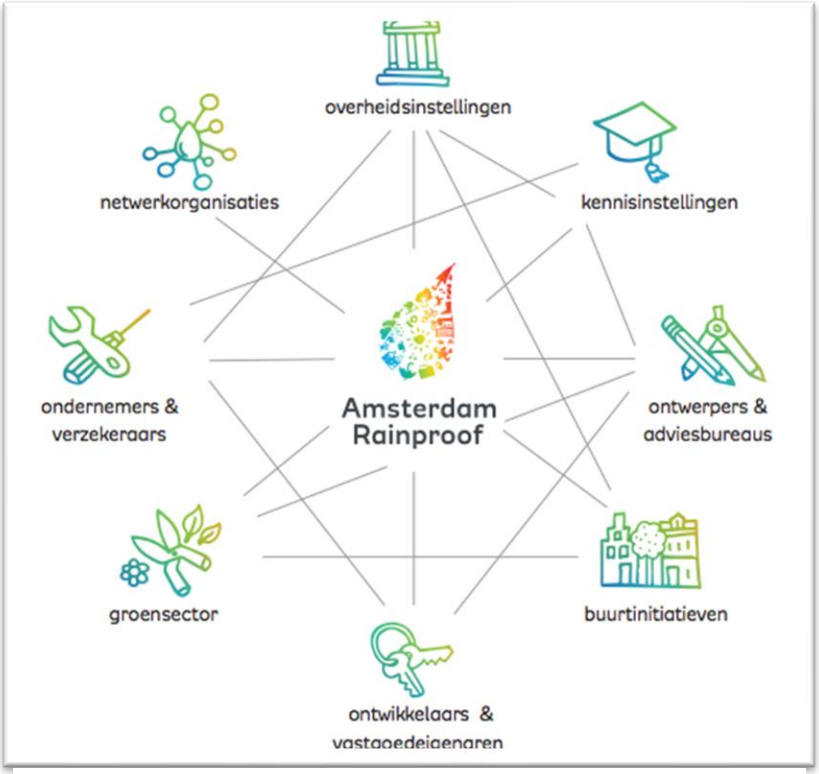

Figure 5 Network-approach by Amsterdam Rainproof

Another characteristic typical for Rainproof Amsterdam is that it is not using one general master plan, but it uses small interventions on a human and small scale (e.g. streets, rooftops, gardens) to make a difference, and at the same time increase the liveability of the city through the increasing and enhancement of BGI. Their goal is to change people's mind-set (Naafs, 2016). This change can influence the dynamics in how things are normally done, and thus will create different and innovative ideas. In this way they are the facilitator for different partners to think of innovative ideas for change.

"I talk to different stakeholders that are involved or can be involved in improving the climate adaption of this the city and try to understand their different needs, motives and the obstacles they face. By making them understand why [because of climate change] it is important to organize the city differently, I want to encourage them to think innovatively and to tackle this problem together, not alone. (…) Working together is key to steps forward."

– *Expert 1 from Amsterdam Rainproof*

Abovementioned quote shows that Rainproof sees strength in encouraging people from all sectors and groups for overcoming climate change. Rainproof anticipates upon the overall desire of a more transparent government that acts as a facilitator (Programmaplan Rainproof, 2014). This correlates with the general vision of the

municipality of Amsterdam. In their strategy plan for an energy neutral city in 2050, one of the four guiding principles is the environmental justice aspect. The programming is focused on giving the people that are financially more dependable a better chance in the transition to a climate sensitive city. Amsterdam wants to achieve this by an equal distribution of risks and benefits, transparency and access to decision-making processes and equal chances on the job market (Routekaart Amsterdam Klimaatneutraal in 2050, 2016). A policy officer that worked on the Climate Neutral roadmap within the department of Sustainability said:

"As government (…) you are obligated to deal with the consequences of climate change, and make the solutions accessible around climate change for the citizens with a lower income, to make sure that there will not be a split within society."

- *Expert 4*

Aspect of justice in Amsterdam

The municipality and Rainproof each consider this aspect as the key to a fruitful and equal transition. Rainproof does not specifically use the term 'environmental justice' within their policy programme compared with the municipality, however, some of their principles are in line with the general principles of EJ. Among them is the importance of transparent decision-making processes (procedural justice) and recognising what needs are present within the community (recognition justice), and also what these needs have to be provided with to be an equally involved member of society, without being disadvantaged because of your income, background or race.

4.1.3 Denmark

The Danish water management is organized along three levels (Figure 6); the national, regional and local level with each a differentiation in power. On a regional level the water infrastructure is mostly operated by non-profit organizations. These organizations deal with the abstraction, treatment and distribution of the groundwater, the second function is related to the collection and treatment of wastewater and storm water. On a local level, the municipalities operate according to the national vision and legislation on

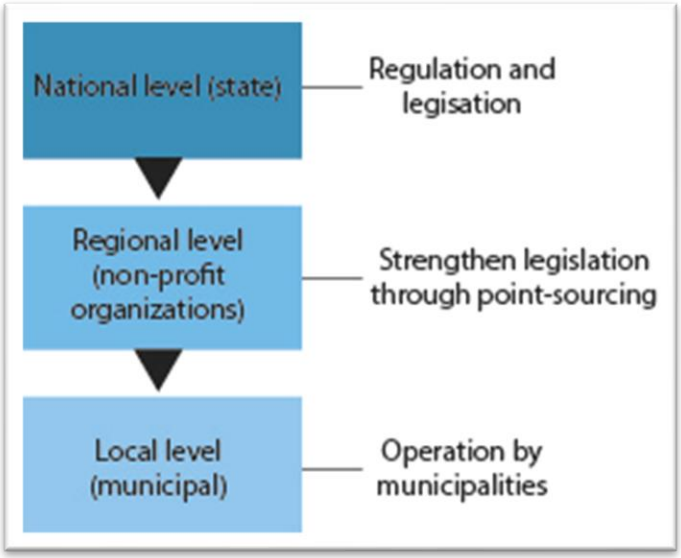

Figure 6 Organizational structure of water management in Denmark. Source: Adapted from Jensen & Iversen (2020).

climate, water and energy (Jensen & Iversen, 2020).

Storm water is managed on local level by authorities such as the municipalities and utility companies. Previously, Denmark defined the criterion for combined sewer overflow with a return period of 10 years. However, IPCC scenarios indicate that this overflow can partly lead to a run-off increase of 15% (Bates et al., 2008; IPCC, 2021). This is because of the increase of intense precipitation that will lead to an increase of 30% of estimated 10-year return period in the next decade in Denmark (Rasmussen et al., 2017). These numbers and the cloudbursts in 2010 and 2011 in Copenhagen were important reasons for the government to work on a national adaptation strategy on adaptive water management, which resulted in a similar adaptation programme by the municipality of Copenhagen (The City of Copenhagen, 2011).

4.1.4 Cloudburst Management Plan

The Cloudburst Management Plan originated in 2011 after the extreme rainfall event. According to Expert 6, a month before the approval of the plan in City Hall, the extreme cloudburst hit and "helped the understanding that we have to do something" (Expert 6).

The Cloudburst Plan is part of the city's general adaptation strategy and provides the methods, priorities and measures proposed to protect against extreme rainfall and seawater storm surges. The plan is a collaboration between the City of Frederiksberg because of its geographical location and hydrological aspects, the Technical and Environmental Administration of the municipality and local authorities that deal with water management (The City of Copenhagen, 2011, 2012). The municipality is divided into seven administrations, of which the Technical and Environmental Administration is responsible for the execution and implementation of the Cloudburst strategy (The City of Copenhagen, 2018).

The Plan consists of two main guidelines for the city: (1) making the sewage system future proof by separating rainwater from wastewater and (2) implementing adaptive measure to counteract extreme rainfall. These adaptive measures include draining the storm water out into sea and partly storing it in accessible and close by fresh water bodies (The City of Copenhagen, 2012). By improving the blue-green infrastructure in the urban landscape of the city storage of rainwater can be increased, however, calculations by HOFOR (drinking water supply company) on hydrological catchment areas in Copenhagen have pointed out that the amount of water that needs to be drained is too much to be stored within the cities' boundaries, hence the drainage to water bodies outside the city (Rasmussen et al., 2017; The City of Copenhagen, 2011).

One of the clearest principles of the Cloudburst Plan is that it should be cost-efficient, considering that adaptation can be very costly.

"It's much cheaper if you can implement this during the development of the city in combination with the renewal of the city."

- *Expert 6 from the City of Copenhagen*

As abovementioned quote indicates, it is efficient to combine development and maintenance plans for the city with extra benefits, such as adaptive BGI measures (e.g. permeable pavement, green rooftops and recreational water storage parks) (The City of Copenhagen, 2011). This is executed by (1) prioritising different areas according to the amount of risk they are facing, (2) the level of implementation that is needed, (3) coherence with urban development projects and therefore achieving a synergistic effect (The City of Copenhagen, 2012). This means that when an area is highly at risk of flooding, but at the same time the measures are easy to implement and beneficial to the urban development, those areas will have higher priority than others. This resulted in a map with areas divided low priority (green), medium priority (yellow) and high priority (red) (Figure 7). It shows that especially the oldest parts of the city, including the city center, are highest priority. According to Expert 5, "the most affluent areas in Copenhagen are the ones that are most at risk from climate change", since the expensive parts of the city are actually in the most wanted places to live.

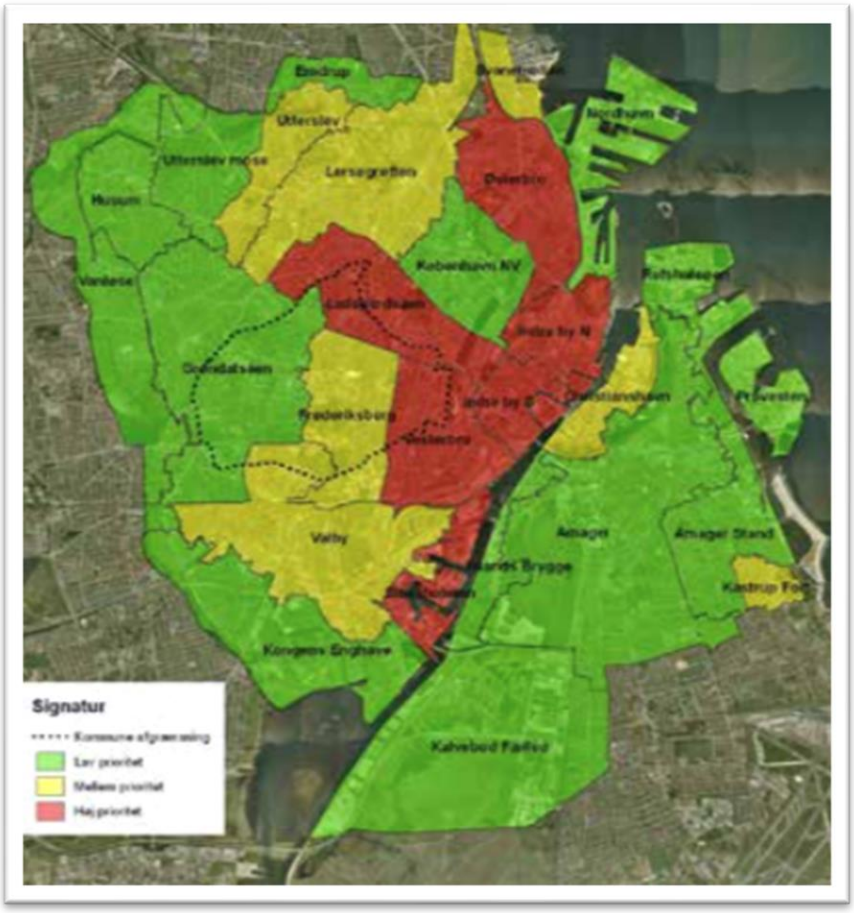

Figure 7 Map of areas with prioritised adaptive measures (Source: City of Copenhagen, 2011).

Aspect of justice in Copenhagen

The Cloudburst Plan does not specifically address the term environmental justice within their strategy programme. This can partly be attributed to the fact that it is a management plan with technical characteristics. There is one aspect that relates to the concept of justice. It is the responsibility of action on pluvial flooding. The plan touches upon the three key players: (private) property owners, the utility companies and the City Administration (The City of Copenhagen, 2012). This means that citizens are responsible for flood proofing their properties such as low laying basements or water collected from rooftops. From this plan it is not clear how this should be done but a policy officer from the City of Copenhagen (Expert 5) mentioned that "we have to engage all different agencies in the municipality to be able to implement this plan", which can indicate that the aspect of justice is touched on, simply not by the Technical and Environment Administration, but by another department within the City.

4.2 Types of Justice within SWM platforms

This section provides the results of SQ2 on which forms of justice are present within the researched SWM platforms Amsterdam Rainproof and the Cloudburst Management Plan. The outline starts with the experts' personal perception of justice in their city, and subsequently whether and how the types of distributional, procedural and recognition justice are present.

4.2.1 Perception of justice

The perception of justice is an important aspect to assess. The way in which policy makers perceive a certain aspect can reflect in the work that is eventually delivered. Thus, when EJ is recognized, it can contribute to the enhancement of social inclusion (Rigolon & Gibson, 2021).

To derive information from the experts on their perception of justice, two questions were formulated. The first question asks for a definition on EJ; this can give the researcher an idea on what their notion is of this concept. To relate this notion to the concept of justice, the answers were categorised according to key words related to the different types of justice (Appendix). This accordance is based on the theoretical characteristics of justice types explained in Chapter 2.

Amsterdam Rainproof

In Amsterdam, the overall perception of EJ is considered twofold. Firstly, the equal distribution of the negative side effects of climate change is found as an important description of EJ.

"For me it has to do with all the wrong in the world. And when it comes to the environment and climate change: who will deal with the negative consequences of that change? (…) That we all share the costs and benefits of climate change."

- *Expert 2, from Amsterdam Rainproof*

Secondly, all experts mentioned the equal access to a healthy and liveable environment as an element of justice. To accommodate equal access to blue-green infrastructure was considered to be a driver for most policy officers within their work.

"I think it is about inclusivity. It sounds idealistic, but I hope that all people can have an equal access to the healthy living environment the city has to offer."

- *Expert 3, from Amsterdam Rainproof*

The experts automatically link this equal distribution of negative side effects of climate change with lower income groups. There is a fear that low-income groups within society can be more negatively affected due to climate change and have less opportunities to protect themselves in the future. This concern is a driver for most experts within Rainproof for working on and increasing SWM measures.

"When the time comes that an extreme rain event hits, it must not be the case that only one person can have sandbags in front of his home and others can't."

- *Expert 2, from Amsterdam Rainproof*

These perceptions relate to distributional justice, because accessibility and equal distribution are key elements. Also, recognition justice is slightly accounted for because the difference in capability by different people (low and high-income groups) is realized and that needs to be addressed.

Cloudburst Plan

In Copenhagen the perceptions related to justice are mostly about economic benefit of justice as opposed to the social or geographical side of justice. Also, all experts related their definition of justice to the Cloudburst Plan instead of defining it as a stand-alone concept. This resulted in an explanation of how justice was incorporated in the Cloudburst Plan and whether this was necessary in the city according to the policy makers.

"Environmental justice was not at the top of our minds because it's not such a big issue in Copenhagen."

- *Expert 5, from the City of Copenhagen*

This can be attributed to several reasons according to the experts, which are mostly economically based. The first reason for this is partly because the areas that have

the highest risk of flooding and damage are also the most affluent areas of the city. As previously stated, the Cloudburst Plan is focused to be cost-efficient. This means to protect and to adapt the areas in the city that have the highest damage value and therefore highest costs to restore.

"The decision we have made was: what is the damage cost per square metre during a cloudburst. And of course, the highest costs are in the richest areas."

- *Expert 6, from the City of Copenhagen*

Another reason is that by combining the areas that might be degraded or in need of renovation, the adaptation strategy will provide the neighbourhood with extra green and blue areas and recreational facilities, and thus previous neglected areas will have a better distribution of blue/green areas, without relating this specifically to the concept of justice.

Also, it is stated that the adaptation plans will increase the fixed water prices in the city. This is because the extra costs that come with the realisation of adaptation measures are added to the current fixed water price per m^3 per household. One expert said:

These [water] prices will go up as a result of adaptation and that will affect a low-income family more than it will affect a high-income family. (…) It would be less than two hundred euros per year, the extra cost. So, I mean, it wasn't a very big cost."

- *Expert 5, from the City of Copenhagen*

This shows that due to climate change and the solutions that are needed will affect citizens economically. This realisation is apparent within the municipality, however according to the policy makers, this increase in costs is not considered problematic.

4.2.2 Distributional justice

In this section the results are provided to show in what way distributional justice plays a part in the policy making within the SWM platforms.

Amsterdam Rainproof

The main characteristic of Amsterdam Rainproof is that it is not a top-down master plan (Naafs, 2016) and that is evident in how distributional justice plays a part within the organization Amsterdam Rainproof. The experts explained that the visibility of green is important for the awareness on how climate adaptation is executed and which then stimulates people to start their own initiatives to increase and enhance the public and private spaces in the city with more green or blue adaptation measures. By expanding the network with organizations and/or citizens that are willing to increase adaptation measures in public and private space, this distribution of green will be spread out over the city more:

"There are many good example of projects that incorporate being 'rainproof' in the public space. This increases the awareness and therefore also the need for more spaces like this, whether it is on private or public property. We are the facilitator to reach people."

- *Expert 3, from Amsterdam Rainproof*

According to the interviewees, this then results in small-scale interventions according to the different needs in neighbourhoods. As Expert 1 said:

"You have to go to where the willingness and specific needs [of citizens] are, otherwise measures and implementations will fail and will cause the reverse effect."

This aspect of the quality and characteristics of the green space is an aspect that is important for measures to work according to experts at Rainproof. If the quality does not match with the needs of the citizens or groups that interact with this space, the project might fail. This is also related to recognition justice and it is important to note that these elements are connected to each other. By knowing the needs and wishes of certain groups, this then will be taken into account in the distribution of fitting adaptation measures.

Cloudburst Plan

As a more top-down policy strategy, the Cloudburst plan is created with a general overview of the whole city and the possibilities for linking adaptation measures to the renovation of each part of the city to increase the sponge capacity of the city.

"The decision was to create the same service level for the whole city (…) A traditional method requires a lot of investment. But if you invest in a surface solution, it can serve as green areas for the citizens as well."

- *Expert 6, the City of Copenhagen*

This means that there is no differentiation made based on social aspects when it comes to the measures implemented in the neighbourhoods, solely whether which neighbourhood has the highest risk of pluvial flooding.

4.2.3 Procedural justice

Procedural justice is concerned with the involvement of all stakeholders and how they are involved in the decision-making processes. During the semi-structured interviews, the emphasis lay on how people are acquainted with the projects and how their opinions are taken into consideration. Also, it is important to understand in what way the policy makers regard the responsibilities of each stakeholder that is

involved in this entire process. That affects the outcome on how these voices are incorporated in the final plans (Rigolon & Gibson, 2021).

Amsterdam Rainproof

The general approach of Rainproof is to act as a mediator between several partners and create awareness on the importance of adaptation to storm water. Therefore, Rainproof actively engages with citizens to increase this awareness, which results in a high level of involvement during projects according to the interviewees.

"The question is: how do you connect people in the easiest way? Usually it is because people can find each other on a certain subject and then physical meet-ups are a good tool to realise this. It gives the people the power to create their own perfect form."

- *Expert 2 from Amsterdam Rainproof*

To actively engage citizens, the approach is to connect with local community centres. These community centres are a trustworthy institution within communities and neighbourhoods. This trust helps build understanding for the importance of adaptation measures. This can be done through community of practice (Expert 2), which is a group of people who share a common interest or concern and start working together to fulfil certain goals. But also social media and providing clear and easy language on public websites help to create this awareness and understanding.

"We created our own communication style, which helped that people easily knew how to find us and connect with us. I think the online platform helped in that sense. Also when it comes to technical solutions, speaking the 'language' of the citizen helped in the involvement process."

- *Expert 3 from Amsterdam Rainproof*

According to the interviewees, this contributed to the fact that they perceive the distribution of responsibilities on who has to deal and act on climate change, as a shared responsibility. By showcasing that citizens can contribute to small-scale interventions and creating a platform where ideas and concerns can be shared, the acceptance on these interventions is higher according to Expert 1 and 3. This does not only mean for citizens, but also for the organizations and companies that can positively contribute to the cities adaptation (Expert 2).

Cloudburst Plan

According to the interviewees, active citizen engagement is a standard procedure when implementing small or big projects and is also seen as an important procedure.

"When we developed the Cloudburst plan, we had public meetings where we talked about the concept and objective. The municipality has a social media account where

they talk about these things. The local councils in the city also tell people what's going on. Above that, we have citizen engagement meet-ups in the individual [smaller] projects also."

- *Expert 5, from the City of Copenhagen*

The reason for this active citizen involvement is because it helps the mutual understanding between citizens, utility companies and municipality on how certain adaptations plans should be carried out. This creates a higher feasibility of these plans in general according to Expert 6:

"It is much more easy for people to see what's in it for them e.g. about the environmental issues (…) and we can avoid that the environmental condition becomes worse because of climate change."

Creating this mutual understanding on why climate adaptation is important is seen as the responsibility of the municipality.

4.2.4 Recognition justice

Recognition justice deals with recognising and understanding the different needs within a certain community. The results in this section provide details on what drives the stakeholders and what their needs are.

Amsterdam Rainproof

According to some experts, the identification of the different needs within several communities is important. Amsterdam Rainproof wants to understand what is important to different people/groups, and this can then be used to motivate citizens to engage. Engagement can have multiple reasons, but the main motivator is to be able to contribute to a better environment. Other reasons are aesthetics or collecting water and using it in their garden (Expert 2). This can be a benefit for low-income citizens to save money.

The people that are involved generally are the people who already know their way in the local districts or how to connect with the municipality.

"It's always the same people that know their way in already whenever they have a question. (…) I hope to connect more with local communities coming year to get a grip on the local communities better. I talk to a lot of different partners and really try to understand the different interests."

- *Expert 2, from Amsterdam Rainproof*

However, on the question whether there is a clear pattern in what kind of people are involved no answer was given. A clear pattern in e.g. age, education background, ethnicity or socio-economic background was not mentioned.

Although Amsterdam Rainproof is reaching certain people in communities, there is still a desire to figure out a way on how to connect with the group of people that are not as easily contacted due to language barriers "and to take them along in certain decisions" (Expert 3). Also people that do not have the time or means to get involved in certain measures are groups that are desired to address in the future. According to Expert 4, the municipality of Amsterdam tries to connect with these people by understanding their needs and local connections. This means to not focus it directly on the people, but by "building upon the local community sense that they already have, otherwise contact is very difficult and they will slam the door in your face." This is similar to the procedural justice element of actively engaging people in previous section by building trust through local community centres.

Cloudburst Plan

In the Cloudburst Plan a similar trend occurs when it comes to the pattern of people that are usually involved and express their needs and desires: the ones who already know their way through the municipal system.

"(…) And in much projects it's more or less the same people who are active and have an opinion about it."

- *Expert 6, from the City of Copenhagen*

Also, the time lived in Copenhagen played an important role in how people identified with the community and therefore cared for the benefits that are implemented. The longer they lived in Copenhagen, the more this community sense played a role in wanting to be active.

"We did a survey a number of years ago where half the people in Copenhagen see themselves as Copenhageners. The other half sees themselves as residents in a district. You see that a lot of times they [the Copenhageners] will be more than willing to take part in a process like that, because if you just see yourself as a citizen, you're not that concerned."

- *Expert 5, from the City of Copenhagen*

Furthermore, a change occurred in the past year due to Covid-19. Usually people that participated in meet-ups and local community issues were the age of 55 or older. During the pandemic many meetings were held online. This decreased the threshold for younger citizens to participate that have generally tighter schedules or other priorities such as their education, family or work.

"The pandemic has actually changed this because a lot of meetings have changed to be virtual meetings. And all of a sudden you're able to see that younger people are participating, (…) sit down in front of the computer and take part in the debate."

- *Expert 5, from the City of Copenhagen*

However, no clear indication on how to improve the inclusion of younger citizens in the future was given.

4.3 Obstacles in SWM and EJ

The final results section elaborates on the possible barriers policy makers perceive in their work when it comes to EJ and the implementation of adaptation measures in SWM. This section is connected to SQ4 that aims to identify how the organizational structure and management can influence the work.

Amsterdam Rainproof

The experts from Amsterdam Rainproof detailed the following barriers:

Make connections with all types of people within the city

Expert 1 mentioned that it is very difficult to involve people in projects on climate change or storm water management. This can be because of language barriers or cultural differences, but also because people do not have the energy, time or money to think about it. Climate change can be a very abstract concept, which might not reach people, unless it happens right in front of them (and then it is already too late).

Teaming up with other partners

Adaptation measures for dealing with climate change can be very costly. This means that collaborating with like-minded partners is the key solution to innovative and cost-efficient ways according to Expert 2. However, organizations find it difficult in connecting on the division of responsibilities and costs.

Financial system

To create a financing system so that citizens benefit equally when it comes to climate measures (e.g. solar panels) is difficult to construct. On top of that, the current system is equipped for people who know their way around the municipal system – however others are neglected due to administrative intricacies and passivity (Expert 3).

Cloudburst Copenhagen

Barriers that the City of Copenhagen deals with are mainly on the organizational level of the municipality according to the experts.

National legislation

Administrative barriers are one of the most important causations of slow implementation. Due to national legislation, cities are sometimes forced to adjust while this decreases the efficiency of certain measures. According to Expert 6, the products that are used for BGI need certain investments, and these investments have to be proven to be cheaper than traditional systems are. It can be hard to prove whether new innovative solutions are actually cheaper while for the long-term vision, they actually are.

Cross-sectorial relations

Another organizational barrier is the communication and collaboration between different sectors within the municipality. According to Expert 5, this leads to opportunities not used to their full potential.

5 Discussion

5.1 Interpretation of results

The aim of this study was to research in what way EJ is present and operationalized within different SWM platforms. Throughout different research phases, information was gathered to answer the four sub-research questions. This section provides a discussion and interpretation of the results according to these four sub-research questions, which are the organizational structure of SWM (SQ1), the presence of EJ in these SWM platforms (SQ2), how the organizational structure influences the output of EJ (SQ3) and obstacles within each case study when it comes to SWM and the operationalization of EJ (SQ4). Extra discussion is provided to zoom out and elaborate on other researches that are focused on the practicality of EJ. Also the relevance and limitations of this study are discussed.

5.1.1 Organization of SWM

The cities of Amsterdam and Copenhagen have a different SWM approach. In Amsterdam it is organized through the municipality and utility companies, from which the independent platform Rainproof Amsterdam originated. Organized independently from the municipality, Rainproof Amsterdam has the ability to work together with many different organizations, companies and citizens, while keeping the general sustainability policy objective of the municipality in mind. This network-approach is beneficial for increasing awareness on the topic of climate change and storm water. On top of that, researchers Provan and Kenis (2007) concluded in their research on governance networks that this also benefits how resources and knowledge are used more efficiently, and therefore it increases the planning capacity of complex problems. This can be a reason for the successful organization of SWM in Amsterdam. On top of that, working independently from governmental bodies can help bypass administrative barriers and passivity within policy making, for a more efficient output as Dhakal and Chevalier (2016) have pointed out in their research on obstacles in SWM.

In Copenhagen, a traditional top-down management approach is used for the implementation of the Cloudburst Plan. After ten years since the plan was introduced, it is seen as a successful way to organize SWM. It takes the whole city into account and enhances the blue-green infrastructure through nature-based solutions on a service level. This top-down approach creates the ability to implement the main goal to the entire city, which then results in a homogenous outcome. Although this plan and its output is the responsibility of the City of Copenhagen, collaborations with parties from outside of the municipality have helped shape the plan. The only distinction was made according to the costs. The areas that had more risks of flooding and therefore had a higher risk of high costs are dealt with first. This

corresponds to the literature review done by Eicken et al. (2021) on whether top-down approaches are effective in environmental policy. The success of this plan can partly be attributed to the fact that the general objective of this plan was to benefit the entire city with knowledge of city experts and a synergy between technical aspects and sustainable aspects. In the research it is stated that through co-design and co-planning with the city and experts in the urban field, a successful plan can be realised which benefits the local communities by creating a safer living environment, protected from climate change. However, this only touches upon the actual implementations of urban interventions and does not yet take the social aspects into account which are fundamental for the complete operationalization of EJ.

5.1.2 Presence of Environmental Justice in SWM platforms

In Amsterdam, the procedural element of justice is mostly present. This can be attributed to its network-approach, because more individuals and parties are included in the decision-making process, and are also given the opportunity to contribute to blue-green infrastructure. In Copenhagen the municipality has standard procedure to involve citizens with the decision-making and planning processes, but policymakers do not perceive this as a justice aspect. Distributional justice is touched upon, because through the enhancement of BGI, the accessibility automatically increases, according to the City.

However, both cities lack the recognition aspect of justice in their approaches. This means that the recognition of different needs of people in the city is not explicitly accounted for. In Amsterdam, it is specifically mentioned that mostly citizens who know their way around municipal facilities and communication services tend to be involved and speak out their needs. This means that marginalized groups are not actively involved, and therefore their wishes are not heard. In Copenhagen, this is similar. On top of that, in Copenhagen the general Cloudburst Plan does not take the needs or desires of local communities in neighbourhoods into account because it uses a general service level approach. Both of these cities' approaches can have an implication on the quality and use of BGI by locals. By not understanding these needs, BGI implementation can have a negative effect and results in green gentrification (Toxopeus et al., 2020). Especially in Copenhagen this can be an issue, due to the characteristics of the Cloudburst Plan.

5.1.3 Influence of management organization on EJ

In Amsterdam, the network-approach influences the way that people, organizations and companies are involved with storm water measures. This is mostly done through creating awareness on the topic. This contributes to the implementation of small-scale interventions, usually by local groups and active citizens. In this way, distributional justice is present in small-scale areas and citizens are actively

participating through procedural justice. In Copenhagen, the top-down approach ensures an equal distribution of the enhancement and increase of BGI, which results in an increase of visibility, objective quality and accessibility of blue-green facilities.

Yet, as previously mentioned, both approaches do not adhere recognition justice and that is influenced by the organizational structure of each city. This implies that a multi-level form of governance, such as Rainproof, contributes to a more inclusive form of involvement, but not necessarily on increasing recognition. And from a top-down perspective, this collaboration between experts with little input from citizens, does not create an understanding of recognition either.

5.1.4 Dealing with obstacles in management

Throughout the study, information is gathered on how certain management aspects can obstruct or slow down the fair implementation of certain environmental measures. Both cities mentioned how financing systems can decrease the incorporation of EJ in policy. Through inadequate laws and regulations in financing and subsidies, not all citizens can benefit equally on certain measures. Although the city of Copenhagen did not find that an increase in the fixed water prices mattered, it still impacts certain groups in society that have to deal with language barriers or low socio-economic status. In Copenhagen this distribution of costs is shared, while in Amsterdam there is still a need for a clear approach on how to deal with this.

5.2 Relevance

This research aimed to understand whether EJ is taken into account during policy processes. Focusing on platforms that deal with storm water creates a new perspective in the EJ debate, since mostly studies have dealt with only the distributive aspect of BGI in cities (Mandarano & Meenar, 2017; Pearsall & Pierce, 2010; Toxopeus et al., 2020).

It has provided information on whether a different management approach differs in how EJ is perceived and accounted for. When it comes to the actual implementation of BGI measures, both approaches have proved advantages and are relatively successful. However, it is clear that further steps can be made towards the inclusivity of EJ in these measures. Both approaches did not fully include all three aspects of environmental justice. Therefore, this study provides information for other northern-European countries that have similar consequences of climate change on how to tackle SWM and related urban planning issues, by elaborating on two different approaches and how EJ is incorporated.

5.3 Zooming out

In the discourse on EJ, the researches remained rather theoretical due to the abstract characteristics of the concept. Also, when a theoretical analysis was made on the overall debate on environmental justice, Pearsall and Pierce (2010) concluded that if there was research done on the practical operationalization of justice, it was mostly focused on the distributional aspect of justice. It was noted that this element is easier to quantify while the other two justice types are not. For example, this is done in the Netherlands by de Vries et al. (2020): with GIS tools the proximity of green recreational areas was analysed while this is linked to the demographic of groups or neighbourhoods close to these areas. The conclusion was that there actually is a difference between the presence and availability of green areas according to socio-economic status. A part of the objective was to increase the knowledge on how the practicality of EJ in policy implementations takes place in the Netherlands and Denmark. To put this research in a broader perspective, it is relevant to see whether the outcomes of this research correspond with the practicality of EJ in other countries or cities.

The EJ discourse started in the U.S. due to dissatisfaction on the distribution of environmental risks and hazards. To this day, the U.S. still plays a big part in the research on EJ since the spatial and social inequality is more apparent, and because it is seen as a overarching characteristic of communities compared to other countries (Agyeman et al., 2016). The approach by Rigolon and Gibson (2021) was set up to explore how EJ is implemented when non-governmental bodies are involved in the state California. Mostly, EJ studies are focused on the role of the government on how to incorporate EJ. It is concluded that mostly through coalitions, environmental justice issues are tackled in environmental problems. This means that collaboration with more than one NGO provides for a bigger platform to tackle justice aspects in policy implementations. Although Amsterdam Rainproof uses the strategy of involving multiple stakeholders, this is done in regard to come up with innovative storm water solutions instead of doing this for achieving EJ.

Similar to this research, the study by Toxopeus et al. (2020) was set up to understand the affect of a hybrid governance structure in NGOs on the outcome of EJ. In their research, one main conclusion was provided, from which one is very similar to the results of this study. While enabling participatory processes can improve the representation of citizens, this democratic control is lost when only the same people are heard (which was acknowledged by the experts in both Rainproof and Cloudburst). According to the research by Toxopeus et al. (2020), this can partly be solved by maintaining long-term and sustainable meeting mechanisms, which should be initiated by the municipality and local organizations involved. Interestingly, this participation obstacle is present in both the network-approach and the top-down approach of the two cities.

Both abovementioned approaches are related to the governance structure of governmental bodies or NGOs. However, a research in Ambler, Pennsylvania, highlighted the importance of taking the watershed-level as a main point of departure. By combining this watershed-level approach specifically with the three elements of justice, this resulted in a successful execution of the storm water management plan in the city (Meenar et al., 2018). In this approach, recognition for the water infrastructure and landscape was accounted for, while at the same time recognition and attention was given to the needs, frustrations and wishes of the community. The city of Copenhagen had a similar approach, as an analysis on the different watersheds helped with the categorization of different risky areas in the city (Figure 7). However, in contrast with the research by Meenar et al. (2018), no specific EJ approach was incorporated. Although the Cloudburst is perceived as a success although it did not consciously include justice, it is difficult to say whether this success was because of other factors, such as the different demographic. Ambler is seen as a "EJ-community" (Meenar et al., 2018), while the need for EJ was perceived as 'unnecessary' and more related to other countries (Expert 5).

5.4 Limitations

Firstly, this study analysed two case studies in two cities. This resulted in very specific data. In this way, a more broad analysis on EJ could not be made. It remains unclear whether the specific analysis and conclusion can be applied to other cities in The Netherlands and Copenhagen as well, but this depends on the current organizational structure and knowledge on EJ, as putting this research in a broader perspective pointed out.

Secondly, the governance aspect of the two case studies is not analysed in depth. The analysis concerned itself with the organizational characteristics of each platform, however, theoretical background on advantages and disadvantages on certain forms of governance can create an extra dimension to the analysis.

Thirdly, the qualitative analysis can be improved by incorporating the demographic background of each city. The research limited itself on the actual policy and coherent documents and interviews, but research with citizens can create understanding of how citizens want to be involved or what they need. The policy documents analysis can be improved by analysing information on socio-economic background such as unemployment rates, political preference, and illiteracy rates.

6 Conclusions and Recommendations

The presence of justice differs in both platforms and therefore also differs during the decision-making processes of both cities. This can be attributed to the organizational structure and it is clear that this influences the operationalization of EJ. Also, how the involved policy makers perceive justice is relevant for the operationalization of EJ.

Distributional justice is in both cities and operationalized through clear objectives and clear implementation. However, recognition justice is not a part of the environmental justice debate (yet) within policy makers' perception. This affects the way blue-green infrastructure is implemented in the city and affects the quality of these measures.

Recommendations for further research are firstly, to broaden the scope by analysing different cities in the Netherlands and Denmark to create a more coherent narrative on how EJ is perceived and executed in these countries. This can further help the discourse of EJ in the Netherlands and Denmark. Secondly, a clear analysis on how governance structures can benefit or disadvantage EJ outcomes is needed to provide tools for policy makers in the field. By understanding how certain administrative boundaries can be overcome, the approach to climate adaptation can be addressed better. Thirdly, the cities' demographic should be accounted for in further research to understand the recognition aspect of justice. It is important to understand who or what sets the standard for what is necessary when it comes to nature-based solutions in cities to adapt to climate change.

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Appendices

Appendix 1

The key words are identified through literature by Toxopeus et al. (2020), Rigolon and Gibson (2021) and Mabon (2020). These key words helped with the categorisation of arguments of justice mentioned by the experts.

Table 4 Key words per justice types

Type of justice	**Key words**
Distributional	Equal access; equal distribution; equal benefits; equal economic benefit; (green) gentrification.
Procedural	Participation; decision-making; representation; power-relations; responsibility; inclusion.
Recognition	Community/individual needs; Necessity; (local) community relations; accountability; capability.

Appendix 2

Semi-structured interview questions and corresponding research themes and domain of justice.

Theme nr.	Research theme	#	Interview question (IQ)	Domain of justice
0	Expert knowledge on EJ	1	Can you describe what you do within Rainproof/Cloudburst?	N.A.
		2	What does Environmental Justice mean to you?	N.A.
		3	According to their definition; have you ever experienced anything similar to what you just described during your work?	N.A.
1	The motivation and the value they expect to capture	4	What is your personal motivation to be involved in Rainproof/Cloudburst?	Recognition
		5	What is needed to achieve the final state of Rainproof/Cloudburst? When is it finished?	Distributional
		6	According to their answer; How can that be achieved?	Procedural
2	Who are the public and private actors as well as their responsibilities with regard to the studied intervention	7	With what types of people do you work with during projects connected to Rainproof/Cloudburst?	Procedural
		8	How are the responsibilities by each actor divided in regard to storm water management and the Cloudburst plan/Rainproof programme?	Procedural
3	Interaction between public and private actors	9	What is the motivation of the people you work with?	Procedural/ Recognition
		10	What is the most important element that you hear from people outside your organization that needs change?	Recognition
		11	How do you incorporate these changes?	Distributional/ Recognition
4	The specific conditions/circumstances that led to the involvement of non-governmental actors in the delivery of this intervention	12	How are people, outside of Rainproof/Cloudburst, involved and acquainted with projects?	Procedural
		13	Do you recognise a pattern in what people get acquainted with projects and who do not?	Procedural

Appendix 3

The table provides the experts that were interviewed.

Table 5 List of key experts

Expert #	Organization	Date
Expert 1	Amsterdam Rainproof, policy officer	June, 2021
Expert 2	Amsterdam Rainproof, policy officer	July, 2021
Expert 3	Amsterdam Rainproof, policy officer	July, 2021
Expert 4	Municipality of Amsterdam, Department Sustainability, policy officer	August, 2021
Expert 5	City of Copenhagen, policy officer	August, 2021
Expert 6	City of Copenhagen, policy officer	September, 2021

Appendix 4

The numbers indicate the frequency of the argument mentioned per SWM platform. The total number of experts of Amsterdam Rainproof are 3 and total of the Cloudburst Plan are 2.

Table 6 Frequency of arguments indicated per case study on EJ

Perception of justice		
Argument	**Rainproof**	**Cloudburst**
Equal distribution of negative side effects	2	1
Equal distribution of environmental hazards	-	1
Equal access to a liveable city	3	-
Provides economic benefit	-	2
Distributional justice		
Argument	**Rainproof**	**Cloudburst**
Expanding of existing BGI	1	2
Visibility of green as an awareness tool	2	-
Procedural justice		
Argument	**Rainproof**	**Cloudburst**
Actively searching for stakeholders	3	2
Social media to engage people	3	2
Physical meet-ups to engage people	3	2
Responsibilities of adaptation is shared	2	-
Create mutual understanding of adaptation	-	2
Recognition justice		
Argument	**Rainproof**	**Cloudburst**
Identifying desired benefits by community	2	1
Identify desired needs by community	3	2
Understanding the motivation to be involved	2	2
Clear pattern of people involved	2	2