Municipal Green Bonds: Climate Finance Amidst Climate Injustices

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ABSTRACT

The climate finance mobilization agenda represents one of the key global responses to the ongoing climate crisis. A dominant discourse within this agenda promotes the idea that by attracting private capital, public authorities and private actors can accelerate the green transition and support initiatives labeled as climate action, including both mitigation and adaptation measures. Green bonds, a green-labeled type of debt instrument issued in financial markets, represents one of the fastest-growing strategies within this agenda. This dissertation offers new qualitative and empirical insights about green bonds from a climate justice perspective. It addresses the overarching question of how municipal green bonds, as instruments of climate finance, engage with climate action (both adaptation and mitigation), and interact with local and global climate injustices.

To explore this question, the dissertation is structured around three interlocking triads: three case studies, analyzed through the three pillars of climate justice, across three research phases. Therefore, this doctoral thesis investigates the issuance and materialization of municipal green bonds in the cities of Cape Town (South Africa); Mexico City (Mexico); and San Francisco (United States). It applies the Intergovernmental Panel on Climate Change's (IPCC) definition of climate justice as the analytical framework grounded in the pillars of procedural justice, recognition, and distributive justice, examining the green bonds through the phases of green labeling, project implementation, and the narratives that emerge around these bonds.

This study achieves three key objectives. First, it identifies the impacts of water infrastructure projects financed by municipal green bonds, with particular emphasis on issues of uneven water distribution and environmental racism. Second, it reveals three previously underrecognized dimensions of climate vulnerability (race, income, and gender) within the context of water infrastructure financed by municipal green bonds. Third, it provides an analytical portrait of the positive narratives of climate action that are associated with municipal green bonds issuance. It argues that these narratives tend to prioritize financial performance and the achievement of quantitative targets while overlooking the climate justice implications and the complexities of the underlying socio-economic contexts.

In conclusion, this dissertation contributes to a deeper understanding of the expanding role of municipal green bonds in climate finance, the implications of their use for climate action, and their limitations in addressing and responding to climate injustice at the local level.

SAMENVATTING

De agenda voor de mobilisatie van klimaatfinanciering vertegenwoordigt één van de belangrijkste globale reacties op de aanhoudende klimaatcrisis. Een dominant discours binnen deze agenda promoot het idee dat overheidsinstanties en particuliere actoren door het aantrekken van privaat kapitaal de groene transitie kunnen versnellen en initiatieven kunnen ondersteunen die als klimaatactie worden gelabeld, inclusief mitigatie- en adaptatiemaatregelen. Groene obligaties, een groen gelabeld type schuldinstrument dat op financiële markten wordt uitgegeven, vertegenwoordigen één van de snelst groeiende strategieën binnen deze agenda. Dit proefschrift biedt nieuwe kwalitatieve en empirische inzichten in groene obligaties vanuit een klimaatrechtvaardigheidsperspectief. Het onderzoek behandelt de overkoepelende vraag hoe gemeentelijke groene obligaties, als instrumenten van klimaatfinanciering, betrekking hebben op klimaatactie (zowel adaptatie als mitigatie) en interacteren met lokale en mondiale klimaatonrechtvaardigheden.

Om deze vraag te onderzoeken, is het proefschrift gestructureerd rond drie samenhangende triaden: drie casestudies, geanalyseerd aan de hand van de drie pijlers van klimaatrechtvaardigheid, in drie onderzoeksfasen. In functie hiervan onderzoekt dit proefschrift de uitgifte en materialisatie van gemeentelijke groene obligaties in de steden Kaapstad (Zuid-Afrika); Mexico-Stad (Mexico); en San Francisco (Verenigde Staten). Het werk past een analytisch kader voor klimaatrechtvaardigheid toe dat is gebaseerd op de pijlers van procedurele rechtvaardigheid, erkenning, en distributieve rechtvaardigheid, waarbij groene obligaties worden onderzocht via de fasen van groene etikettering, projectimplementatie en de verhalen die rond deze obligaties ontstaan.

Dit proefschrift bereikt drie hoofddoelen. Ten eerste identificeert het de impact van waterinfrastructuurprojecten die worden gefinancierd door gemeentelijke groene obligaties, met bijzondere nadruk op kwesties van ongelijke waterdistributie en milieuracisme. Ten tweede onthult het drie voorheen onderbelichte dimensies van klimaatkwetsbaarheid (ras, inkomen en geslacht) binnen de context van waterinfrastructuur gefinancierd door gemeentelijke groene obligaties. Ten derde biedt het een analytisch portret van de positieve verhalen over klimaatactie die geassocieerd worden met de uitgifte van gemeentelijke groene obligaties. Het proefschrift betoogt dat deze verhalen de neiging hebben om financiële prestaties en het behalen van kwantitatieve doelen prioriteit te geven, terwijl de implicaties voor klimaatrechtvaardigheid en de complexiteit van de onderliggende sociaaleconomische contexten worden genegeerd.

Concluderend draagt dit proefschrift bij aan een beter begrip van de groeiende rol van gemeentelijke groene obligaties in klimaatfinanciering, de implicaties van hun gebruik voor klimaatactie en hun beperkingen bij het aanpakken en reageren op klimaatonrechtvaardigheid op lokaal niveau.

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LIST OF ACRONYMS

Argentine Peso (ARS)

Bayview-Hunters Point (BHP)

Clean Development Mechanism (CDM)

Climate Bonds Initiative (CBI)

Climate Bonds Standard (CBS)

Environmental Monitoring Group (EMG)

Environmental Science Associates (ESA)

European Association of Development Research and Training Institutes (EADI)

European Bank for Reconstruction and Development (EBRD)

European Investment Bank (EIB)

Free Basic Water (FBW)

German Development Cooperation (GIZ)

Green Bond Principles (GBP)

Institute of Development Policy (IOB)

Intergovernmental Panel on Climate Change (IPCC)

International Capital Market Association (ICMA)

International Finance Corporation (IFC)

International Institute for Sustainable Development (IISD)

International Monetary Fund (IMF)

Locally Unwanted Land Use (LULU)

Mexican Peso (MXN)

Moroccan Dirham (MAD)

Organization for Economic Cooperation and Development (OECD)

Public Health Emergency of International Concern (PHEIC)

Reducing emissions from deforestation and forest degradation and additional forest-related activities in developing countries (REDD+)

Research School for International Development (CERES)

San Francisco Public Utilities Commission (SFPUC)

Secretaría del Medio Ambiente (SEDEMA)

Sistema de Aguas de la Ciudad de México (SACMEX)

South African Rands (ZAR)

United Nations (UN)

United Nations Environment Programme (UNEP)

United Nations Children's Fund (UNICEF)

United Nations Convention Framework Climate Change (UNFCCC)

United States Dollar (USD)

United States of America (US)

Water management devices (WMDs)

World Health Organization (WHO)

World Meteorological Organization (WMO)

CHAPTER 1. INTRODUCTION

1.1 Municipal Green Bonds: A Climate Finance Instrument Requiring a Climate Justice Approach

The goal of this dissertation is to enhance the academic and policy understanding of municipal green[1] bonds as climate finance instrument aimed at raising capital for climate action (both adaptation and mitigation to climate change), and examine how they interplay with local and global climate injustices. A bond is a type of financial instrument that enables issuers to borrow funds from financial markets, serving as an alternative to borrowing from commercial and development banks. When bonds receive a green label, it signals that the proceeds will be used to finance projects or expenditures classified as environmental initiatives and climate action (Jones et al., 2020).

The two primary voluntary standards guiding green bonds labeling are the Green Bond Principles (GBP) by the International Capital Market Association (ICMA) and the Climate Bonds Standard (CBS) by the Climate Bonds Initiative (CBI). The GBP, established in 2014, is the dominant framework, providing general guidelines for green labeling but lacking explicit criteria for what qualifies as a green project (Spinaci, 2022). In contrast, the CBS, introduced in 2015, builds on the GBP and additionally offers a detailed green taxonomy and requires certification by external reviewers. Issuers must create a green bond framework document, obtain a second opinion, and periodically publish follow-up reports to ensure transparency and compliance (CBI, 2016a). A detailed examination of the green labeling process is presented in chapter 4 of this dissertation.

The literature on green bonds predominantly focuses on the growth aspects of this market from a financial perspective (Jones et al., 2020), as detailed in chapter 2 on methodology. This dissertation makes a novel contribution by approaching green bonds from a different and therefore novel perspective, climate justice, highlighting and making visible the contexts of climate injustice where financed projects are implemented. This allows for an analysis of the climate justice implications and applications of green bonds. This thesis demonstrates why it is relevant to address municipal green bonds from a climate justice perspective and how this financial instrument, through its green narrative, can obscure local contexts of climate injustice while reproducing and creating new injustices.

[1] Throughout this dissertation, ‘green’ is consistently employed as a label rather than merely an adjective.

In the field of climate finance, the predominant stance is that of the 'gap talk,' which prioritizes the mobilization of financial resources (Bryant & Webber, 2024) without addressing transformative outcomes in terms of climate justice for communities and ecosystems. This dissertation takes a critical stance towards the 'gap talk' approach, shifting the analytical lens from financial resource mobilization to the direct observation of green bond-financed projects in specific contexts of climate injustice, discussed in detail throughout the thesis. The concept of 'gap talk' is further explained later in this introduction, while the methodological approach and contribution to the academic literature on green bonds are described in chapter 2. Before examining these details, it is pertinent to present the basic elements of green bonds and their municipal versions.

One of the earliest instances of a bond with an environmental label was issued in 2001 by the City of San Francisco, California, specifically aimed at financing solar energy projects (Bracking, 2019). Subsequently, in 2007, the European Investment Bank launched a climate awareness bond, serving as a direct precursor to the issuance of the first green bond the following year (EIB, 2021). The inception of green bonds dates back to 2008 when the World Bank issued the first green-labeled bond in response to Nordic pension funds demand for investments that were safe, profitable and environmentally friendly (World Bank Group, 2021). Since then, the annual issuance of green bonds escalated from under USD 50 billion in 2014 to USD 263 billion in 2019, reaching a cumulative total of USD one trillion by 2020 (EIB, 2021).

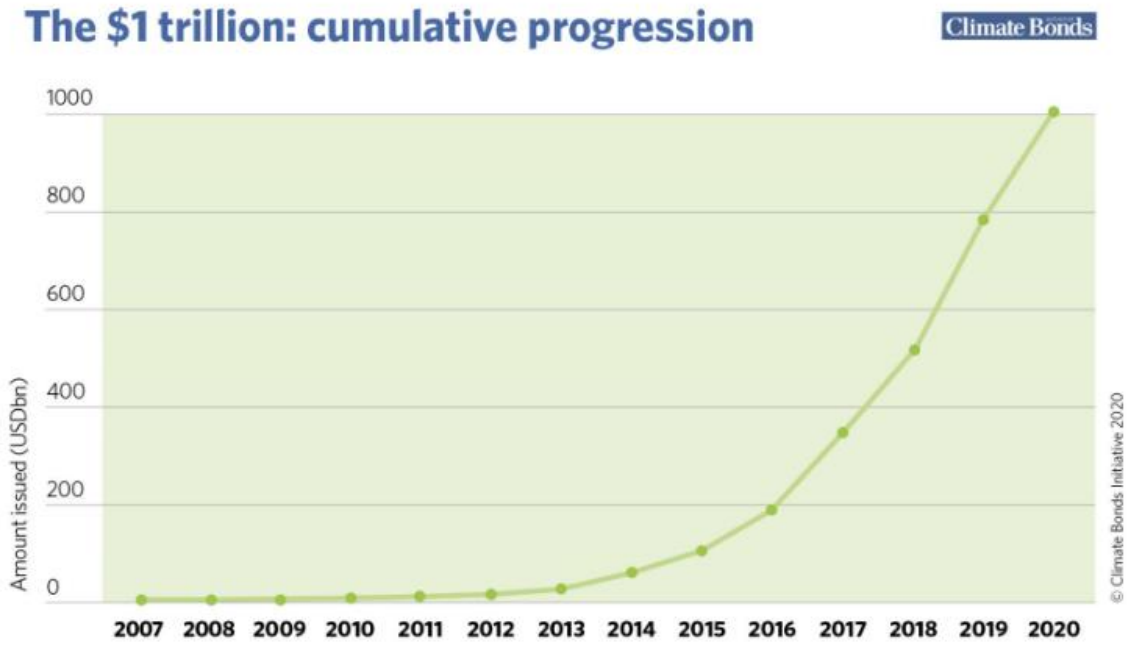

Figure 1. The Green Bonds $1 Trillion: Cumulative Progression. Source: Climate Bonds Initiative (2020).

The green bond market has witnessed exponential growth, surpassing other climate finance instruments like the Clean Development Mechanism[2] or catalysts of 'green finance' like the Green Climate Fund,[3] in terms of accumulated issuance. Despite their rapid expansion, green bonds constituted only a small part of the roughly USD 128.3 trillion global bond market in 2023, which is used by institutions like the Organization for Economic Cooperation and Development (OECD) to indicate that there is ample potential for growth in this sector (OECD, 2023).

Green bonds can be issued by a variety of entities including financial institutions, non-financial corporations, national governments, and subnational or municipal governments (CBI, 2021b). This dissertation specifically addresses the municipal green bond markets in Africa and Latin America in chapter 4. Municipal green bond experiences in Cape Town, South Africa, and Mexico City, Mexico, are explored in chapters 7 and 8, respectively. The United States' municipal bond market, noted for its maturity and associated climate injustices, serves as a critical backdrop; its implications are examined in chapter 5. Furthermore, chapter 6 investigates the experience of one municipal green bond in San Francisco, California, offering insights and material and theoretical connections with the cases in Africa and Latin America explored in the dissertation. The rationale for focusing on the municipal version of the green bonds, particularly within the contexts of Africa and Latin America, becomes evident once climate finance literature is juxtaposed with climate change adaptation and mitigation accounts, and in particular with the increasing amount of publications that recognize the key role of urban contexts as both contributors to climate change and as hotspots for climate adaptation (e.g., IPCC, 2023; Mi et al., 2019; Reckien et al., 2017).

Municipal Green Bonds Between Climate Action and Climate Finance

Municipal green bonds are a type of climate finance instrument used to finance local initiatives, such as infrastructure projects or municipal services, that qualify as climate action. Climate action has been globally recognized as a priority with the Paris Agreement (2015) and is endorsed in the United Nations Sustainable Goal 13, which calls for urgent measures to combat climate change and its impacts (UN General Assembly, 2015). Climate action includes efforts to mitigate the causes of climate change and to adapt to its consequences (EUR-Lex, n.d.). Climate finance has become critical in the agenda of facilitating the mobilization of both public

[2] United Nations Climate Change (2018) reports that between 2001 and 2018, a total of USD 303.8 billion was allocated to the Clean Development Mechanism.
[3] As of 31 July 2020, the Green Climate Fund has mobilized a total of USD 10.3 billion since its establishment in 2010 (Green Climate Fund, n.d.).

and private funding to promote climate action (UNFCCC, n.d.). The interaction between climate finance and climate action continuously influences patterns of capital circulation and the distribution of financial and environmental benefits and burdens. This interaction necessitates examination from a climate justice perspective, particularly focusing on the distributive aspects of justice.

Climate finance has expanded rapidly since the 1990s particularly with the adoption of the Kyoto Protocol and the development of experiments in carbon accounting. Since then, new financial instruments and mechanisms have emerged, such as payment for ecosystem services, REDD+, biodiversity offsets, green bonds, insurance-linked securities, etc. (Bracking, 2019). Many of these instruments have been analyzed from a climate justice perspective, including the Clean Development Mechanism (Eni-ibukun, 2013), carbon market projects (Mathur et al., 2014), REDD+ (Godden & Tehan, 2016), and the Green Climate Fund (Vanderheiden, 2015). At the core of the expansion of climate finance there is the idea of the 'financial gap' a term that is key for the entirety of this dissertation.

The 'Climate Finance Gap' and the Role of Cities

Reflecting on 'Impacts, Adaptation and Vulnerability' to climate change, the Working Group II (WGII) of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) highlighted the critical role of urban[4] settlements in the global South, including in Africa and Latin America, as focal points for climate adaptation strategies (IPCC, 2023). These regions are experiencing rapid urban population growth coupled with escalating environmental impacts (Mi et al., 2019), which exacerbates vulnerabilities to climate change (IPCC, 2023; Reckien et al., 2017). This vulnerability dynamic is critical to understanding the manifestation of climate injustice, a concept explored in detail in chapter 3. The IPCC calls for more attention to the role of cities and municipalities in climate action and climate finance. This financial agenda is considered essential for climate action[5] and the fulfillment of the sustainable development agendas, as encapsulated by the IPCC under the concept of 'climate resilient development' (IPCC, 2023).

The attention to financing the transition unfolds within a prevalent discourse in climate finance that Bryant and Webber (2024) named 'gap talk'. In this framing, climate finance is categorized

[4] The 'urban' and 'cities' concepts are theoretical constructs and dynamic processes rather than fixed, isolated entities. Refer to Brenner and Schmid (2015).

[5] Climate action is defined as the measures aimed at addressing climate change and its consequences, focusing on both mitigation strategies to reduce or prevent emission of greenhouse gases and adaptation efforts to cope with the impacts (EUR-Lex, n.d.).

normatively depending on the "source (e.g., public or private), aim (e.g., mitigation or adaptation) or the tool that is deployed (e.g., grant or loan)" (Bryant & Webber, 2024, p 10). Rather than emphasizing the outcomes of public policies or projects, this mode of analysis focuses on commitments and objectives for mobilizing financial resources to bridge the 'climate finance gap' (Bryant & Webber, 2024). Therefore, the 'gap talk' serves a prefigurative narrative that creates the idea of a 'financial need' and is necessary to support efforts that 'unlock' climate finance by reorientating national and subnational public institutions towards this goal (Knuth, 2015 cited in Bryant & Webber, 2024).

Within the 'gap paradigm' there is another gap that is often discussed, that of climate 'financial gap' (United Nations, Inter-agency Task Force on Financing for Development, 2022; World Economic Forum, 2022), which takes for granted that there is the urgent need to raise private finance to fill the void left by public authorities, and underscores that within the funding required for climate action the bulk of climate finance is directed towards mitigation, suggesting an even larger 'gap' in funding allocated for adaptation to climate change (Naran et al., 2022), which includes water infrastructure projects (United Nations, 2009).

Within the 'gap talk' discourse and paradigm, green bonds are depicted as a promising financial mechanism (Bryant & Webber, 2024). Municipal green bonds must thus be seen as instruments to fill the 'climate finance gap'. Across the years, they have been utilized by cities and other subnational governmental entities to borrow capital for financing projects deemed as climate adaptation efforts, including water infrastructure as actions for climate adaptation, as detailed in chapters 4 and 5 and better explained via the case studies of chapter 7 and following.

Water Infrastructures as a Convergence of Climate Action, Climate Finance, and Climate Justice

Given the relevance of the 'finance gap talk', the role of municipal green bonds as financial instruments proposed to address it, and the importance of water infrastructures as materialization of the municipal green bonds in the context of climate adaptation. This dissertation focuses on municipal green bonds that financed water infrastructure projects in three cities of the United States (San Francisco), Africa (Cape Town) and Latin America (Mexico City). Despite their geographical distance, these cities share a history marked by slavery, colonial rule, and exploitative commercialization.

In the case of Mexico and South Africa, they are part of regions that are recognized as the most unequal regions globally (Galli et al. 2022), hosting countries with the highest income disparities as measured by the Gini coefficient (World Bank Poverty and Inequality Platform

2022). Additionally, the dynamics at the municipal or subnational level in the global South reveal increasing population concentration and environmental and climate impacts in urban areas (IPCC, 2023). Thus, analyzing how cities in the global South finance and implement their climate actions is of growing importance. This dissertation emphasizes the significance of examining the life cycle of municipal green bonds in cities marked by socio-environmental inequalities, urbanization patterns, and climate change exposure.

Observing the 'climate finance gap' across San Francisco, Cape Town, and Mexico City, this study employs a consistent unit of analysis, the municipal green bond financing water infrastructure, under a unified analytical lens, the climate justice framework, thereby maintaining the coherence and thematic continuity of the dissertation (Ragin, 1994) and yielding pertinent findings. Moreover, instead of seeking to identify procedural or substantive divergences through contrast, this study uses the juxtaposition of the three case studies as an opportunity to apply the analytical framework of climate justice. This framework, with its three pillars of distribution, recognition, and procedure (see chapter 3), is tested for its ability to uncover hidden aspects and discursive frictions in the conception, issuance, implementation, and public narration of municipal green bonds.

Essentially, municipal green bonds serves as a climate finance instrument used to finance initiatives, such as infrastructure projects or municipal services, that qualify as climate action, encompassing both mitigation and adaptation efforts. Climate action has been globally recognized as a priority with the Paris Agreement (2015) and is endorsed in the United Nations Sustainable Goal 13, which calls for urgent measures to combat climate change and its impacts (UN General Assembly, 2015). Climate action includes efforts to mitigate the causes of climate change and to adapt to its consequences (EUR-Lex, n.d.). Given these goals, climate finance has become critical, facilitating the mobilization of both public and private funding to support climate action (UNFCCC, n.d.). The interaction between climate finance and climate action continuously influences patterns of capital circulation and the distribution of financial and environmental benefits and burdens. This interaction necessitates examination from a climate justice perspective, particularly focusing on the distributive aspects of justice.

This dissertation operates at the crossroad between municipal green bonds, climate change and climate finance, and combines a qualitative and case study methodological approach to enrich the empirical and theoretical understanding of municipal green bonds as a climate finance instrument and their role in climate action, particularly focusing on water infrastructure, which is crucial for climate change adaptation (Tortajada, 2016).

In San Francisco, the municipal green bond financed the complete reconstruction of the city's largest wastewater treatment facility, a significant source of pollution, which is situated in the Black-majority neighborhood of Bayview-Hunters Point. In Cape Town, during the 2015-2018 drought, the municipal green bond financed water management devices that restricted access to drinking water in low-income households, predominantly allocated in Black-majority and 'Coloured'-majority neighborhoods. In Mexico City, the municipal green bond was utilized to finance infrastructure for floodwater regulation and groundwater filtration in the low-income boroughs of Iztapalapa and Tláhuac, in the eastern part of the city.

In all the cases, municipal green bonds functioned as performative gestures, using green narratives to promote financially lucrative approaches to the green transition while simultaneously (re)producing local climate injustices, especially with regards to water distribution. These bonds connected local injustices to broader climate finance dynamics and financial markets, illustrating the interplay of local injustices, climate vulnerabilities and global capital flows. This demonstrates the critical need to analyze and address municipal green bonds through a climate justice analytical framework.

Through a combination of fieldwork, analytical work, and theoretical reflection, this dissertation provides innovative and valuable points of reflection to academics who study green bonds from a political economy perspective, to policy makers who are already engaged or considering the issuance of such financial tools, as well as to organizations advocating for justice in climate finance and climate justice. From an academic perspective, the dissertation addresses two areas of the existing international literature that appear to be under-discussed (see chapters 3 and 4) and that would benefit from both the analytical and methodological frameworks adopted hereunder. First, the current literature on climate finance from a climate justice perspective largely neglects green bonds and predominantly focuses on the national level of climate finance, often overlooking the municipal or subnational scale (see chapter 3). Secondly, there is a notable gap in the political economy literature on green bonds concerning the integration of a climate justice perspective, as explained in chapter 4. These gaps reiterate the necessity for this research, which seeks to broaden the scope of analysis to include the often-neglected municipal or subnational scales and to infuse the climate justice perspective into the discussions on the political economy of green bonds.

Beyond the academic sphere, this work offers valuable insights for all actors involved in the issuance and implementation of municipal green bonds. This includes local governments, development banks, cooperation agencies, financial intermediaries, standard setters, investors, and affected communities, particularly low-income households. Communities impacted by

projects financed through municipal green bonds and the associated debt burden may question their level of participation in climate finance and climate action decisions that affect them. Civil society organizations that support these communities and safeguard the public interest will find essential elements in this work to engage more effectively in this debate. Furthermore, various actors involved in the municipal green bond issuance process will discover critical components to integrate climate justice criteria into discussions on municipal green debt.

1.2 The Author's Positionality

Social research is not merely a result but a process, a series of efforts undertaken by the researcher who interacts with people, contexts, and data (Bourke, 2014). Consequently, the research process is influenced by the researcher's subjectivity, including aspects of their identity and educational background. Acknowledging this subjectivity is crucial for a deeper understanding of how the research was conducted and its outcomes. Bourke rationalizes the significance of positionality, stating:

> "*To achieve a pure objectivism is a naïve quest, and we can never truly divorce ourselves from subjectivity. We can strive to remain objective, but must be ever mindful of our subjectivities. Such is positionality. We have to acknowledge who we are as individuals, and as members of groups, and as resting in and moving within social positions.*" (Bourke, 2014, p 3).

The positionality of the researcher responsible for conducting this dissertation reveals his subjectivity, providing insight into his approach and interaction with the subject matter of the municipal green bonds within the distinct contexts of the case studies in San Francisco, Cape Town, and Mexico City. The researcher, who is also the author of this dissertation, identifies as a heterosexual, cisgender, first-generation college graduate[6] Colombian man. He has spent the majority of his life in Colombia, with a professional background spanning at least five years as environmental lawyer and coordinator of the environmental justice network in Colombia. He is a PhD researcher in Belgium. He self-identifies as mixed-race ("mestizo"[7] in Spanish). However, his racial and ethnic identity varies across different contexts: in the United States, he is classified as Hispanic; in South Africa, as 'Coloured'[8]; in Mexico, as Colombian; and in

[6] For a definition of first-generation college graduate refer to Bettencourt et al. (2022). For an analysis of this variable among PhDs students, see Van Galen and Sablan (eds. 2021).
[7] Regarding the definition of "Mestizo" [Mixed race], further elaboration is provided in chapter 8, which focuses on the case of Mexico City, where this category holds particular relevance.
[8] The definition of "Coloured" [Mixed race] is further elaborated in chapter 7, which examines the case of Cape Town, where this category is particularly significant.

Belgium perceptions fluctuate between White or Brown Latin American, depending on the observer.

The author's positionality, shaped by personal and professional experiences, has enabled a nuanced observation and understanding of the complex manifestations of climate vulnerabilities and the contextual nature of climate justice. These concepts are elaborated in detail in chapter 3. However, being an outsider to the contexts of the case studies introduces a limitation in fully grasping the complexities inherent in these diverse settings across three distinct countries: South Africa, Mexico, and the United States. Despite this, the diversity of these contexts, cases, and information sources related to the same unit of analysis (municipal green bonds of water infrastructure) has allowed the author to explore their intricacies from both financial and environmental perspectives. This exploration extends to the tangible aspects of the water infrastructure projects and neighborhoods as well as the intangible realms of climate finance and narratives, all through the lens of climate justice.

1.3 Genealogy of this Research

The idea for this research originated with Professor Tomaso Ferrando, who proposed the project titled "Green City Bonds as a Space of Socio-Ecological Conflict" (Ferrando, n.d.). This project aimed to conduct a power-sensitive and socially-informed analysis of three global cities that utilized "Green City Bonds" to finance their climate change adaptation or mitigation strategies (Ferrando, n.d.). In 2020, Héctor Herrera, the author of this dissertation, was selected to undertake this study as part of his doctoral works. The author obtained his Master's degree in Public Policy, a field traditionally grounded in interdisciplinary methodologies designed to generate robust knowledge that addresses policy-relevant issues (Dunn, 2012). This approach aligns with the multidisciplinary nature of Development Studies, which is further elaborated below.

During the literature review, the author noted that the majority of cities issuing green-labeled and non-labeled bonds, known as 'vanilla' bonds in financial jargon, were predominantly in the United States (US) (Baker et al., 2022). US municipal bonds and municipal green bonds would thus need to be central to the analysis, even if these cities were not geographically located in the so-called global South (Karpf and Mandel, 2018; Partridge and Romana, 2019; Baker et.al, 2022). Similarly, the author noted that human geographers tend to refer to these financial instruments as municipal green bonds (see, e.g. Hilbrandt & Grubbauer, 2020; García-Lamarca & Ullström,2020). Consequently, the category 'municipal green bond' was preferred in this dissertation. This adjustment was also motivated by the realization that not only city

governments issue these type of bonds, but also other municipal or subnational entities, such as indigenous reservations, utilities companies, or public transportation agencies, also issue this municipal debt securities (see chapters 4 and 5 for more details).

To examine the socio-ecological conflicts associated with municipal green bonds through a power-sensitive and socially-informed lens, the conceptual framework of climate justice was selected. This framework was chosen due to its roots in racial and environmental justice, its recognition in international climate change politics, as evident in the Paris Agreement (Schlosberg & Collins, 2014; Okereke & Coventry, 2016) and the IPCC (2023), and its application for the analysis of other climate finance instruments (e.g., Vanderheiden, 2015; Baird & Green, 2020). Focusing on the financing of water infrastructure trough municipal green bonds was considered the most pertinent way forward since water both an essential environmental and climate adaptation element, but also a key element for all humans and communities, regardless of income level or cultural practices (Howard et al., 2020). This universality makes water an analogous element across potentially very different cities located in Africa, Latin America, and North America. The concept of the hydrosocial cycle of water, drawn from the tradition of political ecology (Boelens et al., 2016), further supports this focus on water infrastructure, and therefore is better elaborated in the methodological framework contained in chapter 2.

Covid-19 Statement

On January 30, 2020, the World Health Organization (WHO) declared a Public Health Emergency of International Concern (PHEIC) due to the outbreak of COVID-19. Subsequently, on March 11, 2020, the WHO escalated the situation to a global pandemic (Cucinotta & Vanelli, 2020), resulting in widespread closures of borders and public spaces. This emergency period was officially concluded by the WHO on May 4, 2023, by which time there were 766 million reported cases and nearly seven million deaths globally (IISD, 2023).

The author of this dissertation started his doctoral studies on April 1, 2020, three weeks into the declared pandemic. The COVID-19 period presented numerous challenges during the initial two years of the research process. COVID-19 measures complicated research logistics, leading to several interview requests being either rejected or conducted virtually due to pandemic concerns. When required by current COVID-19 regulations, in-person interviews adhered to strict hygiene protocols. These measures included the use of face masks, the availability and use of hand sanitizers, and the maintenance of physical distancing. These challenges were particularly pronounced during the first field visit to San Francisco in December 2021 and

January 2022, limiting the number of interviews conducted. The situation improved significantly during subsequent fieldwork in Mexico City in February and March 2022, and in Cape Town from September to December 2022.

Additionally, the author faced increased levels of stress and anxiety, a common experience for many during this period. However, the pandemic also imparted valuable lessons in self-care and mutual care in diverse contexts related to the research process, including Colombia (the author's country of origin), Belgium, the United States, and Mexico. Similarly, the author's methodological courses at the Research School for International Development, traditionally held in person in the Netherlands, were conducted online from March to June 2021 due to COVID-19, preventing the group from meeting in person.

Initial Reflections on the Fieldwork

As part of the research process, the author had the opportunity to conduct seven months of fieldwork in Cape Town, Mexico City, and San Francisco between 2021 and 2022. To illustrate the importance of the field sites for the dissertation, three snapshots from each location serve as a prelude to the empirical discussions in chapters 6, 7, and 8. These images introduce two key reflections on the fieldwork: the encounter with local climate injustice in the form of racial and gendered climate vulnerabilities, and the dissonance between the green labels of municipal bonds and the realities of the climate change adaptation projects they financed.

Environmental racism, as defined by Pulido (2016), involves the accumulation of pollution sources in Black communities. This issue was openly evident during the first fieldwork visit to San Francisco, particularly in the Bayview-Hunters Point neighborhood, where the municipal green bond financed a wastewater treatment plant. Many households and businesses in this historically Black-majority neighborhood displayed signs demanding the cleanup of toxic and radioactive waste, highlighting the persistent pollution issues (see figure 6). This context stressed the necessity of examining municipal green bond implementations through a climate justice lens.

In Cape Town, the fieldwork began with a workshop on equitable urban climate adaptation, hosted by the African Climate & Development Initiative at the University of Cape Town. During breakfast with a water activist, the author inquired about the Water Management Devices (WMDs) program, which received 83% of the municipal green bond proceeds (KPMG, 2017). The activist referred to these devices as "weapons of mass destruction (WMDs)," a riposte on their acronym, reflecting the negative impact on communities and the resistance they faced in lower-income and Black-majority and ‘Coloured’-majority communities (Scheba et

al., 2021). This initial encounter, supported by subsequent empirical work and documents review detailed in chapter 7, accentuated the importance of addressing this case through a climate justice lens, particularly considering the racial dimension of climate vulnerability.

In Mexico City, during an interview with a female household member regarding the impacts of the municipal green bond-funded water infrastructure, her daughter utilized the time to recycle household wastewater for irrigating the garden (Household member interview, March 14, 2022). This episode was an initial indicator of climate injustice, later substantiated by further empirical work and documents review as presented in chapter 8. It highlights the importance of addressing this case with a climate justice approach, specifically incorporating the dimension of gendered climate vulnerability.

Two key reflections emerged from this fieldwork. Firstly, the water infrastructure projects financed by municipal green bonds in the three case studies are situated in contexts of racial and gendered climate vulnerability. This scenario highlighted a dissonance between the green label of the municipal bond, its associated documentation, and stated objectives, versus the empirical reality of the implementation of these financed water infrastructure projects. Consequently, it became essential to observe firsthand the outcomes of these projects. Therefore, the fieldwork and interviews were invaluable for this dissertation, particularly within the climate justice framework. This is elaborated in detail in the subsequent chapter on the methodological framework and in the empirical chapters 6, 7, and 8.

Engagement in Educational and Professional Growth Activities

Participation in education and professional development activities, such as training, seminars, and workshops, significantly enhance the author's understanding of urban climate finance from a justice perspective. Notably, the Urban Climate Finance Network hosted an online Masterclass series in 2021-2022 titled 'Decentering Urban Climate Finance,' which included sessions on urban climate finance research, the urban materialities of climate finance, and climate finance and justice in cities. Furthermore, this network organized a writing workshop in Zurich (Switzerland) in May 2022. These opportunities enable the author to deepen his knowledge on these subjects and collaborate with colleagues, culminating in the publication of the article "The 'Colorblindness' of Climate Finance: How climate finance advances racial injustice in cities" (Hofmann et al., 2024).

In September 2022, the author attended the workshop on Equitable Urban Climate Adaptation, organized by the African Climate and Development Initiative at the University of Cape Town, South Africa, which provided a valuable platform for learning and dialogue. Thanks to the

participation of community members, government officials, and academic colleagues in the region, such dialogue enriched the author's understanding of the Cape Town context, as he participated in roundtables where community members, government officials, and academics debated urban climate adaptation issues. The workshop culminated in the production of the policy report *Equitable Adaptation to the Urban Climate: The Importance of Structural Considerations* (Dongo et al., 2023).

The policy report (Dongo et al., 2023) emphasizes that the challenges of climate change adaptation are exacerbated in low-income urban settlements in Africa due to historical socio-economic disadvantages. Consequently, the 2022 workshop led to the formulation of several public policy recommendations. These include mapping existing climate change adaptation efforts, ensuring inclusive community participation, integrating adaptation into broader social and economic programs, acknowledging historical injustices and structural barriers, and balancing climate governance through a combination of bottom-up and top-down approaches. These recommendations aim to promote transformative and just climate adaptation (Dongo et al., 2023).

In May and June 2023, the author contributed to the *Debt and Green Transitions* blog series published on the European Development Association Research Portal. This series served as a platform to explore various aspects of green finance, including green bonds and green transition (Ferrando & Jokubauskaite, 2023), blue bonds (Kiliç, 2023), green bond certifications (Garcidueñas Nieto, 2023), and funding gaps and blended funding (Bigger, 2023). To enhance the discussion on green finance in Latin America, the series was also translated into Spanish and published by the Mexico City office of the Heinrich Böll Foundation (Ferrando & Jokubauskaite, 2023b).

The debate in the blog series significantly contributed to the author's learning process and shaped his positionality by examining the relationship between climate finance instruments and debt, including their redistributive, intergenerational, and exclusionary effects (Ferrando & Jokubauskaite, 2023). This exploration deepened the understanding of the connection between the climate justice approach and green bonds, which are green-labeled debt instruments financing climate change adaptation projects in local contexts of climate injustice, as examined in the cases under study in this dissertation.

In addition, from March to June 2023, the three-day training series on interdisciplinarity in a urban research context, organized by the Institute of Development Policy (IOB) and the Urban Studies Institute at the University of Antwerp, significantly enhanced the author’s research

approach. This training reinforced the interdisciplinary nature of the research, rooted in the tradition of Development Studies, which integrates diverse academic disciplines to understand social changes from local to global levels and their interconnections (Monks et al., 2017). Defined by the European Association of Development Research and Training Institutes, Development Studies aim to address complex societal issues like climate change and environmental sustainability through a rights-based and policy-influential approach that is sensitive to social and environmental contexts (Monks et al., 2017).

Benefitting from the continuously evolving and reflective nature of Development Studies, the author decided to adopt an interdisciplinary[9] stance and to focus on the material and immaterial nexuses between local and global climate injustice and on the way in which they interplay with the global climate finance and climate action. The context of the growing municipal green bond market appeared perfect for this enquire, and the climate justice analytical framework equally aligned with growing themes in the field of Development Studies such as the research on climate change and socio-environmental sustainability as inherently linked to the improvement of living conditions, people-planet relationships and the construction of economies that operate within planetary and social boundaries where no one is left behind (Monks et al., 2017).

The foundational concepts of sustainable development can be operationalized through frameworks such as doughnut economics (Raworth, 2017), green growth and sustainability (Sachs et al., 2019). Additionally, alternatives that critique the feasibility of sustained economic growth within planetary boundaries, such as degrowth and post-development, have been proposed (Escobar, 2015; Hickel & Kallis, 2020). While this broader debate extends beyond the scope of this dissertation, it provides a relevant backdrop for discussions on climate finance, which are inherently situated within this larger discourse on sustainable development.

Ultimately, the four-years research project has resulted in the establishment of an international and trans-disciplinary network, which has already led to the publication of three articles in peer-reviewed journals:

- Herrera, H. (2024b). The proliferation of municipal green bonds in Africa and Latin America: The need for a climate justice approach. Environment and Urbanization, 36(1), 147–172. https://doi.org/10.1177/09562478241230290

[9] Slot (n.d.), drawing on Huutoniemi et al. (2010), provides a clear definition of multidisciplinarity and interdisciplinarity. A multidisciplinary approach involves investigating the same topic from multiple disciplines simultaneously without integration. An interdisciplinary approach involves researching a topic using multiple disciplines in an integrated manner, such as through methodological or theoretical frameworks.

- Herrera, H. (2024a). Embedding Municipal Green Bonds in Mexico City's hydrosocial cycle: "Green" debt and climate action narratives. Journal of Political Ecology, 31(1). https://doi.org/10.2458/jpe.5664
- Hofmann, S. Z., Ponder, C. S., Herrera, H., De Vera, M., Rodriguez, A. D., & Buyana, K. (2024). The 'colorblindness' of climate finance: How climate finance advances racial injustice in cities. City, 1–21. https://doi.org/10.1080/13604813.2024.2348209

The first article provides an overview of municipal green bonds, tracing their origins and drawing lessons from the municipal bond experience in the United States (Herrera, 2024b). It then details the current state of the municipal green bond market in Africa and Latin America. Following, the article uses the case studies of municipal green bonds in Mexico City, Cape Town and San Francisco to demonstrate the necessity of a climate justice perspective in understanding and addressing this climate finance instrument (Herrera, 2024b). While this article (Herrera, 2024b) shares some elements with this dissertation, it focuses solely on demonstrating the relevance of applying a climate justice approach. In contrast, this dissertation delves deeper, thoroughly applying the climate justice framework and providing additional insights into the case studies. It explores the narratives associated with the bonds and examines the broader context of the green bond market and the local contexts of climate injustice in which projects financed by municipal green bonds were implemented in San Francisco, Cape Town, and Mexico City.

The second article dives into the specific experience of the municipal green bond for water infrastructure of Mexico City, examining its interaction with the city's hydrosocial water cycle (Herrera, 2024a). However, this dissertation goes further by offering a comprehensive examination of the municipal green bond experience of Mexico City through the lens of the three pillars of climate justice: procedural justice, recognition, and distributive justice. Additionally, it contextualizes and discusses the findings from the Mexico City case with those from Cape Town and San Francisco, particularly in the discussion presented in chapter 9.

The third article, co-authored with fellow researchers from multiple disciplines and affiliations (Hofmann et al., 2024), explores how climate finance perpetuates racialization in urban climate adaptation projects using the analytical lens of racial capitalism (Robinson, 1986; Jenkins and Leroy, 2021; cited in Hofmann et al., 2024). This piece analyzes three case studies, a Payment for Ecosystem Services project in the Philippines, an urban redevelopment project in the United States, and the municipal green bond experience in Mexico City (Hofmann et al., 2024). This dissertation goes beyond the analysis presented in the collective article by providing a more detailed examination of the Mexico City case, alongside analogous cases of municipal green

bonds in Cape Town and San Francisco. Moreover, it develops the racial aspect not from the perspective of racial capitalism but as a dimension of climate vulnerability, particularly in the discussion in chapter 9. Finally, elements and ideas of all three articles (Herrera 2024a, 2024b; Hofmann et al., 2024) are integrated into this dissertation, which extends beyond them by providing more empirical detail and broader theoretical analysis, thus stablishing its own coherent and unique line of argumentation.

1.4 The Triangular Structure of this Dissertation

The structure of this thesis can be visually conceptualized as three interlocking triads: three case studies are discussed through three phases of their lifecycle, and analyzed through the three pillars of climate justice. In particular, the three municipal green bonds of Mexico City, Cape Town, and San Francisco are examined trough three distinct phases of the municipal green bond process (green labelling, the implementation of the financed projects, and the narratives that emerge thereafter) and then scrutinized through the three pillars of the conceptual framework of climate justice: procedural justice, recognition, and distributional justice.[10] The triangular analogy simplifies the comprehension of how this dissertation is structured, providing a clear approach to examining the complexities of climate justice within the context of municipal green bonds.

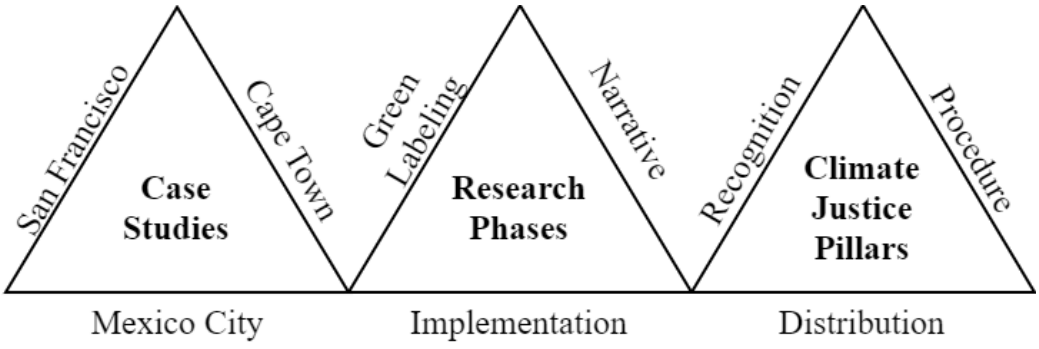

Figure 2. Triangular Structure of the Dissertation. Source: Author.

First, chapter 2 outlines the link between the procedural steps behind a municipal green bond and the methodology adopted in this dissertation. In particular, the methodology is divided into three components in a way that mirrors the three steps behind each municipal green bond. Initially, the green labeling of the municipal bonds is scrutinized trough the review of documents, primarily the green bond framework document and the subsequent follow-up reports. Then, the implementation of the three water infrastructures financed by the municipal

[10] These pillars are explored alongside various intersecting climate vulnerability dimensions such as income, race, and gender. It is important to note that these dimensions are not exhaustive; and other dimensions may be relevant depending of the context, as explained in the chapter 3 about the climate justice analytical framework.

green bonds is studied via a combination of direct observation, semi-structured interviews and document analysis. Finally, the dissertation focuses on public interventions, documents and policy communications to analyze the narratives that have emerged around the issuance of each green bond and how they contributed to and were shaped by broader discussions of climate action and financial innovation.

Such tripartite structure is utilized in each of the empirical chapters. The reflection begins with San Francisco (chapter 6) because of the role that the US bond market played as term of reference for countries and cities in the global South, which allows to establish a link between the discussion on municipal bonds in the US, a global North country, and the cases in the global South. Then, the municipal green bond experience in Africa is analyzed via the case of Cape Town (chapter 7), while the experience in Latin America is examined via the example of Mexico City (chapter 8). In all three cases, the issuers promoted a narrative framing the municipal green bonds as successful instruments of climate action, that was not informed by any adequate engagement with the implications on the underlying social and climate injustices, therefore obliterating the experience of the people who were most affected by the construction and functioning of the infrastructure as the material representation of the municipal green bonds (see the final section of each empirical chapter).

In all the cases examined in this dissertation, municipal green bonds are portrayed by their issuers and other stakeholders involved in their promotion and circulation as success stories of climate action (Environmental Finance, 2017; 2018; Johansson, 2019). This narrative emphasizes the positive achievements of the financed projects, as illustrated in the empirical chapters of this dissertation, while simultaneously obscuring local climate injustices. The construction of this positive narrative around green bonds occurs in two stages: first, the green label is obtained for the municipal bond, establishing its credibility as a climate action tool; second, public relations efforts, such as media coverage, participation in key events, and receipt of green awards, are made to reinforce the perception of success. These efforts reinforce the narrative of municipal green bonds as climate action initiatives with positive impact, overlooking the complex realities of injustice within specific contexts. Therefore, identifying and critically examining these constructed narratives is crucial in this dissertation to provide a broader understanding of municipal green bonds and their environmental and social impacts.

The three pillars of the climate justice framework are used to critically analyse the three phases of the bonds: labeling, implementation, and communication. Recognition explores which actors, factors, and worldviews or perspectives were considered within the context of municipal green bonds. Distributional justice pays attention to how financial and environmental benefits

and harms are allocated among individuals, states, and different generations (IPCC, 2023). These pillars are explored trough the dimensions of climate vulnerability, with income, race, and gender playing a central role to critically scrutinize the way in which climate finance, climate change and climate justice interact at the local and international level.

The IPPC defines vulnerability to climate change as the predisposition to be adversely affected, including susceptibility to harm and deficient capacity to cope and adapt to climate impacts (IPCC, 2023). This dynamic concept varies across time, communities, and countries, reflecting complex interactions of factors like economic status, social position, and location. Vulnerability is closely linked to risk, indicating potential adverse consequences in the context of climate change (IPCC, 2023). This dissertation operationalizes the IPCC's climate justice framework by integrating the concepts of vulnerability and intersectionality, emphasizing how climate impacts disproportionately affect marginalized urban populations. Vulnerability is shaped by intersecting factors such as gender, race, class, ethnicity, age, ability, sexuality, and nonconforming gender identities. These intersecting vulnerabilities are deeply rooted in historical structures of discrimination including patriarchy, racism, colonialism, and other exclusionary practices (IPCC, 2023). The integration of vulnerability and intersectionality within the climate justice framework is explained in detail in chapter 3.

In the cases of San Francisco and Cape Town, historical reviews highlight the context of racial injustice and environmental racism (Pulido 2016, Seamster & Purifoy, 2021) in which water infrastructure projects financed by municipal green bonds were implemented. In San Francisco, the research conducted for this thesis reveals that the municipal green bond reproduced the existing environmental racism by financing the perpetuation of the operation of the Southeast Wastewater Treatment Plant, a source of pollution located in Bayview-Hunters Point, a predominantly Black neighborhood within a majority White city. In this first case study, race is the most relevant climate vulnerability dimension. Similarly, in Cape Town, the empirical work evidenced that the bond financed a water management device program that restricted access to potable water in low-income households, predominantly affecting non-White populations in the city. In this second case study, income and race are the most relevant dimensions. These cases are discussed in detail in chapters 6 and 7. For the case of Mexico City, covered in chapter 8, the decision was made to deploy the concept of the hydrosocial cycle of water, rooted in the tradition of political ecology (Boelens et al., 2016), to make visible the local climate injustice in the dimensions of climate vulnerability of income, gender, and race.

Through a combination of methodology and analytical framework, the three triads (empirical cases, investigative phases, and climate justice pillars) illustrated in figure 2 converge and

complement each other throughout this dissertation. The pillars of climate justice provide an analytical framework that exposes the realities of climate injustice in the local contexts of the three case studies, where municipal green bonds finance water infrastructure. The triad of the three phases of the municipal green bond lifecycle structures the investigative process of this dissertation, guiding the analysis from the initial green labeling of the bonds, through their implementation, to their subsequent narration. Each triad constitutes a fundamental component of this dissertation: the pillars of climate justice serves as the analytical lens; the municipal green bonds cases are the objects of analysis; and the three investigative phases delineate the temporal structure of this analysis.

Ultimately, this dissertation is guided by the overarching question: How do municipal green bonds, as climate finance instruments, engage with climate action (adaptation and mitigation) and interplay with local and global climate injustices? Each case study addresses this central question in its respective empirical chapter. The sub-research questions include:

1. What impacts does the implementation of infrastructure financed by municipal green bonds have on water distribution and adaptation to climate change?

2. What relevant dimensions of climate vulnerability are recognized or overlooked by the implementation of projects financed by municipal green bonds?

3. What narratives emerge from the issuance of municipal green bonds?

1.5 Dissertation's Outline

This dissertation examines municipal green bonds financing water infrastructure through the analytical lens of climate justice and the use of qualitative and empirical work on three specific case studies. It draws on the experiences of actors and territories involved in all the phases behind three specific municipal green bonds issued in San Francisco, Cape Town, and Mexico City and uses the findings to provide a reflection on the alignments and misalignments between climate action, climate finance and climate justice. The next sections provide a short summary of each of the following chapters.

Chapter 2. Methodology and Location in the Literature. This chapter delineates the rationale behind the methodological choice of this dissertation, emphasizing the adoption of a qualitative and empirical approach. It details the selection of the three case studies, Cape Town, Mexico City, and San Francisco, and the elements that keep them in common despite their geographical, social, economic, and legal differences. The specific focus on water infrastructure is also explained, for which is introduced the concept of the hydrosocial cycle of water (Linton

& Budds, 2014; Boelens et al., 2016). Likewise, the three research phases of this dissertation are explained and the corresponding methods. In the first phase, the green labeling documents are reviewed to identify the objectives and projects to be financed by the municipal green bonds. In the second phase, the materialization of green bonds in the selected projects, namely water infrastructure, is analyzed through direct observation, semi-structured interviews and documents review. In the third phase, the narratives built around the municipal green bonds are analyzed. Finally, the ethical considerations are explained.

Chapter 3. The Umbrella of Climate Justice as the Analytical Framework to Reflect upon Green Bonds. This chapter explains the conceptual framework of climate justice used to examine municipal green bonds. It traces the evolution of climate justice from its origins in racial justice and environmental justice to its incorporation into international climate change policy. This serves as an introduction to detailing the IPCC (2023) definition of climate justice, which is adopted in this dissertation. The analogy of climate justice as an analytical umbrella is used to elucidate this definition and facilitate its application to the subsequent case studies. The chapter also introduces the literature that addresses climate finance from a climate justice perspective, with particular attention to its two main clusters: the distribution of the burden of climate finance among countries and the analyzes of specific financial mechanisms. Both clusters are then questioned because of their limitations, that this dissertation aims to address. The thesis shifts the focus from the national or country-level to the subnational or municipal-level, and highlights the lack of specific analyzes on green bonds and municipal green bonds as financial instruments that play a direct role in (re)producing the conditions for climate (in)justice.

Chapter 4. Understanding Green Bonds and Municipal Green Bonds. This chapter provides introductory but exhaustive information on municipal green bonds as a sub-category of green bonds and bonds more broadly. It starts by tracing their origin, from the development banks support starting in 2008 to the publication of international voluntary green labeling standards starting in 2014. Understanding the green labeling process is crucial for this dissertation, as it relies on documents from this process as primary inputs, such as the green bond framework documents and follow-up reports. Other basic elements of green bonds in general and municipal green bonds in particular are also explained. This also helps to justify the relevance of crossing the analysis of green bonds with municipal bonds, historically advanced in the United States, as further elaborated in chapter 5. Also, is presented the state of the municipal green bonds market in Africa and Latin America. All of this information serves the stage for the three case studies that follow located in the United States, South Africa and

Mexico, providing a comprehensive background necessary to understand the implications and applications of municipal green bonds within these diverse geographical contexts.

Chapter 5. United States Municipal Bonds as a Relevant Precedent: Racial and Environmental Injustices. Given that municipal green bonds are essentially municipal bonds with a green label, it is pertinent to explore the origins and development of municipal bonds in the United States. This exploration is crucial as development banks and cooperation agencies have often promoted US municipal bonds as a model to follow in the global South to obtain financial resources for development projects, as discussed in this chapter. This chapter looks into the US experience with municipal bonds, examining both quantitative and qualitative evidence of how these debt instruments can perpetuate racial and environmental injustices. A particular focus is given to environmental injustices linked to water infrastructure projects, illustrating the critical need to analyze spatial distribution to fully understand climate-related water injustices in the cases under study. Finally, the chapter discusses how, in the United States, with a municipal bond market with more than two centuries of history, a debate centered on municipal debt and racial justice has begun.

Chapter 6. San Francisco Municipal Green Bond: Wastewater Distribution Amidst Climate Injustice. The chapter begins with an introduction to the basic details of the San Francisco case, moving into an analysis of the climate injustice context regarding the distribution of wastewater. It critically examines the climate justice pillars and concludes with a discussion on the narrative surrounding the municipal green bond. In San Francisco, contaminated water and its treatment is concentrated in the Black-majority neighborhood of Bayview-Hunters Point (BHP), a community historically subjected to environmental injustice due to pollution sources. The municipal green bond, issued by the San Francisco Public Utilities Comission in 2016, raised debt of 241 million USD dedicated to the renovation of the wastewater infrastructure, of which the most relevant is the Southeast Treatment Plant in BHP, which processes 80% of the city's polluted water. The investment from the green bond contributed to the complete reconstruction of this treatment plant in the same location in BHP, increasing the capacity, longevity, and environmental standards purportedly benefiting the whole city. However, this investment also perpetuated environmental racism, or the concentration of pollution sources in Black spaces, by maintaining the pollution source within BHP, sidestepping more transformative solutions such as relocating the plant. By allocating financial resources to service the municipal green debt and promoting a green narrative, the bond diverted attention and resources away from substantial solutions to these deep-rooted

injustices. Race emerges as the most critical dimension of climate vulnerability in this case study.

Chapter 7. Cape Town Municipal Green Bond: Potable Water Restriction Amidst Climate Injustice. This chapter begins with an overview of the basic facts of the case, then addresses the climate injustice linked with the water distribution restrictions enforced by the water management devices financed by the 2016 municipal green bond, and then examines the case under the climate justice pillars. It concludes by examining the green narrative advanced by the bond and reviewing the key findings. In Cape Town, the distribution of drinking water exemplifies a state of climate injustice. From 2007 to 2021, access to drinking water was restricted by the installation of water management devices in low-income households, primarily located in neighborhoods historically racialized during the apartheid. In 2016, the Cape Town government issued a municipal green bond for 75 million USD (one billion ZAR), with 83% of the proceeds earmarked to finance these water management devices. The municipal green bond overlooked the prevailing climate injustice context, thereby exacerbating it by allocating financial resources to service the green municipal debt and by emphasizing the green narrative associated with the bond. In this case study, race and income emerge as the most relevant dimensions of climate vulnerability.

Chapter 8. Mexico City Municipal Green Bond: Water Regulation Amidst Climate Injustice. This chapter introduces the case's basic details, exploring the climate injustice associated with water and space distribution in Mexico City. It critically examines the green bond-financed projects within this context, and explores the climate justice pillars, followed by the narrative promoted around the green bond, and then ends with the conclusions. In Mexico City, a situation of climate injustice exists in the distribution of water, marked by both excess (floods) and scarcity (intermittence and overexploitation of groundwater), particularly in the eastern side of the City, where low-income neighborhoods are concentrated. In 2016, the Mexico City Government issued a municipal green bond worth 53.2 million USD (one billion MXN), with the biggest allocation of proceeds on water infrastructure directed towards the Vicente Guerrero infrastructure for floodwater regulation and the Selene plant for groundwater treatment, both situated in the eastern part of the city. While these projects yield positive short-terms effects, they fail to offer substantial solutions, as they do no tackle the fundamental issues of water and space distribution within the city. Additionally, the short-term benefits of the Selene plant could become detrimental in the long run, as the continued depletion of groundwater leads to the collapse of the surface above, affecting low-income households located in that surface. The municipal green bond did not address the prevailing climate

injustice related to the distribution of water and space in Mexico City; instead, it perpetuated this situation by allocating resources to services green municipal debt and emphasizing the green narrative surrounding the bond. This case study highlights the intersectionality of climate vulnerability, with income, gender, and race emerging as critical dimensions.

Chapter 9. Discussion and Conclusions. This chapter synthesizes and puts into dialogue the findings from the case studies of municipal green bonds in San Francisco, Cape Town, and Mexico City, examining how these bonds intersect with issues of climate justice and climate action. This chapter explores the dialogue between the global North and South in relation to urban climate finance, particularly by reflecting on the insights from academic discussions on municipal bonds in the United States presented in chapter 5, and how these insights help to understand experiences in Africa and Latin America, especially in terms of racial injustice. Following the triangular framework proposed in this dissertation, the subsequent sections of the chapter are organized around the three pillars of climate justice, highlighting the similarities that emerge when juxtaposing the three empirical cases. The chapter then focuses on the positive narratives surrounding municipal green bonds in the case studies and argues that these narratives contradict the persistence or reinforcement of local climate injustices. In the final part, the chapter proposes that adopting a climate justice perspective to analyze municipal green bonds contributes to the academic debate on green bonds specifically, and on climate finance more broadly, while also indicating potential avenues for future research.

Chapter 10. Policy Recommendations. This chapter provides five science-based public policy recommendations to guide municipal green bonds issuers, climate finance professionals, social organizations, and affected communities. 1. Open spaces for debate and participation with relevant communities before issuing municipal green debt. 2. Ensure accessible information and effective participation for communities in the green labeling of municipal bonds. 3. Recognize income, race, and gender dimensions of climate vulnerability in the green labeling process. 4. Ensure a just distribution of environmental and financial burdens and benefits. 5. Promote a global subnational dialogue with South-South and South-North exchange spaces on municipal green debt and its interrelationship with climate finance, climate action, and climate justice.

CHAPTER 2. METHODOLOGY AND LOCATION IN THE LITERATURE

2.1 Introduction

This chapter situates the dissertation within the growing literature on green bonds, outlines the adopted methodological framework, and introduces the case study strategy, explaining its suitability for this dissertation and the rationale behind the selection of San Francisco, Cape Town, and Mexico City as case studies. This approach allows for a comprehensive understanding of the scope and limitations of the dissertation's findings from a methodological standpoint. Additionally, it opens the possibility for future research on green bonds to replicate the methodology and research phases either in whole or in part.

Narrative analysis is also introduced in this chapter, highlighting its relevance in examining the interaction between the cases and the pillars of climate justice. The latter part of this chapter describes the methodological execution in three phases corresponding to the municipal green bond process. The first phase involves the green labeling that accompanies the preparation and issuance of the municipal green bond in the financial market, analyzed primarily through a review of green finance documents. The second phase focuses on the implementation of municipal green bond-financed projects, particularly water infrastructure projects, employing fieldwork, interviews, and additional document review. The third phase analyzes the emerging narratives of the municipal green bonds under study, utilizing document review and observations of public events and social media engagements promoting these bonds. The chapter concludes by addressing the ethical considerations that have guided this research.

2.2 Identifying the Research Gap in Social Sciences' Research on Green Bonds

Social sciences' research is a way of understanding and representing social reality, characterized by its reliance on the scientific method across various disciplines such as economy, sociology, anthropology, etcetera. It encompasses a diverse array of methodologies and research designs, including qualitative and quantitative approaches, which are directed towards investigating issues justified as relevant (Ragin, 1994). Therefore, the broad landscape of social research can be seen as including numerous academic communities that either utilize similar methodologies, concentrate shared themes, or come from the same discipline (Ragin, 1994; Sovacool, 2014). Emphasizing this is useful because green bonds have emerged as a significant topic for investigation within different disciplinary and methodological communities of social research (Jones et al., 2020; Cortellini & Panetta, 2021). This overarching perspective

provides a reference framework to situate this dissertation in the social research about green bonds.

Green bonds have gathered considerable interest as significant subject of social research across various disciplines such as economy and geography, employing diverse research designs, both qualitative and quantitative to study this climate finance instrument (Jones et al., 2020; Cortellini & Panetta, 2021; Gilchrist et al., 2021; Bhutta et al., 2022). Jones and colleagues (2020) identified four primary clusters within the literature on green bonds: applied research stemming from economics and law, public policy papers and market reports, news articles and analyses from financial publications, and academic analyses from human geography and related disciplines.

All the clusters of literature on green bonds can be categorized into two major segments based on the analytical focus:

- the practical challenges of market expansion (e.g., Liaw, 2020 and McAskill et al., 2021 cited in Cortellini & Panetta, 2021), and
- the political concerns regarding financial and environmental redistributions (e.g., Jones et al., 2020; Ferrando et al., 2022).

The majority of green bond literature concentrates on addressing the practical challenges associated with market growth (Jones et al., 2020). This includes discussions on safeguarding product integrity (Shishlov et al., 2016), enhancing financial and environmental performance (Yeow and Ng, 2021), facilitating market globalization (Banga, 2019), and achieving additionality (Chiang, 2017; Lam & Wurgler, 2024). Additionality refers to the financing of new or additional projects beyond those already planned (Jones et al., 2020).

The second segment, focused on political concerns, has experienced less growth compared to the practical challenges segment and centers on issues as exacerbating social inequalities, prioritizing financial returns over environmental benefits, and amplifying financial and environmental risks (Jones et al., 2020). Research within this segment already includes contributions from human geography (Jones et.al, 2020), political ecology (Christophers, 2018; García-Lamarca & Ullström, 2020), and political economy with a focus on distribution patterns (Neumann, 2023). This dissertation contributes to this body of work by addressing the political challenges associated with green bonds through a climate justice lens, which includes the pillar of distributive justice explained in the next chapter, employing qualitative and case study methodologies detailed subsequently.

With regards to the segment of the academic literature focused on political concerns, several studies have examined both green bonds and municipal green bonds. Bracking analyzed the performative aspect of green bonds within the green economy (2015) and their role in sustaining narratives that perpetuate historical structures of racialized capitalism (2024). Christophers, Bigger and Johnson (2020) explored how green bonds redistribute climate-related political risk both spatially and temporally. Ferrando and colleagues (2021) investigated the issuance of green bonds for forestry projects in Brazil, highlighting their role in extending the frontiers of capital accumulation under the World Ecology framework. Perkins (2021) provided a critical examination of green bond standards, discussing how they reinforce neoliberal capital by positing it as a virtuous contributor to public environmental goals. Neumann (2023) studied the role of green bonds in South Africa's energy transition, analyzing the political economy barriers to their effective implementation.

Within this segment of the literature, few studies have specifically focused on green bonds at the municipal scale. Christophers (2018) examined the complex financial and environmental risks linked to the issuance of a municipal green bond for green water infrastructure in Washington, D.C., United States. Hilbrandt and Grubbauer (2020) investigated municipal green bonds issued by Mexico City's government, noting that the application of green standards had minimal impact on project implementation but facilitated market promotion, knowledge dissemination, and garnered short-term political support. García-Lamarca and Ullström (2020) analyzed a municipal green bond in Gothenburg, Sweden, which financed green housing and supported capital circulation within a consensual, non-conflictual, and sustainable framework. Bigger and Millington (2020) explored municipal green bond issuances in Cape Town, South Africa, and by the Metropolitan Transit Authority in New York, United States. They found that these green bonds disproportionately placed financial and environmental burdens on impoverished communities and people of color (Bigger & Millington, 2020), and reduced options for the structural changes needed for just climate adaptation (Bigger & Millington, 2023).

In conclusion, the body of literature on green bonds is expanding rapidly, particularly in addressing the practical challenges associated with growing this market, in line with the climate finance "gap talk" outlined in the introduction (Bryant & Webber, 2024). However, the development of literature focusing on political concerns is progressing more slowly, especially in terms of explicitly integrating a climate justice analytical framework. This dissertation does a novel contribution to the green bond literature, especially within the analytical segment on political concerns, by applying a climate justice approach to case studies on municipal green

bonds. This is achieved through a qualitative and case study methodological approach, the details of which are discussed below.

2.3 A Qualitative Approach to Municipal Green Bonds

In social research, the research design typically adopts one of two approaches based on the number of cases examined and the depth of analysis: quantitative and qualitative (Ragin, 1994). The selection of methods, which can range from surveys and interviews to document analysis, is determined by the chosen research approach. A quantitative research design typically involves a large number of cases and focuses on a limited set of aspects or variables within these cases (Ragin, 1994; 2004). This approach is advantageous for identifying general patterns, stablishing correlations between variables, making predictive statements, or for testing and refining theories (Ragin, 1994). Examples from research on municipal bonds in the United States utilizing quantitative methods will be discussed below, illustrating how this approach has effectively identified general patterns and variable correlations related to racial dimensions. While this dissertation does not utilize a quantitative approach, it is mentioned here in order to juxtapose it with the qualitative methodology and highlight the distinct advantages and limitations of the latter.

A quantitative research approach to bonds can be illustrated by Loftus and colleagues (2022) who analyzed and sample of 362 municipal bonds issued by 56 indigenous governments from 1992 to 2021 in the United States, discovering that borrowing costs were higher for these issuances compared to those by non-indigenous governments. This discrepancy "(…) *translates to approximately $79,000 to $310,000 in higher annual interest payments for the average tribal issuer*" (Loftus et al. 2022, p 2). Another example is the study by Smull and colleagues, who examined 712,855 municipal bonds issued up until April 2022 in the United States, revealing a "systemic mispricing of risk in the municipal bond market, where race impacts the cost of capital, and climate does not" (Smull et al., 2023, p 1). In both studies, the quantitative approach enabled the identification of general patterns and correlations among variables related to the issuance of municipal bonds, borrowing costs, and ethnic and racial issues.

It is highlighted here the substantial sample sizes used in the aforementioned quantitative analyses of municipal bonds, with one study analyzing 362 bonds (Loftus et al., 2022) and another examining 712, 855 bonds (Smull et al., 2023). The prevailing quantitative approach to green bonds is well-represented in the literature, particularly within the discussion on practical challenges (Jones et al., 2020; Cortellini & Panetta, 2021). In contrast, this dissertation employes a qualitative approach, focusing in-depth on only three municipal green bonds. This

approach does not allow for the establishment of general patterns, correlations between variables, or predictions about the broader green bond or municipal bond markets. Conversely, examples of qualitative research on municipal green bonds are presented below and subsequently the unique methodological advantages and contributions of this dissertation.

The qualitative approach typically involves examining a smaller number of cases but explores a broader array of aspects or variables with those cases. This methodology facilitates deeper understanding and potential reinterpretation of phenomena, which is pivotal for incorporating perspectives of actors and factors that might otherwise be overlooked. It also offers a platform for proposing new theories (Ragin, 1994). Such an approach is strategically employed in this dissertation, applying the climate justice analytical framework in a novel manner to the study of green bonds. This methodology enables a nuanced interpretation of municipal green bonds as instruments of financial and environmental redistribution within contexts of climate injustice. Importantly, the qualitative methodology provides the possibility to enhance the representation of previously ignored actors and factors in green bond research, aligning closely with the recognition pillar of climate justice (Amorim-Maia et al., 2022), and enriching the discussions around procedural justice and distributive justice as well. To illustrate, two examples (Bigger & Millington, 2020; García Lamarca & Ullström, 2022) illustrate how this approach has been applied to the study of municipal green bonds.

Bigger and Millington (2020) conducted a study on the issuance of municipal green bonds by Cape Town, South Africa, and the New York Transportation Authority in the United States, highlighting how these bonds disproportionately burdened low-income working-class people of color with financial costs and environmental impacts (Bigger & Millington, 2020). Similarly, García Lamarca and Ullström (2022) explored the issuance of Gothenburg, Sweden's first municipal green bond, reinterpreting this financial instrument trough the politics of affect and post-political dynamics (Mouffe, 2011). Their analysis of the discourse by key stakeholders revealed how the green bond facilitated capital circulation in a way that sidestepped political contention and debate (García Lamarca & Ullström, 2022). These studies illustrate how a qualitative approach can uncover previously overlooked perspectives, such as the impact on working-class people of color in South Africa and the United States, and reinterpreted the role of green bonds in the sustainability discourse in Gothenburg, Sweden.

The research design of this dissertation diverges from a quantitative methodology, which typically involves large sample sizes and focuses on a limited number of variables to stablish general patterns, correlations, or predictive statements (Ragin, 1994). Instead, this thesis adopts a qualitative approach, diving into a comprehensive examination of three specific cases of

municipal green bonds: San Francisco, California; Cape Town, South Africa; and Mexico City, Mexico. This qualitative methodology was thus chosen for its ability to explore a wide array of aspects within each case, offering a detailed and nuanced understanding of the unique contexts and impacts of each municipal green bond (Ragin, 1994). Such an approach is useful for the recognition of perspectives frequently overlooked in green bond analyses, notably those from communities and neighborhoods affected by financed projects (with the notable exception of Bigger & Millington, 2020). In the opinion of the author, such methodology not only facilitates a rich interpretative analysis of green bonds as a complex phenomenon but also allows for the critical reinterpretation of narratives associated with these financial instruments (Ragin, 1994; García Lamarca & Ullström, 2022).

Finally, it is important to clarify that this dissertation does not employ a comparative[11] methodology. As discussed in this chapter, quantitative methodologies typically involve a large number of cases and analyze a limited set of aspects to identify general patterns or make predictions (Ragin, 1994). In contrast, the qualitative methodology used in this dissertation examines many aspects of a small number of cases, focusing on their commonalities to reinterpret a phenomenon and give voice to marginalized actors (Ragin, 1994). Comparative methodologies, however, occupy a middle ground, examining an intermediate number of cases and aspects to explore the diversity among them, such as how similar contexts and analogous situations can lead to different outcomes. As Ragin notes, "[w]henever a set of cases has different outcomes (cities with different reactions to Somali refugees, countries with different reactions to IMF-mandated austerity programs […]), comparative methods can be used to find simple ways of representing the patterns of diversity that exist among the cases" (1994, p. 160). The present work does not focus on the diverse aspects between cases but rather looks for point of convergence and relation, in particular with regards to the territorial implications in terms of climate injustice, with the aim to reinterpret municipal green bonds in light of their material life and give visibility to actors and factors that are often marginalized when it comes both to issuing the financial tools and preaching their role in climate action.

2.4 A Case Study Approach to Municipal Green Bonds

This dissertation employs a case study methodology, a research strategy that involves a detailed examination of the unit of analysis within its real-world context (Priya, 2021). Here, the unit of analysis are the municipal green bonds and their associated projects within the urban settings of San Francisco, Cape Town, and Mexico City. Case studies serve descriptive, explanatory, or

[11] For a comparative analysis of municipal bond financing for water infrastructure in Detroit, Baltimore, and St. Louis, refer to Phinney (2021, 2022). For a critique of comparative approaches, see Frankenberg (2017).

exploratory purposes (Yin, 2003), and this dissertation utilizes all three to examine the selected instances. The case study approach allows for an in-depth exploration of green bonds, integrating novel research questions and investigative processes from a climate justice perspective. This approach could be extrapolated to other research endeavors involving green bonds as units of analysis. Additionally, the case studies are designed to elucidate the social dynamics of green bonds, capturing both the tangible impacts of project implementation and the intangible aspects of capital flow and narrative construction. Ultimately, these cases provide explanatory insights into the operational mechanisms of green bonds and their significance within the broader contexts of climate finance and climate justice.

The selection of municipal green bond cases in San Francisco, Cape Town, and Mexico City was informed by five key considerations.

- First, these cases are recognized within the global discourse on green bonds as exemplary models of success and innovation, receiving prizes in climate finance, as detailed in chapters 6, 7, and 8.
- Second, the municipal green bonds selected adhere to a green labeling process that aligns with the one outlined in chapter 4. This consistency allows for the application of the same research methodology phases across all cases, starting with the documentation of the green labeling, followed by the analysis of project implementation, and culminating in the exploration of emerging narratives. This structured approach ensures access to comparable sources, such as green bond framework documents and follow-up reports, and by maintaining uniform methodological phases, it enables a coherent and integrated analysis across the three cases, facilitating their deepened discussion in chapter 9.
- Third, the case selection is rooted in their potential for replicability (Yin, 2003). This is achieved through a unified unit of analysis—municipal green bonds dedicated to water infrastructure projects—and an initial assessment of analogous data extracted from green financial documents in each instance. This encompasses the initial green bond framework document and the subsequent follow-up reports for all three cases. This uniformity not only ensures the coherence of this dissertation heuristics but also facilitates the replication of this dissertation analytical and methodological frameworks with the same research phases and sources, either with the selected cases or other analogous experiences of municipal green bonds beyond this dissertation.
- Fourth, in all three cases, the proceeds are partially or fully allocated to water infrastructure, a critical environmental and climate element essential for any

community, regardless of context (UN Water, 2020). This shared material focus on water infrastructure enables enhanced analysis of how financed projects are implemented in diverse settings in South Africa, Mexico, and the United States. Regardless of location, whether in the global North or global South, central or peripheral neighborhoods, or in high- or low-income households, every individual requires a minimum daily water intake for hydration and sanitation. According to WHO and UNICEF (2000) guidelines, less than five liters per day per person signifies very poor access, affecting hygiene and public health; 20 liters provide minimal hygiene but high health risks; 50 liters ensure daily hygiene with low health risks; and 100 liters or more per day per person are considered optimal, substantially reducing health risks and satisfying hygiene needs (WHO and UNICEF, 2000; cited in Martínez Moscoso et al., 2018). In Cape Town, as explained in detail in chapter 7, most of the proceeds from the municipal green bond were directed to water management devices that restricted each household's water access once an assigned daily quota of 50 liters per person registered was reached (City of Cape Town, 2018), often disproportionately affecting households with more occupants than officially registered, given the social housing deficit.

- Fifth, this dissertation intentionally juxtaposes two cases from the global South with one from the global North, aiming to highlight their commonalities to enrich the analysis and strengthen the arguments presented. By examining municipal green bonds as a consistent unit of analysis across varying contexts, this study identifies recurring issues, such as the non-recognition of climate vulnerability dimensions, including income, race, and gender. This contrasting approach is valuable from a climate justice perspective, revealing how municipal green bonds as a widely adopted climate finance instrument can replicate climate injustices in various settings, both in the global South and North. Such cross-contextual analyses have proven insightful in previous studies such as Bigger and Millington's (2020) analysis of municipal green bonds in Cape Town, South Africa and New York, United States, or in governance of urban climate resilience against pluvial flooding in Amsterdam, the Netherlands, and Dhaka, Bangladesh (Sharma, 2023).

2.5 Narrative Analysis in Green Bonds Research

As mentioned above, the dissertation unfolds through three research phases: green labeling, implementation, and narrative analysis. It is thus crucial to clarify the concept of narrative and its significance in social research on green bonds. A narrative is broadly defined as "*the representation of an event or a series of events*" (Abbott, 2008, p 13). This concept is pivotal

because narratives are fundamental to how humans communicate, coordinate, and comprehend the world (Figgou & Pavlopoulos, 2015). People not only convey information but also shape decisions through the stories they share. In the context of green bonds, narratives can be a strategic tool that various stakeholders use to advance their interests or agendas (Curran, 2021). Narrative analysis[12] employs diverse analytical techniques to interpret data presented through stories or representations of events (Figgou & Pavlopoulos, 2015), offering insights into how different actors construct or portray what is politically feasible or desirable (Curran, 2021). This approach is essential for understanding the influence of narratives in shaping perceptions and outcomes related to green bonds.

The field of narrative analysis has experienced considerable expansion within social research and incorporates both qualitative and quantitative methods (Abbott, 2008). Its application to green bonds stresses the methodological importance and practical utility of narrative frameworks in comprehending the social dynamics surrounding this climate finance instrument (Tripathy, 2021; Bracking, 2024). For instance, Bracking (2024) employed digital ethnography, a review of industry literature, and interviews with investors in London, England, and Johannesburg, South Africa to perform a narrative analysis on green bonds. This study highlighted that between 2019 and 2022, the prevailing narrative surrounding green bonds was marked by optimism and perceived opportunities, forecasting market growth despite inherent instabilities and weaknesses in this climate finance instrument (Bracking, 2024).

Conversely, Tripathy (2021) conducted ethnographic research on the narratives surrounding green bonds, engaging with financial experts in London, England, and in New York and Boston, United States. This study focused particularly on the Climate Bonds Initiative (CBI) headquartered in London. Tripathy (2021) suggests that numerical and quantitative data regarding the green bond market gain significance through the propagation of narratives. Tripathy identified three dominant thematic narratives that have supported the early growth of green bonds by emphasizing the necessity for innovative climate finance instruments that: mitigate climate and environmental risks; enable bankers to utilize markets to address these risks while concurrently shaping their professional identities; and seek validation in terms that resonate with bankers and market participants, making the concept more accessible and credible within the financial sector (Tripathy, 2021).

[12] For a differentiation and possible complementarity in qualitative research among narrative analysis, discourse analysis, and grounded theory, see Burck (2005).

Within these broader narratives, Tripathy (2021) discerned five specific normative narratives that shape the discourse around green bonds:

1. "$1 trillion by 2020"—highlighting ambitious growth projections for the green bond market.
2. Aligning the Sustainable Development Goals with green bonds—linking green bond initiatives with broader global sustainability efforts.
3. "A Hot Air Balloon"—critiquing whether green bonds are a substantial response to climate change or merely symbolic.
4. "Is there a Greenium?"—exploring whether green bonds yield more favorable debt capital costs compared to *vanilla* or conventional bonds.
5. "A Market Born of Low Interest Rates"—suggesting that the expansion of the green bond market is influenced by the economic environment of low interest rates (Tripathy, 2021).

Along with Tripathy (2021), Bracking (2024) offer also a valuable context for analyzing specific narratives or narrative 'snapshots' of municipal green bonds within the case studies of this dissertation, utilizing the analytical elements and data sources detailed subsequently. According to Curran (2021), a narrative 'snapshot' focuses on a confined selection of sources from a distinct time period that correspond to a particular event or sequence of events, thereby restricting its scope to pertinent occurrences without generalizing. This focused approach helps to anchor the narrative analysis in concrete and documented phenomena.

This dissertation investigates the narratives between the issuance of municipal green bonds in San Francisco, Cape Town, and Mexico City and three specific storied events. For each of these situations, it examines the narratives constructed by various actors involved, including bond issuers (municipal governments), intermediaries and advisors, financial stakeholders, standard setters, and media outlets covering these events. Primary data sources encompass financial documents, media reports, and social media interactions. Each case study details how the positive narrative associated with these municipal green bonds was beneficial for the public image of the issuers, as perceived by the participants involved in their issuance.

2.6 Research Phases and Methods

As anticipated in the introduction, the research underpinning this dissertation combined a qualitative and case study methodological approach to each of the three phases that characterize the lifecycle of municipal green bonds: labeling, implementation, and communication.

The first phase and associated methods allowed to identify both the water infrastructure projects relevant to this dissertation as well as the essential elements of the green labeling of municipal bonds. This research process begins with the analysis of green financial documents, including the green bond framework and follow-up reports, conducted for the municipal green bonds of San Francisco (see table 4), Cape Town (see table 6) and Mexico City (see table 7). This analysis aims to outline the objectives of the green bonds, the projects financed, the amounts of debt mobilized and the results announced. Chapter 4 provides a detailed explanation of the green labeling process. This initial phase involves a document review covering both green finance documents and academic literature, as well as gray literature. This also made it possible to identify the capital circulation cycle triggered by the investigated green bonds (see figure 15 for Cape Town and figure 21 for Mexico City). With all these elements in mind, municipal green bonds issued to finance water infrastructures were identified as the most suitable.

The second phase of research focused on the implementation of the selected water infrastructure projects financed by the municipal green bonds and their tangible impacts on communities and neighborhoods. This phase involved extensive fieldwork over seven months, conducted through direct observation in San Francisco (December 2021 to January 2022), Mexico City (February and March 2022), and Cape Town (September to December 2022). It involved conducting 36 semi-structured interviews with key stakeholders, including water activists, household members, and climate finance experts, selected for their expertise in water management and climate finance. The interviews were conducted in English and Spanish, audio-recorded, and transcribed for comprehensive coding and analysis. To preserve confidentiality, all participant information was anonymized in accordance with the ethical guidelines of the University of Antwerp's Ethics Committee for the Social Sciences and Humanities. Additionally, this phase encompassed the review of academic literature, reports, and media articles pertinent to the projects' implementation contexts and their effects. The fieldwork and interviews enabled direct observation of project execution and assessment of the impacts within communities, thereby uncovering aspects of local climate injustice.

Fischer (2023) defines direct observation as a qualitative method where the phenomenon under study (such as the implementation of a public policy) is directly observed, necessitating the physical presence of the researcher. Direct observation goes beyond quantitative analysis, which provides numerical descriptions, makes predictions, and identifies general patterns and correlations between variables (Ragin, 1994), but falls short in capturing the practical realities of on-the-ground implementation (Fischer, 2023). In other words, direct observation "[*a]llows*

us to grasp the practical situations that constitute policy implementation on the ground: we then have a first-hand description of the implementation of a given programme, but also of the material conditions of its success or failure." (Fischer, 2023, p 1).

However, direct observation is a demanding method that requires significant effort, including long-term physical presence in the field, detailed note-taking, comprehensive preparation prior to fieldwork, and thorough analysis of the collected data (Fischer, 2023). This method is often complemented and cross-checked with semi-structured interviews and the analysis of written resources (Pin, 2023). Pin defines the semi-structured interview as a "*verbal interaction solicited by the interviewer from a respondent, based on a grid of questions used in a very flexible manner. The interview aims both to collect information and to give an account of the person's experience and view of the world, from a comprehensive perspective.*" (Pin, 2023, p 1).

Regarding the sample of interviewees for the semi-structured interviews, the universe, size, strategy, and origin of the sample (Robinson, 2014) align with the qualitative research design of this dissertation. Therefore, the sample universe includes household members, water activists, policy experts, and academics, representing a diverse range of perspectives relevant to the dissertation. The sample size comprises 36 participants across the three local contexts where water infrastructure projects financed by municipal green bonds were implemented in San Francisco, Cape Town, and Mexico City. The sampling strategy was purposive, aligned with the overall research design, which aims to reinterpret municipal green bonds as phenomena and make visible previously overlooked actors and factors. Finally, the sampling was sourced through a referral process, with initial participants suggesting other potential interviewees to the researcher. As previously discussed, the findings from the semi-structured interviews were triangulated with direct observation and analyses of written and media sources to ensure robustness.

Finally, in the third phase, the narratives surrounding municipal green bonds in the three case studies were explored through a comprehensive review of green financial documents, public events, news coverage and social media. This phase also involved contrasting the narratives found in green financial documents and municipal green bond promotions in events and media with the material impacts of the financed projects in the climate injustice contexts in which they were implemented. Ultimately, for all three case studies, analysis was conducted to connect the material realities of municipal green bond-financed projects to the circulation of capital and debt, all through the lens of climate justice as an overall analytical framework. As explained in the previous point about the analysis of the narratives associated with green bonds, this allows

to understand how municipal green bonds were promoted and justified by the actors involved in their issuance.

2.7 Ethical Considerations

This research project received approval and positive clearance from the Ethics Committee for the Social Sciences and Humanities at the University of Antwerp, under the reference SHW_21_120. All participants in the interviews provided their informed consent, were fully briefed on their rights, and their confidentiality was ensured. All participants were informed that they could withdraw from the interview at any time. The personal data of the research subjects was thoroughly anonymized, safeguarding their right to privacy and mitigating potential risks, such as those pertaining security. Regarding this research project, no emotional or physical risk were identified for participants in the interviews or for individuals in the neighborhoods where observations were conducted. The researcher adhere to ethical principles throughout the study, safeguarding that the rights and well-being of participants were protected at all times.

CHAPTER 3: THE UMBRELLA OF CLIMATE JUSTICE AS THE ANALYTICAL FRAMEWORK TO REFLECT UPON GREEN BONDS

3.1 Introduction

The concept of climate justice is central to this dissertation.[13] In particular, this concept is used to provide a different understanding of climate finance beyond economic and quantitative considerations and to discuss both the tangible and intangible aspects of municipal green bonds as the financial backbone of material water infrastructures. However, climate justice is not a uniform and universal notion.

Before diving in the case studies, it is thus considered pertinent to delineate the concept of climate justice, tracing its origins, components, and its application in the analysis of climate finance. This chapter reviews the existing literature on climate finance from a climate justice perspective and highlights the current research gap regarding green bonds, which this dissertation seeks to address. This discussion identifies the role of climate justice within international climate change policy frameworks, notably by the United Nations. This sets the stage for a detailed examination of the definition of climate justice provided by the Intergovernmental Panel on Climate Change (IPCC) (2023), which this dissertation adopts as analytical framework to examine the case studies in the chapters 6, 7, and 8 and to illustrate how this framework aids in understanding and addressing overlook complexities of climate finance.

Before moving forward, four important clarifications are provided as context for the upcoming discussions:

- The concept of climate justice aligns and resonates with the core principles of human rights, human dignity, and social justice. The IPCC recalls that social justice in general terms "(…) *comprises just or fair relations within society that seek to address the distribution of wealth, access to resources, opportunity and support according to principles of justice and fairness*." (IPCC, 2023, p 7). This echoes the political consensus articulated in the Universal Declaration of Human Rights, which asserts "recognition of the inherent dignity and of the equal and inalienable rights

[13] It is crucial to emphasize that the struggle for climate justice and its recognition in international climate change policy arenas primarily originates from communities, neighborhoods, movements, and peripheral territories (e.g., see Pettit, 2004; Paredes, 2022).

of all members of the human family is the foundation of freedom, justice and peace in the world" (UN General Assembly, 2013, p 1). Therefore, the pursuit of justice and the common effort against discrimination are fundamental objectives shared by humanity. Whitin this context, climate justice is rooted in the principles and historical foundations of social justice, ensuring that not individual is excluded or subjected to discrimination based on their race, gender, ethnicity, income, age, or any other innate or acquired characteristic.

- This dissertation deliberately avoids engaging in broader philosophical debates on general theories of justice as articulated by authors such as John Rawls (2003), Iris Marion Young (1990), Nancy Fraser (1997, 2021), and Amartya Sen (2009). It also refrains from detailed discussions on additional justice frameworks, including water justice[14] (Zwarteveen & Boelens, 2014), restorative justice (Robinson & Carlson, 2021), just transitions (McCauley & Heffron, 2018), and epistemic justice (Temper & Del Bene, 2016).
- Philosophical examinations on climate justice engages in debates surrounding the application of principles like the "polluter pays principle" and the "beneficiary pays principle" (Heyward, 2021; García-Portela, 2023). While the philosophical dialogue, centering on principles, contributes valuable epistemological insights and addresses externalities linked to global warming, it faces challenges in empirically integrating social injustices associated with pollution sources and victims of the climate crisis at the community level. This debate highlights the need for an empirical approach that incorporates and addresses social injustices alongside broader philosophical principles.
- While this dissertation primarily adopts a human-centered approach to climate justice, it acknowledges the significance of the growing dialogue around multispecies justice amidst the climate crisis (Haraway, 2018; Tschakert, 2022; Srinivasan, 2022). As Tschakert and colleagues suggest, "*A multispecies justice lens broadens the scope of climate justice by decentering the human and recognizing the everyday interactions that links individuals and societies to networks of distant others, including other people and more-than-human beings*" (Schakert et al., 2021,

[14] Water justice, like climate justice, has been profoundly shaped by environmental and social movements. It encompasses not only the material and economic redistribution of water resources but also the cultural dimension of recognition and the political dimension of participation (Zwarteveen & Boelens, 2014). However, this dissertation centers on climate justice, specifically within the context of urban climate finance. While it acknowledges aspects related to the redistribution and governance of water, the focus is broader, addressing systemic issues of justice that transcend water-specific concerns.

p 1). This perspective highlights an important expansion of the climate justice framework, integrating ecological interdependencies into considerations of justice, and extends beyond the human-centered approach of this dissertation.

- Given that the focus of this work is the application of a climate justice lens to municipal green bonds, exploring the broader or additional theoretical domains behind climate justice would exceed the intended scope of this dissertation. For this the IPCC definition of climate justice is adopted as an internationally recognized understanding of climate justice, although not the only one possible and in some sense the outcome of a compromise, as explained in sections 3.5 and 3.6. This chapter acknowledges the relevance of the multiple debates and frameworks that animate the transdisciplinary conversation around climate justice, and notes their potential for further exploration in subsequent research on green bonds. However, they are not directly addressed in this chapter nor throughout the dissertation.

3.2 The Interplay of Climate Finance and Climate Justice

According to most academic accounts (e.g., Khan et al., 2020; Islam, 2022), a climate justice approach to climate finance is a way to critically examine the distribution of responsibilities and impacts associated with anthropogenic climate change.[15] This perspective seeks to clarify both the entities accountable for causing climate change and the manner in which its burdens are disproportionally borne by those with more climate vulnerabilities (Birkmann et al., 2022), often those contributing least to global emissions (Hickel, 2020). Understanding this distribution dynamic is crucial for analyzing how climate finance engages with climate action, including adaptation and mitigation strategies. It often involves a spectrum of actors and factors across varied geographic and socioeconomic landscapes in contexts marked by local climate injustice, as described in detail in this dissertation.

The prevailing climate justice approach to climate finance emphasizes a historically-grounded, country-focused analysis. Countries in the global North, including the United States and others listed in Annex II[16] of the United Nations Framework Convention on Climate Change (UNFCCC, 1992), have accumulated significant wealth through industrialization and the extensive use of fossil fuels, thereby contributing significantly to global greenhouse gas

[15] In this dissertation, the definition of anthropogenic climate change as outlined by the IPCC (2023) is adopted. However, it is important to note that there is a significant debate challenging the anthropogenic perspective, highlighting other phenomena as drivers of the biosphere crisis (e.g., Moore, 2016).

[16] Australia, Austria, Belgium, Canada, Denmark, European Economic Community, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland, United States of America (UN, 1992).

emissions (Hickel, 2020). Based on this historical context, article 4 of the UNFCCC mandates Annex II countries to provide new and additional climate finance resources to support Non-Annex II countries, primarily those in the global South, with their climate action initiatives (UN, 1992).

Moreover, a climate justice approach to climate finance highlights the increased climate vulnerabilities concentration in countries in the global South, often compounded by the enduring legacies of slavery, colonization, patriarchy, and other forms of historical oppression (Perry, 2021; Sultana, 2022). This heightened climate vulnerabilities are particularly evident in the case of Small Island Developing States,[17] whose economic predicaments are often rooted in their colonial histories and which severely impact their capacity for climate change adaptation, as seen in the Caribbean (Gahman & Thongs, 2020; Perry, 2021), and notably in Haiti (Perry, 2020). These factors demand a critical examination of how financial responsibilities for climate action are distributed globally, particularly emphasizing the uneven burden placed on countries with minimal historical greenhouse gas emissions (Hickel, 2020). The prevailing climate justice literature on climate finance frequently debates which countries should finance climate action and to what extent (Robert & Parks, 2009; Baer, 2010; Khan et al., 2020; Basty & Azouz Ghachem, 2022; Dafermos, 2023). This issue is further elaborated upon in this chapter.

As visible to the reader, these discussions often center on the national level and the relationship (historical and present) between sovereign states and their financial obligations vis-à-vis other states. Departing from this approach, this dissertation advocates for expanding the analytical scope to include the subnational and local levels, with a particular focus on municipal green bonds as financial tools that impact local climate (in)justice and the lived experiences of people, rather than national public accounts and Gross Domestic Products alone. This expanded perspective aims to enhance the understanding of the intricate engagement between climate finance and climate action (adaptation and mitigation), through the lens of the lived experiences of both climate finance and climate justice. Such an approach, which is detailed in the discussion in chapter 9 and illustrated through the case studies in the empirical chapters 6, 7, and 8, seeks to provide a comprehensive exploration of the nuanced dynamics and implications of climate finance as engages with climate action and enters contexts of local climate injustice.

[17] Antigua and Barbuda, Bahamas, Barbados, Belize, Cabo Verde, Comoros, Cook Islands, Cuba, Dominica, Dominican Republic, Fiji, Grenada, Guinea-Bissau, Guyana, Haiti, Jamaica, Kiribati, Maldives, Marshall Islands, Micronesia, Mauritius, Nauru, Niue, Palau, Papua New Guinea, Samoa, São Tomé and Príncipe, Singapore, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Seychelles, Solomon Islands, Suriname, Timor-Leste, Tonga, Trinidad and Tobago, Tuvalu, Vanuatu (UN, n.d.).

It is thus important to adopt an expansive understanding of climate justice in the context of climate finance that transcends the scope of loss and damage and macro-financial considerations (e.g., Colenbrander et al., 2018).

Before diving into the academic and non-academic literature that proposes wider and deeper approaches to climate justice, the following section presents a brief overview of the way in which the dominant approach to climate justice has been used to discuss climate finance and provides some specific case studies concerning the use of climate justice to discuss climate finance instruments (e.g., Khan et al., 2020; Dafermos, 2023). Through this section it is possible to grasp the need for a wider and deeper understanding of climate justice to provide a more appropriate and socially embedded analysis of climate finance, but also the need for more academic work on the green bonds (and municipal green bonds) as they are underrepresented in international literature.

3.3 Climate Justice Approach to Climate Finance: State of the Art and Contribution

Since the inception of climate finance under the UNFCCC framework, academic research from a climate justice perspective has sought to analyze how the costs and benefits related to climate change have been distributed among states, given the global nature of the climate challenge (e.g., Khan et al., 2020; Dafermos, 2023). As detailed below, the existing academic literature with a climate justice approach to climate finance has focused mainly on two key approaches: the definition of and fair distribution among states of the climate finance burdens and assessing specific experiences of climate finance instruments. These explorations are based on several contrasting analytical categories, including public finance versus private finance, debt versus concessions, and mitigation versus adaptation, just to name a few.

The first approach of this stream of literature on climate finance seeks to articulate a definition of climate justice by addressing the question of which countries should assume the financial burden associated with the climate crisis and ensuing climate action efforts, as well as the extent of these responsibilities. Scholars such as Robert and Parks (2009), Khan and colleagues (2020), Basty and Azouz Ghachem (2022) and Dafermos (2023) highlight the obligation of wealthier countries to provide support to their less affluent counterparts, particularly in climate adaptation. Baer (2010) emphasizes the principle of *common but differentiated responsibilities* as delineated in the UNFCCC, advocating for the global North to assume a substantial portion of adaptation-related expenses.

Khan and colleagues (2020) address the role of debt in climate finance through the concepts of *climate debt* and *adaptation debt*, establishing that countries in the global North owe a

substantial debt to those in the global South. This debt arises from the North's disproportionate consumption of atmospheric space through historical carbon emissions, significantly contributing to anthropogenic climate change. Khan et al. (2020) argue that the preference for loans over grants in climate finance perpetuates the financial dependencies of the global South and fails to incorporate climate justice principles. Consequently, they advocate for a climate finance system rooted in climate justice that supports the global South in its climate adaptation efforts.

Further, Colenbrander and colleagues (2018) emphasize the need to include local organizations in adaptation financing beyond national governments and multilateral entities. Sheridan and Jafry (2018) argue for the prioritizing of vulnerable communities in adaptation finance, urging for a harmonious integration between development finance and climate finance strategies. Moreover, Islam (2022) draws attention to the significant hurdles faced by climate-vulnerable countries in securing necessary financing.

This body of work on climate finance predominantly focuses on the national-level responsibilities (e.g., Robert & Parks, 2009; Islam, 2022), revealing a significant research gap in examining the distributive justice aspect of climate finance at municipal, subnational, and intergenerational levels. The emphasis has largely been on the responsibilities of states, with less attention given to how climate finance can address inequalities at a more granular level, ensuring justice for individuals, communities, neighborhoods, and future generations. This gap highlights the need for further investigation into how climate finance mechanisms can be designed and implemented to not only address immediate national needs but also consider the broader implications for individuals and the enduring legacy of climate finance and the financed climate action projects for the generations to come, particularly in the case of servicing of municipal green debt.

The second approach in this stream of climate finance literature examines specific case studies under the climate justice lens to elaborate on the practical implementation and impacts of climate finance instruments. For instance, Vanderheiden (2015) examined the Green Climate Fund (GCF), a financial mechanism established by the UNFCCC to facilitate the transfer of financial resources from the global North to the global South in support of climate action. Vanderheiden highlighted several challenges, including the voluntary nature of contributions, which results in insufficient and unpredictable funding. Vanderheiden (2015) recommended, in accordance with climate justice principles, enhancing transparency and accountability, formalizing the involvement of civil society in monitoring contributions and financed projects, and ensuring that at least half of the funds are allocated to adaptation projects.

Baird and Green (2020) analyzed from a climate justice perspective the implementation of the Clean Development Mechanism (CDM) in financing hydroelectric dams in Cambodia. They argued that the financed dams caused significant flooding, disrupted the livelihoods of local communities, and that consultations with these communities were either inadequate or nonexistent. This analysis emphasizes the adverse impacts and lack of community engagement in climate finance initiatives (Baird & Green, 2020).

This stream of literature includes a diverse array of instruments, including the financing of adaptation projects in Malawi (Barret 2013, 2014), the operational dynamics of the Green Climate Fund (Vanderheiden, 2015), and the financing of dams in Cambodia through the Clean Development Mechanism (Baird & Green, 2020). Other notable investigations include the study of the financing for the Loss and Damage agenda (Williams, 2021; Scott Cato, 2022), the examination of the interplay between forest carbon accounting and financial markets (Gifford, 2020; Sauls, 2020), the analysis of the European Union financing of climate justice initiatives (Minas, 2022), the financing of low-carbon transition projects in Fiji and Indonesia (Anantharajah and Setyowati, 2022), the Australian public climate financing in the Pacific (Ledger & Klöck, 2023) and carbon finance in island countries of the Pacific (Morgan & Petrou, 2023). Collectively, these studies contribute to a nuanced understanding of how climate finance operates across different contexts and the varied impacts of climate finance mechanisms. However, they fall short in analyzing municipal green bonds.

In summary, the literature on climate finance from a climate justice perspective predominantly focuses on the distributive pillar of climate justice. It argues that wealthier nations, which often contributed most significantly to climate change, should provide support to countries with less financial capacity, especially in their climate adaptation efforts. While this body of literature has extensively documented climate injustice related to various climate finance instruments in various contexts, it reveals a notable gap in the detailed exploration of green bonds and municipal green bonds. This omission is significant, as these instruments of municipal green debt are crucial for triggering financial redistributions among lenders, borrowers, and the communities impacted by financed projects. This importance is further elaborated in chapter 4, which discusses the basic elements and capital circulation cycle in green bonds.

3.4 The Expansive Academic Debate on Climate Justice

The concept of climate justice is receiving increased attention across various academic fields, marked by diverse definitions and analysis by scholars (e.g., Schlosberg & Collins, 2014; Chu & Michael, 2019; Khan et al., 2020; Wagle & Philip, 2022). This part draws on Elisabeth

Cripps' examination of the contrast between climate injustice and climate justice (Cripps, 2022) to explore the expanding debate. Cripps' work effectively capture the nexus of climate change, society, and justice, offering essential perspectives on the pillars of distribution, recognition, and participation (e.g., 2013, 2017, 2022). This triad of pillars resonate with other definitions of climate justice (e.g., Bulkeley et.al, 2014; Chu & Michael, 2019; Gonzalez, 2020), and is also included by the IPCC (2023) framework applied in this dissertation.

Cripps articulates climate injustice as a situation where the impacts of climate change encounter and reinforce historical injustices, stating:

> "*Climate change does not destroy at random. Climate injustice is racial injustice, gender injustice. Those with most at stake, who are least responsible for climate harms, are losing everything, and they are losing it because of colonialism, slavery, oppression, and systematic disregard for basic human rights.*" (Cripps, 2022, p 107).

She portrays a scenario where historically marginalized communities, already contending with adverse conditions, struggle with limited resources to adapt to climate change, thereby exacerbating what the IPCC (2023) defines as climate vulnerabilities. In contrast, climate justice is described as an aspirational goal grounded in the principles of fair distribution and participation:

> "*Climate justice means systematic change. It requires participation: global, intersectional, and intergenerational. It requires mitigation, adaptation and compensation. Polluters must pay for this, unless they're too poor. The rich must pay, especially if they're rich on the back of past injustice. The most vulnerable must not be made to pay*." (Cripps, 2022, p 107).

Cripps' framework explains climate justice as an ideal counter to the tangible and historical reality of climate injustice, advocating for systemic change that addresses the socio-economic conditions tied to legacies of colonialism, racism, apartheid, patriarchy, slavery, and oppression. This framework emphasizes that the climate crisis, intertwined with these historical legacies, can deepen and perpetuate these injustices and climate vulnerabilities, disproportionately affecting historically marginalized groups. The academic debate on climate justice is rooted in the stablished traditions of racial and environmental justice, as detailed next.

3.5 From Racial Justice to Environmental Justice and Climate Justice

Racial and environmental justice serve not only as historical and social foundations but are integral components of the definition of climate justice detailed below. Whitin the distributive

justice pillar of climate justice, the fair allocation of environmental elements, such as drinkable water (Mehta et al., 2014) or breathable air (Gouveia et al., 2022), is crucial. Equally vital in the recognition pillar of climate justice is acknowledging the perspectives of communities and individuals historically discriminated against based on race. These elements of fair environmental distributions of water and the recognition of the climate vulnerability of race are central to the case studies explored in this dissertation as well.[18]

According to the promoters of environmental justice, negative environmental externalities are unevenly distributed across the population, in a way that mostly affect communities, individuals and territories that are already marginalized or politically invisible. The aim of the environmental justice movement, then translated into academic work, is the achievement of a fair distribution of environmental benefits and harms, ensuring the fulfillment of basic environmental needs for everyone, regardless of climate vulnerabilities dimensions and paying particular attention to the way in which race, income, gender, and forms of intersectional injustice define the way in which environmental degradation is experienced (Pulido, 1996, 2017; Bullard, 2000; Pellow, 2016). Essential aspects of this includes access to breathable air (Gouveia et al., 2022), potable water (Mehta et al., 2014), and nutritious food (Alkon & Norgaard, 2009; Ferrando, 2022), which are vital for sustaining individual and community well-being, and that are often unevenly distributed across the population of a state, a region or even a city.

In the United States, environmental justice has closely followed the path of racial justice, explicitly condemning environmental racism and higher concentrations of pollution in Black-majority areas (Pulido, 2016; Bullard & Wright, 2019). A pivotal moment in understanding climate injustice occurred with Hurricane Katrina in 2005. This extreme climate event significantly impacted Black-majority municipalities like New Orleans, Louisiana, highlighting the complex interplay between climate, environmental, and racial injustices and sparking widespread social mobilization against these interconnected climate vulnerabilities (Bullard & Wright, 2019). Reflections have also emerged on the interplay between racial injustice, climate injustice, and colonial legacies in response to the impact of extreme climate events, such as hurricanes in Caribbean countries like Haiti, the Dominican Republic (Sheller & Leon, 2016; Perry, 2023; Baptiste & Robinson, 2023), and Puerto Rico, which remains a United States territory (Malavet, 2004; García-López, 2018; Ponder, 2023). Climate justice movements have

[18] Such understanding of climate justice encompasses and builds upon environmental justice local movements and their lived experiences of the socio-economic inequalities associated with environmental degradation (Bickerstaff, 2012; Perez et al., 2015; cited in IPCC, 2023).

grown, continuing to call for effective climate action that addresses different forms of injustice, including environmental racism and the legacies of colonialism (Schlosberg & Collins, 2014; Sultana, 2022; Bautista et al., 2023).

Social movements for environmental justice have catalyzed mobilization and fostered ideas for climate justice, with both fronts increasingly finding common ground (Scholberg & Collins, 2014). The interplay of social mobilization for environmental justice with international climate change policy dates back to early 21st Century. The first international gathering of social and environmental movements dedicated to climate justice took place in 2000 in The Hague, The Netherlands, coinciding with the sixth Conference of the Parties (COP 6) of the UNFCCC (Whitehead, 2014). In 2004, the Durban Group for Climate Justice worked on this concept in the Durban Declaration on Carbon Trading (Scholberg & Collins, 2014). Later, in 2007, a broad coalition of organizations championed climate justice at COP13 in Bali, Indonesia. While focusing primarily on carbon trading, this coalition included environmental justice organizations and accentuated the importance of gender, social and ecological justice within the broader climate justice narrative (Scholberg & Collins, 2014). This historical progression illuminates the interconnected evolution of environmental justice movements and the emergence of climate justice on the global stage.

A critical juncture occurred at COP 15 in Copenhagen, Denmark, in 2009, where the negotiation outcomes disappointed many civil society organizations. These groups argued that the discussions focused on false solutions that perpetuated a flawed system in serious need of change (Paredes, 2022). As a counteraction, the first World People's Conference on Climate Change and the Rights of Mother Earth was convened in Cochabamba, Bolivia, in April 2010, offering an alternative vision. The final Declaration of the Cochabamba Conference stated:

> "*To face climate change, we must recognize Mother Earth as the source of life and forge a new system based on the principles of:*
> *Harmony and balance among all and with all things;*
> *Complementarity, solidarity, and equality;*
> *Collective well-being and the satisfaction of the basic necessities of all;*
> *People in harmony with nature;*
> *Recognition of human beings for what they are, not what they own;*
> *Elimination of all forms of colonialism, imperialism and interventionism;*
> *Peace among the peoples and with Mother Earth*"
> (People's Agreement of Cochabamba, 2010, p 2).

However, the rights and justice oriented propositions of the Cochabamba Conference had limited influence on the subsequent COP 16 that was held in 2010 in Cancún, Mexico (Riplinger, 2012; Paredes, 2022). The Cancun Agreements that was then adopted reflected a market-oriented approach to tackling climate change that translated into the establishment of the Green Climate Fund and the proposal of expanding market mechanisms to raise private capital and address the climate gap (UNEP Finance Initiative, n.d.).

Over the following years, environmental and climate justice advocates from social movements in the global South often faced obstacles in gaining recognition within international academic and policy spheres (Paredes, 2022). However, the efforts of social movements and their struggles for territorial protection gradually advanced the causes of environmental and climate justice, increasingly influencing major international frameworks such as the Paris Agreement in 2015. This emphasizes a complex dimension of the global dialogue on climate justice, stressing the important role of the recognition and incorporation of diverse perspectives to influence the international politics of climate change effectively.

Ultimately, it is possible to say that the historical underpinnings of climate justice aligns and builds on the concepts of environmental justice (Schlosberg & Collins, 2014) and racial justice (Bullard, 2000; Bullard & Wright eds., 2019). This alignment reinforces the limitations of a rigid and narrow interpretation of climate justice as an inter-state concept that may overlook crucial aspects of injustice significant to specific contexts. As such, climate justice has evolved into a multifaceted concept with varied definitions across social movements and scholarly debate and now serves as a political arena that consolidates diverse demands from social movements into the discussions of international climate change policy (Almeida, 2019). The interpretation of climate justice that was recently adopted in the framework of the United Nations Framework Treaty on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC) seems to go in such expansive direction, and for this reason is adopted as the term of reference for this dissertation.

3.6 An Expansive Understanding of Climate Justice in the Context of Global Climate Change Governance?

The adoption of the 1992 UNFCCC established the foundational architecture for the global response to climate change, emphasizing climate action (both adaptation and mitigation) and conferring international political recognition on the climate crisis. It acknowledges the disproportionate contribution of countries in the global North to greenhouse gas emissions and, consequently, their greater responsibility in leading both climate action and the related climate

finance efforts. In line with an inter-state understanding of climate costs and benefits (although not yet in the context of climate justice), the Convention introduced the principle of *common but differentiated responsibilities and respective capabilities*, according to which countries categorized under Annex II, also known as developed or global North countries, must assume a leading role in addressing climate change and its harmful impacts. This principle highlights the acknowledgement of both the universal challenge represented by the climate crisis and the need for tailored responsibilities that reflect the disparate capacities and historical emissions of nations.

The Treaty mandated the establishment of financial mechanisms "*for the provision of financial resources on a grant or concessional basis*" (UN, 1992, p 14), to support climate action. This directive emphasizes the focus on cooperative financial instruments over debt-laden alternatives such as green bonds, highlighting a preference for mechanisms that alleviate rather than exacerbate financial burdens on global South countries. Since its inception, the UNFCCC has convened annual Conferences of the Parties (COPs), serving as a fora for negotiation, dialogue, and consensus-building among state parties, civil society, and other stakeholders. The COPs have increasingly witnessed calls from non-Annex II countries, representing the global South, as well as civil society sectors, for the integration of climate justice principles within the UN's climate policy framework. These demands articulate growing consensus on the necessity of embedding justice at the hearth of global efforts to address climate change (Okereke & Coventry, 2016).

At the 2015 COP 21, the Paris Agreement emerged as a landmark accord with the aim of limiting the increase in global average temperature to below two degrees celsius above pre-industrial levels (1850-1900). Notably, the Preamble of the Agreement acknowledges the "*importance for some of the concept of climate justice*" (UN, 2015, p 2), in the context of climate action. This acknowledgement represents a significant step forward in the recognition of climate justice, highlighting its complex and, at times, contentious nature. Despite its mention, the Agreement does not provide a precise definition of climate justice, thereby leaving the concept open-ended yet officially recognized. This absence of a rigid definition does not restrict the operationalization and attainment of climate justice but rather enables its incorporation into international climate change policy. Additionally, the Paris Agreement elaborates on the principle of differentiated responsibilities, with particular emphasis on the obligations of the global North towards the global South, especially focusing on countries most vulnerable to the impacts of climate change (UN, 2015).

The inclusion of climate justice in the Paris Agreement's Preamble highlights the concept's escalating prominence within both academic inquiry and political dialogue. Although the Agreement itself stops short of defining climate justice, its mention signifies a foundational acknowledgement of its relevance. The concept's formal recognition and subsequent elaboration in the 2022 IPCC Sixth Assessment Report is not legally binding, but signals its growing importance. This definition is therefore validated by the IPCC academic and policy verification process based on the systematic review of scientific literature (IPCC, 2023). The Report delineates three core pillars of climate justice: procedural justice, recognition, and distributive justice. These pillars, drawn from the examination of environmental and climate justice movements and case studies, and provides a comprehensive foundation for integrating justice into global climate policy. Through this academic and policy validation process, the IPCC has played a pivotal role in advancing the conceptualization and application of climate justice within the international climate dialogue.

3.7 The IPCC's Definition of Climate Justice

The IPCC was created by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) in 1988 and represents a group of international scientists whose mission is to synthesize and disseminate knowledge on climate change to inform policy decisions and international accords (IPCC, 2023). This endeavor involves rigorous review of present scientific literature, necessitating a broad consensus among member states, scientists, and experts to forge conclusions and recommendations, a process acknowledge for its complexity (Paglia & Parker, 2021). The IPCC's role as an epicenter of globally relevant scientific information confers its legitimacy, establishing it as preeminent authority on climate science. In other words, the "*IPCC is widely recognized as the global authority on climate science. Its assessment reports have provided the scientific foundation for the creation and evolution of the international climate regime*" (Paglia & Parker, 2021, p 296).

Despite its respected status, the IPCC has faced critiques on several fronts. These critiques highlight perceived biases within the organization, including geographical bias with an overrepresentation of scientists from the global North, gender bias due to a predominance of male contributors, disciplinary bias with a focus on natural sciences at the expense of social sciences, and cosmological bias, privileging western worldviews over the indigenous knowledge systems, particularly those from the global South (Chakraborty & Sherpa, 2021). Such critiques accentuate the need for a more inclusive and fair approach to climate science, one that recognizes and integrates diverse perspectives and knowledge-systems. Despite its identified limitations, the IPCC stands as the most authoritative international body within the

field of climate science, providing pivotal support for decision-making processes in international climate change policy through comprehensive reports.[19] The preferred use of the IPCC's definition in this dissertation is justified by the organization's significant role in shaping global climate science and policy frameworks.

The IPCC thoroughly explored the concept of climate justice in its recent "Impacts, Adaptation and Vulnerability" contribution to the Sixth Assessment Report.[20] The IPCC defines climate justice as follows:

> "*The term climate justice, while used in different ways in different contexts by different communities, generally includes three principles: distributive justice which refers to the allocation of burdens and benefits among individuals, nations and generations; procedural justice which refers to who decides and participates in decision-making; and recognition which entails basic respect and robust engagement with and fair consideration of diverse cultures and perspectives*." (IPCC, 2023, p 7).

Given the international legitimacy that characterizes the IPCC, and given the tripartite nature of the definition (procedural justice, recognition and distributive justice), this dissertation adopts the IPCC's definition of climate justice as a foundational framework that offers a more holistic approach to climate justice that can be particularly pertinent for examining climate finance and the material and immaterial implications that it generates when it concretizes in water infrastructures.

3.7.1 Procedural Justice: Decision-Making Dynamics

Procedural justice, as a critical component of climate justice, scrutinizes the dynamics of decision-making in climate action. In other words, addresses who and how makes decisions. It examines the integrity of the decision-making process and the authenticity of the decision-makers' authority (Gutmann & Thompson, 2009; Kitcher, 2011; cited in IPCC, 2023). Procedural justice in the context of climate justice emphasizes several key criteria: "*transparency, the application of neutral principles among parties, respect for participants'*

[19] Hughes (2024), in her book *The IPCC and the Politics of Writing Climate Change* delves deeply into the complex interplay between science and politics within the IPCC. Hughes describes the IPCC as a *boundary organization* that mediates between climate science and policy, managing the tensions between the two. She highlights the asymmetries in participation between the global North and South within the IPCC, attributing these disparities to differences in the availability of economic and scientific resources, which ultimately reinforce inequities in global climate governance.

[20] For a detailed explanation of the preparation of the Working Group II Contribution to the Sixth Assessment Report of the IPCC, you can consult the preface on page ix where the scope, structure and process are explained (IPCC, 2023).

rights and inclusive participation in decision making, which often takes the form of participatory processes." (IPCC, 2023, p 160).

Furthermore, procedural justice mandates that communities impacted by climate change are not only heard but also empowered with the effective capacity to influence decision-making and implementation phases. For this communities must be adequately informed about the potential impacts of climate change on their local environments (IPCC, 2023). In fact, decision-making processes that are diverse and inclusive tend to yield more robust and effective outcomes. Research supports the notion that groups with a broad range of decision-makers make better decisions compare to those made by more homogeneous groups (Hong & Page, 2004; Landemore, 2013; Singer, 2019 cited in IPCC, 2023). Accordingly, procedural justice not only concerns the fairness of the processes by which decisions are made but also the inclusivity and representativeness of those processes, ensuring that they reflect a wide array of perspectives, knowledge systems, and diversity of people. This is also connected with the next pillar of recognition.

In the context of municipal green bonds, several decision-making procedures play a crucial role. These include the voluntary green labeling process for municipal bonds and the decision-making regarding projects financed by these bonds, as detailed in the three cases studies in chapters 6, 7, and 8. Procedural criteria such as transparency and access to information are critical to obtaining documentation related to the green labeling process of municipal bonds and effective participation can allow communities to voice their concerns before projects are approved and municipal green debt issue.

3.7.2 Recognition: Embracing Diversity in Actors and Perspectives

The pillar of recognition of climate justice emphasizes the importance of acknowledging and respecting diversity of actors, perspectives, cultures, and values. In other words, recognizing diverse perspectives and cultures on what and who is relevant in terms of climate action. The other two pillars of climate justice, procedural justice and distributional justice, are interdependent of recognition (Hourdequin, 2019 cited in IPCC, 2023). The IPCC concludes that "(*w)ithout recognition, actors may not benefit from the other two aspects of justice (medium confidence)*." (2023, p 160). Recognition involves respect and embrace of diversity with effective participation.

Lack of recognition can lead to unjust distribution of benefits and detriments and deficiency in the participation process (Svarstad & Benjaminsen, 2020 cited in IPCC, 2023). This highlights that recognition is not merely a complementary component of climate justice but a foundational

component to achieve just results in both decision-making and distribution processes. Despite is critical importance, the pillar of recognition is often minimized in the broader discussion on climate justice pillars (Chu & Michael, 2018; IPCC, 2023). This risks overlooking the unique and necessary contributions and needs of diverse groups, particularly those from historically discriminated communities, knowledge systems, and perspectives.

The pillar of recognition in climate justice necessitates acknowledging and addressing the needs, rights, and identities of historically marginalized groups disproportionally impacted by and more vulnerable to climate change (Chu & Michael, 2019). In urban contexts pertinent to this dissertation, the frequent non-recognition of these marginalized communities typically originates from their political exclusion, complicating the representation of their needs and interests in climate-related policies and urban development strategies. Moreover, these groups often experience non-recognition when prevailing narratives and approaches fail to adequately recognize or inaccurately portray their needs, thereby further excluding them from meaningful participation in climate action (Chu & Michael, 2019).

In the context of municipal green bonds, the case studies reveal that key actors, perspectives, and climate vulnerabilities were inadequately recognized in the green labeling process of the municipal bonds and in the implementation of the financed projects. For instance, the case study of Mexico City in chapter 8 shows that the additional water-related responsibilities shouldered by women were not recognized. Similarly, in the Cape Town case, in chapter 7, the racial perspective was either overlooked or masked under the income variable during the implementation of the water management devices project. These issues regarding recognition are detailed in the respective empirical chapters.

3.7.3 Distributive Justice: Across Individuals, States, and Generations

The pillar of distributive justice within the framework of climate justice is pivotal in examining the just distribution of environmental burdens and benefits across spatial and temporal dimensions (Islam, 2022). This pillar is dissected into three distinct levels of analysis: individuals, states, and generations, as outlined by the IPCC (2023). The literature on climate finance from a climate justice perspective primarily focuses on the distributive pillar at the state level, specifically examining how financial burdens should be allocated among states (e.g. Basty & Azouz Ghachem, 2022; and Dafermos, 2023). However, this dissertation shifts the focus towards the distributive justice pillar at the subnational level and to future generations trough debt, for the experience of municipal green debt and the associated climate adaptation projects.

At the individual level, the distributive justice pillar emphasizes that the allocation of climate-related risks and burdens should be neither arbitrary nor disproportionally affect any individual or group, such as families or neighborhoods. Additionally, benefits for one group in terms of climate action should not result in harm for another (IPCC, 2023). For instance, if a climate adaptation policy protects certain communities while increases risk for others, it would be considered unjust. This pillar advocates for an approach to climate action that protects individual rights and ensures no one is unfairly burdened.

At the state level, or in the context of international politics of climate change, distributive justice is illuminated by the principle of *common but differentiated responsibilities* (UN, 1992, p 2), included in the Principle 7 of the Rio Declaration[21] (UN, 1992) and the Kyoto Protocol[22] (UN, 1998). This principle explains that while all countries are responsible for climate action, there are countries that are in a better position to adapt to the climate crisis and mitigate their greenhouse gas emissions. Conversely, nations with limited financial resources and higher climate vulnerability, such as Least Developed Countries (LDCs) and Small Island Developing States (SIDS), might prioritize adaptation strategies over mitigation strategies in their climate action planning (IPCC, 2023). This pillar of distributive justice highlights the intricate balance between universal commitment and differentiated responsibilities, recognizing the contrasting capabilities and impacts faced by countries, and the "uneven distribution of wealth and power between (and within) countries" (IPCC, 2023, p 160).

At the generational level, the distributive pillar confronts the challenge of ensuring that today's climate actions do not compromise the well-being and opportunities of future generations (Jonas, 1985; Llavador et al., 2010 cited in IPCC, 2023). This aspect addresses the temporal distribution of climate change effects and climate finance burdens and the imperative to hand down a viable and just world to future generations. It involves a conscientious evaluation of long-term environmental impacts and the pursuit of policies that support intergenerational justice. Thus, young climate activists and philosophers have argued that children and unborn people will face a worse climate crisis than current adults, including those designing and implementing international climate change policy (IPCC, 2023). Under this pillar of climate justice, climate policy should then include the interests of future generations and should avoid

[21] Principle 7 of the Rio Declaration states: "*States shall co-operate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, states have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command*." (UN, 1992, p 2).

[22] Driesen (2008) explains that the Kyoto Protocol integrated the global governance models of market liberalism and sustainable development.

passing on the burdens and costs of adaptation to climate change to unborn people. In consequence, it is crucial to examine how municipal green bonds, as debt instruments, impose burdens on future generations. Equally important is the analysis of how projects financed by these bonds can benefit or adversely affect future generations. This dual focus provides a comprehensive view of the long-term implications of using municipal green bonds.

The three scales of the distributive justice pillar of climate justice, including individuals, states, and generations, have direct implications for climate finance mechanisms, notably debt instruments like municipal green bonds. Such financial instruments play a pivotal role in the redistribution of the costs associated with climate change adaptation and mitigation efforts. The deployment of debt as a tool for climate finance inherently shifts the financial burden of current climate actions onto future generations. Moreover, it delineates the allocation of costs and benefits between different actors, individuals, and states, based on their roles as lenders or borrowers within the global capital flows earmarked for climate action. This is something to take into account in a climate justice approach to climate finance, and as proposed in the last part of this chapter in the analytical umbrella of climate justice.[23]

Specifically, the projects financed by municipal green bonds have activated redistributions with associated harms and benefits. For instance, in San Francisco, a treatment plant financed by these bonds has facilitated the redistribution of contaminated water (see chapter 6). In Cape Town, the installation of financed water management devices has influenced the distribution of drinking water in lower-income households (see chapter 7). Similarly, in Mexico City, the Vicente Guerrero water infrastructure and Tláhuac treatment plant projects have affected the redistribution of floodwater and groundwater (see chapter 8). The financial redistributions associated with municipal green bonds inherently involve public significance, as municipalities or cities use public resources to repay the municipal green debt. These financial redistributions encompass debt service obligations and the potential enrichment of bond investors. Furthermore, the water infrastructure projects financed by these bonds have both positive and negative impacts on the communities in which they are situated, reflecting the broader implications of financial redistribution.

3.8 Compounding Dimensions of Climate Vulnerability

This dissertation operationalizes the IPCC's analytical framework of climate justice by integrating two critical concepts: vulnerability to climate change and intersectionality. The

[23] An additional point to address that goes beyond the scope of this dissertation is the role of additionality in the distributive justice of climate finance. For more details on additionality in green bonds see (Jones et al., 2020) and on additionality in climate and development finance see (Brown et al., 2010).

IPCC defines vulnerability as "*the propensity or predisposition to be adversely affected and encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and the lack of capacity to cope and adapt*" (IPCC, 2023, p 5). Vulnerability in ecological and human systems is inherently linked to risk and the potential for adverse consequences, in the context of climate change. This concept of vulnerability is dynamic, varying over time, within and between, communities and countries, reflecting a complex interplay of factors (IPCC, 2023). For this dissertation, which concentrates on green bonds issued by subnational urban governmental entities to finance water infrastructure projects classified as climate change adaptation, the IPCC's (2023) conclusion on vulnerability and intersectionality is highly pertinent:

> "*Climate impacts on urban population health, livelihoods and well-being are felt disproportionately, with the most economically and socially marginalised being most affected (high confidence). Vulnerabilities vary by location and are shaped by intersecting processes of marginalization, including gender, class, race, income, ethnic origin, age, level of ability, sexuality and nonconforming gender orientation (high confidence)*." (IPCC, 2023, p 54).

In essence, vulnerability to climate change is intertwined with intersectional processes of marginalization, exclusion, discrimination, and violence, which are historically rooted in structures of patriarchy, sexism, slavery, racism, colonialism, classism, apartheid, segregation, and other discriminatory practices. The IPCC (2023) identifies these dimensions of climate vulnerability as crucial for understanding and addressing climate justice. Each dimension of vulnerability has been extensively studied within the climate justice framework, encompassing gender (Terry, 2009), class (Harlan et al., 2015), race (White-Newsome, 2016; Pulido, 2017; Tuana, 2019; González, 2020; Méndez-Barrientos et al., 2023), ability level (Schlosberg, 2012), and sexuality and non-conforming gender orientation (Dalton, 2023).

The dimensions of climate vulnerability often overlap, highlighting the importance of an intersectional approach, which will be explained further. However, it is crucial to clarify that, despite perceived overlap among different dimensions, maintaining their distinction is important as they respond to distinct forms of discrimination. For example, at first glance, there may appear to be repetition between class and income, as in some contexts, high income is an indicator of belonging to the privileged or elite class. However, a privileged individual who falls into complete bankruptcy does not immediately lose other class-based privileges, such as social connections or educational level. Conversely, a person who suddenly becomes wealthy does not automatically enter the privileged class of their context and may still face

discrimination based on other dimensions such as race, ethnic origin, sexual orientation, and so forth. In summary, each dimension of climate vulnerability addresses a distinct form of exclusion and discrimination, which, when intersecting with other vulnerability dimensions, can create a compounded discrimination and climate vulnerability scenario that necessitates an intersectional approach. For a detailed analysis of the compounded effects of race, class,[24] and income on inequality in Brazil, see Salata (2020).

One of the seminal definitions of intersectionality was introduced by Kimberlé Crenshaw (1991), who conceptualized it to articulate how race and gender interact to shape the discrimination experience by Black women's in job applications. Crenshaw aimed to demonstrate that the discrimination experience by Black women cannot be adequately understood by examining the dimensions of race and gender separately, but must instead consider how these dimensions of exclusion intersect. Since this pivotal definition the application of intersectionality has expanded significantly, proving its utility in comprehending the complex phenomena of discrimination and exclusion across various intersecting dimensions such as race, gender, ethnicity, income, and others (e.g., Icaza Garza and Vasquez, 2017; Wekker, 2021). The concept of intersectionality is not an academic notion and should not only be associated with academic production. On the contrary, it has roots in, and continues to be integral to, social movements and academic discussions, notably within Black Feminist Thought, Critical Race Theory, and Third World Feminism (e.g., Houh, 2022; Combahee River Collective, 1977).

The IPCC advocates for climate action that is inherently inclusive and recognizes intersecting climate vulnerabilities to promote transformative adaptation to climate change (IPCC, 2023). This approach necessitates centering the concept of intersectionality in the analysis of climate action from a climate justice perspective (Kaijser & Kronsell, 2014; Kuran et al., 2020; Amorim-Maia et al., 2022; Mikulewicz et al., 2023, IPCC, 2023). Consequently, climate justice is conceptualized in this dissertation as an analytical umbrella that integrates the three pillars of procedural justice, recognition, and distributive justice. These pillars are explored alongside various intersecting dimensions of climate vulnerability, illustrating the comprehensive and intersectional nature of climate justice as analytical framework to understand and address the interplay between climate action and climate finance.

[24] Salata defines class as "*aggregates of individuals whose initial life conditions, provided by families, allow access to similar volumes and structures of cultural and economic resources, which are able to condition – to a greater or lesser degree – one's life chances*." (Salata, 2020, p 28). Consequently, Salata (2020) employes the terms *class* and *social origin* interchangeably.

3.9 The Umbrella of Climate Justice as Analytical Framework of this Dissertation

To facilitate the understanding of climate justice and to streamline its application to the concrete case studies, the author of this dissertation has developed the analogy of an *analytical umbrella* to capture the overarching nature of climate justice, as discussed below. The analogy of an umbrella provides a vivid and accessible way to portray climate justice as analytical framework, encapsulating its essence in a practical visual metaphor.

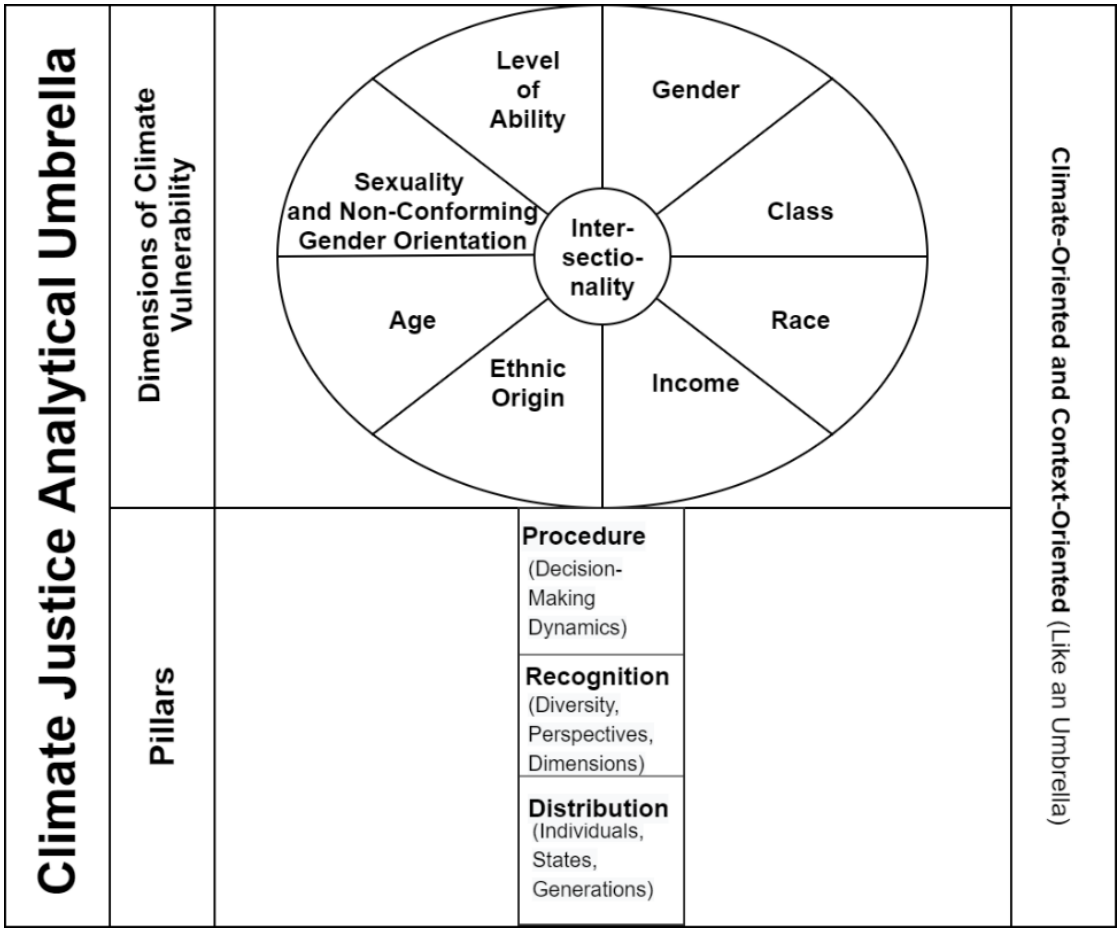

Figure 3. Climate Justice Analytical Umbrella. Source: Author Based on the IPCC (2023).

In this framework, climate justice serves as a conceptual tool akin to an umbrella's purpose, providing protection against changes in the climate. This concept is employed variously across different contexts by diverse actors including communities, social movements, and academics. Its flexibility is similar to an umbrella's versatility, capable of expanding or collapsing to suit the specific requirements and conditions of its users. This flexibility makes climate justice a versatile framework for acknowledging and addressing the multifaceted challenges of the climate crisis and the different intercepting climate vulnerabilities manifest in each local context.

While the concept of climate justice is highly versatile, it is underpinned by enduring pillars that lend structural integrity. These foundational pillars are procedural justice, recognition, and distributional justice, that function like the handle of the climate justice umbrella, providing a firm grip on the overarching concept. The analytical umbrella of climate justice spans intersectional dimensions of climate vulnerability including gender, class, race, income, ethnicity, age, sexuality and non-conforming gender orientation, among others. This analogy illustrates climate justice as not only a dynamic and versatile framework but also one with a solid base, guiding efforts to understand and address the interplay between climate finance and climate action.

In alignment with the perspectives presented by the IPCC (2023), this dissertation adopts climate justice as a foundational concept to understand and address the interplay between climate action and climate finance. This also entails framing climate justice not merely as a tool for theoretical analysis but also as a dynamic strategy for advocacy and policy development, as well as a catalyst for social mobilization within the sphere of international climate change policy. In this line of argument, Goodman (2009) explained that aspects of global justice are increasingly subsumed by climate justice, which has the advantage of being a totalizing concern that is at the same time connected to scientifically measurable objectives and requires global paradigmatic changes.

The concept of climate justice, while appearing complex in its scope and implications, is underpinned by a straightforward logic. The response to the climate crisis necessitates profound structural adaptation and mitigation efforts across various aspects of society, including shifts in energy systems and water infrastructures overhauls (IPCC, 2023). These necessary structural changes present a critical juncture at which the enduring legacies of injustice, deeply embedded within the current ecological and human systems, can either be perpetuated and exacerbated, or alternatively, can be actively dismantled. It is argued that the opportunity of climate justice lies in seizing this moment of global restructuring because of the climate crisis as a pivotal opportunity to address and rectify historical injustices that configure climate injustice and dimensions of vulnerability.

3.10 Conclusion: From Climate Justice to Just Climate Finance

This chapter has elucidated the origins and evolution of the concept of climate justice and its growing recognition within the sphere of international climate change policy. Climate justice, deeply rooted in and extending from racial justice and environmental justice (Schlosberg & Collins, 2014), transcends these bases to critically address both local and global contexts of

climate injustice (Goodman, 2009). While diverse definitions of climate justice emerge from academic and social movements discourses, three core pillars consistently recur, recognized by the scientific community and encapsulated by the IPCC (2023): procedural justice, recognition, and distributive justice.

Procedural justice focuses on the processes governing decision-making. Recognition emphasizes the acknowledgement of diverse actors, perspectives, and dimensions of climate vulnerability. Distributive justice concerns the allocation of climate change-related benefits and harms (IPCC, 2023). These pillars interplay with intersectional dimensions of climate vulnerability, such as a gender and race (Amorim-Maia et al., 2022; Mikulewicz et al., 2023), providing a robust framework to critically examine municipal green bonds that financed water infrastructure projects in the empirical chapters of this dissertation. This analytical framework offers new insights into understanding the nuances of climate finance and its effects on climate action.

The analytical framework of climate justice proves invaluable in scrutinizing the dynamics of climate finance, providing lens through which to assess the distribution of losses and benefits within the financial system amidst climate change. This perspective facilitates the exploration of green bonds across various scales, from national to subnational levels to more localized contexts such as households, communities, or neighborhoods. It also considers the long-term implications for future generations, highlighting the overlapping influences of climate finance decisions on diverse population segments.

Similarly, the three pillars of climate justice are instrumental in operationalizing this dissertation. The procedural pillar of climate justice is crucial as it scrutinizes the governance and decision-making processes associated with green bonds. This examination covers the criteria for green labeling, the transparency of these processes, and the extent to which they enable or obstruct participation from a broad range of actors. By analyzing these procedural aspects, this thesis aims to uncover the mechanisms through which various actors, factors, and perspectives are included or excluded in the decision-making processes surrounding the issuance of green bonds and the projects they finance.

Recognition also serves as a fundamental pillar of climate justice in the context of green bond financing and implementation. It involves acknowledging the diverse range of actors affected by climate change and ensuring that their perspectives and worldviews are integral in the formulation and execution of climate finance instruments and the projects they financed. This dissertation also engages with the pillar of distributive justice by examining, across the three

cases, how financial resources are allocate and how water, a crucial environmental element, is redistributed. It also assesses the environmental and climate impacts stemming from these allocations in various communities, particularly those that are historically marginalized and more vulnerable to the climate crisis.

Finally, the novelty of this dissertation particularly lies in applying the analytical framework of climate justice to the specific situation of municipal green bonds. This innovative approach bridges theoretical knowledge of climate justice with the practical implementation of climate finance instruments, enhancing understanding of how the principles of climate justice can be operationalized within the realm of municipal climate finance. Moreover, this work fosters academic dialogue between studies on green bonds and other climate finance instruments, like the Green Climate Fund (Vanderheiden, 2015) and the Clean Development Mechanism (Baird & Green, 2020).

In this context, this dissertation dialogues with and enriches the international academic literature on climate finance by adopting a climate justice perspective that extends beyond the conventional inter-state level of loss and damages and *common but differentiated responsibilities*, and by using this paradigm to analyse municipal green bonds as a financial innovation. Although there is no doubt that the predominant focus of the climate finance research agenda on the national level significantly contributes to the understanding from a distributive justice perspective, this dissertation aims to broaden this focus by incorporating more localized contexts and examining the impacts on future generations through the use of debt instruments like municipal green bonds. It explores the extensive range of scales in climate finance, from the issuance of green bonds by local governments to the lived-experiences within communities. Expanding the analytical focus to include these varied scopes is crucial for developing a comprehensive understanding of how climate finance interacts with climate action and its implications within the contexts of climate injustice it affects.

This refined approach enables more detailed and localized research that pays close attention to the lived experiences of communities and neighborhoods, thereby illuminating various dimensions of climate vulnerability such as income, race, and gender. These aspects are captured under the climate justice umbrella analogy detailed in the figure 3 on this chapter. This expansion not only contributes to fill existing gaps but also deepens the understanding within the climate finance literature, offering new insights into how climate justice can be integrated at different governance levels of climate finance.

CHAPTER 4: UNDERSTANDING GREEN BONDS AND MUNICIPAL GREEN BONDS

4.1 Introduction

This chapter provides a general summary of green bonds and municipal green bonds as two popular financial instruments in the context of the 'climate finance gap' and the financialization of the green transition. More specifically, it provides foundational information on their key components and markets, setting the stage for the detailed case studies that follow. It starts with outlining the basic features of green bonds to then present the notion of green standards, and thoroughly explaining the green labeling process. Understanding the interplay between the bond (a financial instrument), the standard (a set of guidelines) and the labeling process (the attribution of green qualities to the financial instrument) is vital for grasping the research methodology of this dissertation, which utilizes green labeling documents, including the green bond framework documents and follow-up reports, as primary sources.

The second part of the chapter enters more into the details of municipal green bonds as a sub-category of green bonds and offers some reflection on the cycle of capital circulation that is triggered when such financial instruments are issued in order to raise the funds needed for specific green infrastructures. The conclusion is dedicated to the state of the municipal green bonds' market in Africa and Latin America, reflecting on its modest growth despite the significant promotion that international actors have been putting in place throughout the global South.

In other words, this chapter provides the essential insights into green bonds and municipal green bonds, highlighting their global status and regional situations in Africa and Latin America. This foundational knowledge is crucial to explore the case studies and subsequent discussions, as it offers the necessary global and regional context. Understanding this context is vital for grasping the relevance and mechanics of municipal green bonds within the broader frameworks of green bonds and climate finance.

4.2 Fundamental Components of Green Bonds

Green bonds are unique debt instruments distinguished by their green label. This chapter dissects their dual components: the debt mechanism and the green label, before charting the market's evolution since its origin in 2007. There are three main financial markets: money markets, where cash is traded; stock markets, where equity shares are exchanged; and bond markets, the platforms for trading debt securities (Mobius, 2012). Specifically, in bond markets,

bonds function as loans from investors to governments, financial institutions, corporations, and other entities over a set period. Investors receive periodic interest payments and the principal amount is repaid at the bond's maturity (Mobius, 2012). Key stakeholders in these markets include issuers, investors, dealers, and rating agencies, all playing crucial roles in the functionality and stability of the bond market (Mobius, 2012).

Green bonds have emerged as a pivotal instrument in the realm of climate finance, experiencing remarkable growth over the past two decades since their inception in 2008, reaching one trillion USD in cumulative issuance by 2020 (CBI, 2020). They are actively promoted by development banks and various public and private entities. Several international initiatives have been established to foster the development of green bonds, including the International Finance Corporation's Green Bond Technical Assistance Program (n.d.), the African Development Bank Group's Sustainable Bond Program (n.d.), the European Union's Global Green Bond Initiative (n.d.), and the Interamerican Development Bank's Green Bond Transparency Platform (n.d.), among others. Collectively, these programs indicate the widespread endorsement of green bonds as a debt instrument within climate finance.

Green bonds serve as a significant tool for climate-focused investments, enabling issuers to raise debt capital in financial markets. The application of a green label on these bonds signals to investors that the proceeds will be directed towards climate and environmental projects. Currently, the green labeling landscape is primarily dominated by two voluntary standards: the Green Bond Principles and the Climate Bonds Standard. Initiated by the International Capital Market Association (ICMA) in 2014, the Green Bond Principles is the more prevalent framework, serving as the unofficial global benchmark for green bonds (Spinaci, 2022). It delineates a clear process for green labeling, including steps such as project selection and the allocation of funds to green initiatives. However, it does not provide explicit definitions or criteria for what specifically qualifies as a green asset or project, leaving some room for interpretation (Spinaci, 2022).

In contrast, the Climate Bonds Standard, introduced by the Climate Bonds Initiative (CBI) in 2015, offers a more detailed framework than the Green Bond Principles. Enhancing the foundational aspects of the Green Bond Principles, the Climate Bonds Standard establishes a detailed green taxonomy that specifies investments aligned with climate goals (CBI, 2016a). According to the CBI, “CBS V2.0 [Climate Bonds Standard published in 2015] essentially turns the GBP [Green Bond Principles] into a set of requirements and actions that can be assessed, assured and certified in a robust and repeatable way” (CBI, 2016b, p. 18). Furthermore, the Climate Bonds Standard mandates that green bonds receive certification from approved

external reviewers, while the Green Bond Principles does not make external reviewers mandatory, although they are recommended (Spinaci, 2022). Table 1 below presents both standards, those of ICMA and CBI, side by side.

Standard (First Version)	**Standard Setter**	**Comments**
Green Bond Principles (GBP) (2014)	International Capital Market Association (ICMA)	Voluntary process guidelines with four components: 1. Use of Proceeds. 2. Project Evaluation and Selection Process. 3. Management of Proceeds. 4. Reporting. This standard offers an unrestricted list of eligible categories for green projects. An external review is optional but recommended.
Climate Bonds Standard (CBS) (2015)	Climate Bonds Initiative (CBI)	The CBS was developed based on the GBP guidelines, incorporating additional details and a specific green taxonomy for assets and projects that are compatible or incompatible with climate action. According to the CBS, an external review is mandatory.

Table 1. Main Green Bond Standards (based on CBI, 2016b; ICMA, 2016; and IFC, 2022).

The initial step in issuing a green bond, particularly by municipal or city governments, entails creating a green bond framework document. This framework lays out critical details about the bond, such as the intended application of the proceeds, the criteria for project selection and evaluation, management of the proceeds, and the strategies for ensuring transparency, including the production of follow-up reports (ICMA, 2016). An independent third party, typically a consulting firm hired by the issuer, reviews this framework document to ensure it aligns with the chosen voluntary green standard and provides a second opinion on its adequacy (ICMA, 2016). Following a favorable second opinion, the green bond is then issued in the financial market, accompanied by the second opinion document. Throughout the bond's tenure, issuers are required to regularly publish follow-up reports to track the implementation of projects and the attainment of the outlined objectives (CBI, 2021b; IFC, 2022). Below, table 2 illustrates the step-by-step process of voluntary green bond labeling.

1. **Green Bond Framework:** The issuer, such as the city or municipal government, formulates the green bond framework. This document describes the intended use of proceeds or capital, criteria for project selection and evaluation, included projects, proceeds management and strategies for transparency and monitoring reports. This framework is formulated following the chosen voluntary green standard, such as the Green Bond Principles or the Climate Bonds Standard.
2. **Second Opinion on the Green Bond Framework:** The issuer engages an independent third party, typically a consulting firm, to assess the green bond framework. This entity provides a second opinion, evaluating the framework's compliance with the selected green standard.
3. **Bond Issuance:** The issuer places the green bond in the financial market through a financial intermediary, such as a commercial bank. The issuance documentation comprises the green bond framework and the second opinion.

4. **Allocation of the Green Bond Proceeds:** The Proceeds are allocated to eligible assets and projects listed in the green bond framework.
5. **Follow-Up Reports:** Periodically, the issuer releases monitoring reports that detail the financial execution and outcomes in accordance with the green bond framework and the chosen green bond standard.
6. **Bond Payments and Maturity:** The green bond debt is periodically amortized according to the prevailing interest rates. Upon reaching maturity, typically after a set number of years, the release of follow-up reports ceases.

Table 2. Voluntary Green Labeling Process for Bonds. Source: Author.[25]

The municipal green bonds experiences in San Francisco, Cape Town and Mexico City, as discussed in the empirical chapters 6, 7, and 8, followed this process of green labeling. Both the green bond framework documents and the subsequent follow-up reports served as relevant sources of information for this dissertation (see tables 4, 6, and 7 for more details). This approach facilitated a coherent, and replicable analysis among the selected cases. Moreover, it stablished a methodology potentially replicable to any other green bond that has followed this same process of green labeling.

4.3 Evolution of the Green Bonds Market

The development of the green bond market can be segmented into three distinct phases, which are elaborated on below: 1) Inception (2007-2014), 2) Consolidation (2014-2020), and 3) Diversification (2020-present).

During the inception phase from 2007 to 2014, the first issuances of green bonds were primarily undertaken by development banks, utilizing self-defined green labels in the absence of established global voluntary standards. The consolidation phase marked the emergence and adoption of major voluntary green standards, namely the Green Bond Principles in 2014 and the Climate Bonds Standard in 2015. This period witnessed rapid growth, culminating in a milestone of one trillion dollars in cumulative green bond issuances by 2020 (CBI, 2020).

The diversification phase, beginning in 2020, observed a diversification of bond labels, with green bonds now sharing market space with bonds labeled for social, environmental, and climate purposes. Collectively termed 'GSS+' by the Climate Bonds Initiative (2022), this category includes green bonds, social bonds, sustainability bonds, sustainability-linked bonds, and transition bonds. Although the analysis of these recently labeled bonds extends beyond the

[25]This simplified summary is intended for explanatory purposes only, aiming to provide a clear understanding of the green labeling process. For a more detailed summary of the bond issuance process, see IFC (2022) and Department of Forestry, Fisheries and the Environment (DFFE) and the National Treasury, Republic of South Africa (2022).

scope of this dissertation, their emergence represents a significant trend that could be explored using the climate justice analytical framework in future research.

To illustrate these developments, this dissertation includes two graphs from the Climate Bonds Initiative: one showing the cumulative issuance of green bonds reaching one trillion USD (figure 1) and another depicting the diversification of the labeled bond market beginning in 2020 (figure 4), which marks the transition from the consolidation to the diversification phase of green bonds.

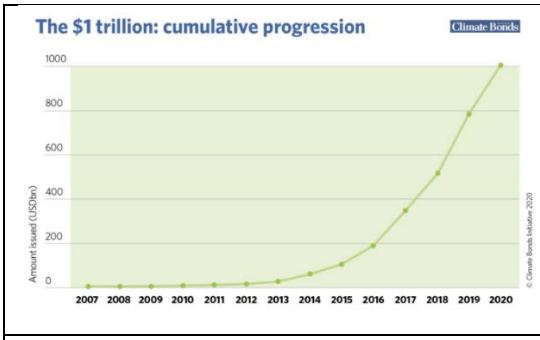

Figure 1. The Green Bonds $1 Trillion: Cumulative Progression. Source: CBI (2020).

Figure 4. GSS+ Bonds Volumes Reached USD 858.5 Bn In 2022. Source: CBI (2022).

In the inception phase of the green bond market (2007-2014), the European Investment Bank (EIB) issued a climate awareness bond in 2007, serving as a direct precursor to green bonds (EIB, 2021). Following this, the World Bank, responding to the demand from Nordic pension funds for investments that were both green and secure, launched the first officially green-labeled bond in 2008 (World Bank Group, 2021). During these early years, the green bond market operated without standardized criteria, leading issuers to rely on self-defined green standards. For instance, the criteria for the World Bank's 2008 bond were self-established by the issuer (World Bank Group, 2019). The landscape began to evolve in 2014 with the introduction of the Green Bond Principles, the first voluntary standard aimed at providing a unified framework for green bonds.

During the consolidation phase of the green bond market (2014-2020), the International Capital Market Association introduced the Green Bond Principles in 2014, and the Climate Bonds Initiative followed with the Climate Bonds Standard in 2015. These voluntary standards provided a foundational framework for participants entering this market. The market experienced a significant upturn in 2013 when the International Finance Corporation (IFC), the private sector arm of the World Bank Group, issued a groundbreaking USD one billion green

bond. This issuance coincided with a rapid expansion in the market, with annual green bond issuances increasing from less than USD 50 billion in 2014 to USD 263 billion in 2019. By 2020, the cumulative issuance had crossed the trillion-dollar threshold (EIB, 2021), cementing green bonds' status as a crucial instrument in climate finance.

The diversification phase in the evolution of the green bond market began in 2020 when the total issuance of green bonds reached USD one trillion (CBI, 2020). Concurrently, the issuance of other types of labeled bonds, such as social bonds, surged (Giraldez and Fontana, 2022). While this recent stage is beyond the scope of this dissertation, which centers on municipal green bonds issued between 2016 and 2017, it represents a significant development in the market that may offer intriguing avenues for future research.

Green bonds have emerged as a leading instrument for mobilizing debt capital within the climate finance arena, outperforming other mechanisms like the Clean Development Mechanism Fund, which mobilized USD 303.8 billion between 2001 and 2018 (United Nations Climate Change, 2018), and the Green Climate Fund, which raised USD 10.3 billion from its inception in 2010 until July 31, 2020 (Green Climate Fund, n.d.). Despite their rapid growth, green bonds accounted for just under 4% of the global bond market's nearly USD 120 trillion valuation in 2020, highlighting their potential for further expansion, according to the European Investment Bank (2021). Since their debut issuance by the World Bank in 2008, the green bond market has expanded significantly, yet it still has considerable room to grow within the financial debt market (EIB, 2021). This raises critical questions about the implications for climate justice of this market's continued rapid growth and whether there are more effective alternatives in terms of climate justice. This dissertation contributes to this ongoing debate.

The Climate Bonds Initiative estimates that the green bond market could reach an annual issuance volume of USD five trillion by 2025 (CBI, 2022). This forecast emphasizes the remarkable ascent of the green bond market since its inception in 2007, surpassing other climate finance mechanisms in its growth trajectory. Despite its impressive expansion, the green bond market still represents a small fraction of the broader global bond market, indicating significant potential for further growth, contingent upon favorable market conditions (CBI, 2022; S&P Global Ratings, 2023). This chapter will proceed to detail the fundamental components and formative experiences of green bonds in their municipal variant.

4.4 Municipal Green Bonds

Municipal green bonds are a distinct segment of the green bond market, tailored specifically for financing at the municipal level. Broadly speaking, they combine the environmental and

climate focus of green bonds with the structure of local governance and the financing mechanisms that is proper of municipal or city bonds. Across time and geographies, municipal green bonds have been issued by local governments, municipal authorities, or other entities within their purview, such as water utilities or transportation agencies, to secure funding for environmentally-focused and climate-oriented municipal projects (Bigger & Millington, 2020). This form of debt financing is presented as an alternative to traditional borrowing from commercial or development banks and a way to reach out to international sustainable investors and green capital that may not be otherwise accessible in the local context (e.g., OECD, 2017).

Municipal green bonds are labeled municipal bonds. It is thus important to remind that municipal bonds are generally categorized into two types according to their sources of repayment: revenue bonds and general obligation bonds. Revenue bonds are repaid from the earnings generated by the projects they fund, such as the income from water bills in the case of water infrastructure projects. General obligation bonds, on the other hand, are serviced through the issuer's general revenues, typically derived from taxes (O'Hara, 2012).

Municipal bonds generally consist of the following key components: the principal (the borrowed amount), the interest rate (the borrowing cost), the maturity date (when the principal must be repaid), the issuer (the municipality or city government), the intended use of the proceeds (either for operational expenses or specific projects), and the revenue source for debt service (see figure 5). Municipal green bonds share these fundamental attributes but are distinguished by their green label, which signifies that the bond proceeds will be used for environmental and climate-focused projects (CBI, 2021b). This green label uniquely positions municipal green bonds within the broader financial spectrum. Additionally, the bond market includes other labeled bonds like sustainability bonds, which target both environmental and social benefits, and blue bonds, designed specifically to fund marine and coastal projects (UNFCCC Standing Committee on Finance, 2021; Kılıç, 2024).

Municipal green bonds mobilize debt capital for initiatives classified as climate action at the subnational level, engaging a diverse array of stakeholders from financial markets and investment sectors. These bonds are issued by subnational entities on financial markets with the aim of collecting resources from private investors such as pension funds and insurance funds (CBI, 2021b).

Usually, the issuance and administration of municipal green bonds represent a public-private collaborative activity involving public officials, standards' setters, private consultants and rating agencies who prepare and oversee the bond offerings, and investors who fund these bonds

anticipating a return on their investment with interest upon maturity. This process exemplifies the crossing of public policy and financial investment within the framework of climate finance, as illustrated in the figure 5 below.

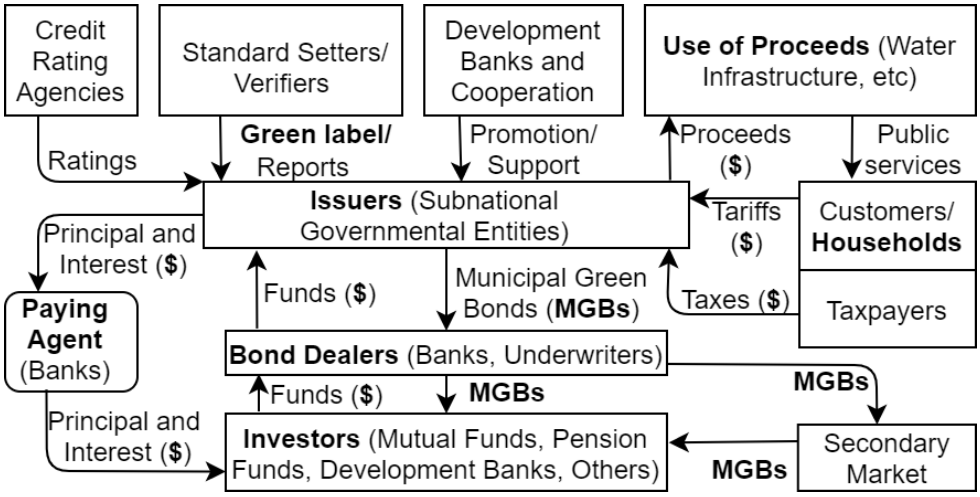

Figure 5. Municipal Green Bond Cycle. Source: Author Based Partially on O'Hara (2012).

The early precedent for municipal bonds with an environmental label began in San Francisco, California, when the city issued a 'solar' labeled bond in 2001 to fund solar energy projects (Bracking, 2019). In Europe, early instances of green bonds in their municipal form appeared in Île-de-France, the metropolitan area of Paris, France, in 2012 (CBI, 2018) and in Gothenburg, Sweden, in 2013 (García-Lamarca & Ullström, 2020). In the United States, the Commonwealth of Massachusetts advanced this trend by issuing the country's first municipal green bond in 2013 (Baker et al, 2022). Since that time, the municipal green bond market in the United States has expanded extensively, reaching a cumulative issuance of 3,983 municipal green bonds valued at USD 28 billion by 2018 (Baker et al., 2022).

The municipal green bond market has experienced growth beyond the United States, with various global regions participating in its development. Ontario, Canada, issued its first municipal green bond in 2014 (Ontario Financing Authority, n.d.). This was followed by Tokyo, Japan, in 2017 (Shizimiku et al., 2021), and Jiangxi Province, China, in 2019 (Lincoln Institute of Land Policy, 2020). More recently, Moscow, Russia, entered the market in 2021 (MOEX Group, 2021), alongside Ghaziabad, India, also in 2021 (The Hindu, 2021). Despite this international growth, the United States remains the largest market for municipal green bonds by far (Baker et al., 2022). The subsequent section of this chapter examines the state of the municipal green bond market in Africa and Latin America, which are of particular interest in this dissertation, before addressing the circumstances surrounding municipal bonds in the United States, with special attention to aspects relevant to this dissertation.

4.5 State of the Municipal Green Bond Market in Africa and Latin America

The market for green bonds (state, municipal, and private) is predominantly concentrated in the global North, with the share of global South's issuances being mostly represented by Chinese actors, while Africa and Latin America have a moderate participation. From 2012 to 2021, green bond issuances in the global South amounted to USD 323.4 billion, with China accounting for 68% of this total, highlighting its dominance in the developing regions' green bond markets. Latin America, contributing 10.3%, shows growing participation, suggesting an emerging interest in leveraging green bonds for climate finance. Conversely, Africa's involvement remains limited, with only 1.32% of the issuances, reflecting significant barriers to expansion within the green bond sector in the region, as further discussed below (Amundi Asset Management and International Finance Corporation, 2022).

Municipal or subnational governments play a relatively minor role in the green bond market compared to other issuers. At the sectoral level, green bond issuance in the global South is predominantly driven by financial institutions, non-financial corporations, as well as sovereign and governmental agencies (Amundi Asset Management and International Finance Corporation, 2022). Within this broader context, municipal green bonds in Africa and Latin America have seen a total of eight issuances from their inception with the first issuance in Johannesburg, South Africa, in 2014, through to 2022. The market for municipal green bonds in these regions has primarily been concentrated in South Africa, Morocco, Mexico, and Argentina, as detailed in table 3 below.

Year	Subnational government (Country)	Amount (Billion)	Amount in USD (Million)	Use of proceeds	Green standard
2014	Johannesburg (South Africa)	ZAR 1.46	134.59	Biogas to energy project, solar water heater program, and other projects	Information not available
2016	Mexico City (Mexico)	MXN 1	53.28	Transport, sustainable energy, and water infrastructure	Green Bond Principles (GBP)
2017	Cape Town (South Africa)	ZAR 1	75.07	Water management devices, water infrastructure, flood defenses	Climate Bonds Standard (CBS)
2017	La Rioja Province (Argentina)	-	300	Wind energy	Information not available
2017	Jujuy Province (Argentina)	-	210	Solar energy	Green Bond Principles (GBP)

2018	Mexico City (Mexico)	MXN 1.1	56.92	Transport, sustainable energy, and water infrastructure	Green Bond Principles (GBP)
2022	Agadir City (Morocco)	MAD 1	97.85	Solar street lights, water infrastructure, green spaces	Information not available
2022	City of Córdoba (Argentina)	ARS 2	15.8	Solar street lights, solar energy, and water infrastructure	Green Bond Principles (GBP)
2023	Godoy Cruz Municipality (Argentina)	ARS 0.3	1.29	Solar street lights, bike lanes, and solar energy	Green Bond Principles (GBP)

Table 3. Municipal Green Bonds in Africa and Latin America, 2014-2023.[26] Source: Author.[27]

Within the overarching structure of this dissertation, it is acknowledged that the proliferation of green debt introduces distinct challenges for countries, city governments, and municipalities already burdened by high levels of debt (Tänzler et al., 2017). The use of debt instruments like municipal green bonds is inherently limited to municipalities and urban regions that possess the necessary prerequisites for borrowing. These prerequisites include a robust regulatory framework, a solid legal infrastructure, financial expertise, fiscal health, and well-established local financial markets (Gorelick, 2018). These conditions ensure that the issuance of municipal green bonds is feasible and sustainable over time, taking into account the specific socioeconomic and legal contexts of the issuing bodies.

Despite these challenges, this dissertation emphasizes that municipal green bonds will persist in being issued, albeit at a slower pace by cities located in regions like Africa and Latin America (as described in table 3)[28]. Therefore, there is a compelling need to meticulously explore and shed light on the complexities, frictions, and inconsistencies inherent in the issuance and management of municipal green bonds. This thorough examination is crucial for understanding the actual implications of expanding green debt, especially in contexts where economic vulnerabilities and fiscal limitations significantly hinder the adoption of such financial mechanisms (Tänzler et al., 2017).

4.6 Conclusion: Growth and Challenges of the Municipal Green Bond Market in the Global South and the Global North

[26] Approximate amount for the year in which the bond was issued, based on the average exchange rate according to information from the central banks of each country.

[27] With information from City of Johannesburg (2014), Sustainalitycs (2016), Cape Town (2017), Triaca (2020), Economic Commission for Latin America and the Caribbean (2017), Carbon Trust (2018a), KPMG (2019), van Niekerk (2022), Zgheib (2022), Córdoba Capital (2022), Municipality of Godoy Cruz (2023). Additionally, Nairobi City County (2022) announced its commitment to issue a municipal green bond (Shetty, 2022).

[28] For a detailed explanation of the barriers to the green bond market in the global South, refer to Banga (2019) or Tänzler et al. (2017).

This chapter has provided a comprehensive understanding of green bonds and municipal green bonds, detailing their fundamental components, market evolution, and the specific characteristics and status of the market within the contexts of Africa and Latin America.

Initially, the fundamental components of green bonds and the evolution of their market were elucidated. Green bonds, distinguished by their green label, function as debt instruments whose proceeds are allocated to projects classified as climate action and environmental sustainability. Since their inception in 2008, they have gained prominence in climate finance, experiencing substantial growth. The most important voluntary standards for green labeling are the Green Bond Principles (GBP) and the Climate Bonds Standard (CBS), which provide frameworks for labeling and certifying bonds (ICMA, 2016; CBI, 2021b).

The evolution of the green bond market can be segmented into three phases: inception (2007-2014), consolidation (2014-2020), and diversification (2020-present). During the inception phase, development banks issued the first green bonds without standardized criteria. The consolidation phase saw the establishment of the Green Bond Principles and the Climate Bonds Standard, leading to rapid market growth, with cumulative issuance reaching one trillion USD by 2020 (CBI, 2021a). The diversification phase introduced new types of labeled bonds for various social and environmental purposes, highlighting the increasing scope of these debt instruments.

Municipal green bonds are issued by local or subnational governments or government entities under their control, such as water companies. The municipal bond green labeling process involves preparing a green bond framework document, obtaining a second opinion, issuing the bond, allocating the proceeds to eligible projects, and publishing annual follow-up reports (CBI, 2021b).

The municipal green bond market in Africa and Latin America has shown limited growth compared to the global North, particularly the United States. From 2012 to 2021, green bond issuances in the global South amounted to USD 323.4 billion, with China dominating (Amundi Asset Management and IFC, 2022). Latin America's share is growing, while Africa's share remains minimal, reflecting significant barriers to market expansion (Banga, 2019). Notable issuances include the Johannesburg green bond in 2014, Mexico City in 2016 and 2018, and recent issuances in Morocco and Argentina (see table 3). These examples are often utilized to illustrate the potential of municipal green bonds to finance climate initiatives despite challenges such as high transaction costs in the issuance and the lack of proper institutional arrangements (Banga, 2019). Thus, a critical academic reflection on them is justified and much needed.

In particular, the proliferation of green debt, including municipal green bonds, presents challenges for countries and municipalities already burdened by high levels of debt. The issuance of such bonds is only viable in regions that meet the necessary prerequisites, including sound legal and financial infrastructure (Tänzler et al., 2017). Despite these challenges, the promotion of municipal green bonds in Africa and Latin America is expected to persist (Tänzler et al., 2017; African Development Bank Group, n.d.; Inter-American Development Bank, n.d. 2019, 2021), necessitating further exploration of the complexities involved in their issuance and management. Analyzing these bonds through a climate justice lens is crucial due to their potential to reveal and address climate injustices in local contexts. This analysis is not only relevant to the regions in question but could also improve the understanding of green bonds globally in terms of climate justice.

Finally, the key elements discussed in this chapter pave the way for the case studies on municipal green bonds that will be explored in empirical chapters 6, 7, and 8. Before diving into the specific case studies, chapter 5 focuses on the experience of municipal bonds in the United States, serving as a relevant precedent to the use of municipal green bonds in the South, thus demonstrating the complexities of climate injustices and informs the climate justice analytical framework applied to municipal green bond case studies examined in both the global South and the global North in this dissertation.

CHAPTER 5: UNITED STATES MUNICIPAL BONDS AS A RELEVANT PRECEDENT: RACIAL AND ENVIRONMENTAL INJUSTICES

5.1 Introduction

This chapter examines the history of municipal bonds in the United States, demonstrating its relevance and utility for this dissertation, which aims to facilitate a dialogue between the municipal green debt experiences of the global South and the global North. Development banks and international aid agencies often cite the US municipal debt market as a model for economies in the global South (Chemonics International Inc., 2009). The US has a robust history with municipal bonds, with a tradition spanning over two centuries and a market comprising hundreds of thousands of bonds (O'Hara, 2012), including thousands of green-labeled bonds (Baker et al., 2022). This extensive experience serves as a valuable reference point for understanding and addressing municipal green debt in diverse contexts.

However, US municipal bonds have faced criticism and have been central to numerous academic studies. These studies provide racial and environmental justice analyses that align with the definition of climate justice adopted in this dissertation (Yinger, 2010; Ponder, 2021; Phinney, 2022; Eldemire et al., 2022). By elaborating on these points, the present chapter emphasizes the role that the US municipal bond market is playing in the ongoing expansion of municipal bonds as a form of local financing, while at the same time stressing the importance of going beyond the financial datum and engage with the impact on people and territories, in particular the most marginalized.

Considering the primary objective of this dissertation, it is thus intellectually valuable and useful to engage with and learn from academic research that has unpacked the justice implications of municipal bonds in the US. This examination provides a foundation to assess findings that may be pertinent to the contexts of municipal bonds, green bonds, and municipal green bonds in the global South. Particularly, academic research that scrutinizes justice in US municipal bonds, especially regarding their impact on water infrastructure (Ponder, 2021; Phinney, 2022), holds relevance for this dissertation which similarly addresses water infrastructure in its case studies. This inquiry is driven by the need to explore several questions: Have justice considerations been adequately addressed in the use of municipal bonds as financial tools for public investments and infrastructure? How is the lens of justice applied to water infrastructure projects financed through these bonds? And importantly, has there been

any concerted effort to integrate a climate justice perspective in analyzing these financial instruments?

This chapter starts by showing how the promotion of municipal bonds in the global South by development banks and cooperation agencies since the 1990s was based on the US model, and how the same happened from the 2010s when these agencies also began promoting municipally issued green bonds in both the global South and the United States. Given the use of the US market as a benchmark for the use of municipal bonds in the global South, academic work and case studies are gathered that showed the justice and injustice implications deriving from the issuance of US municipal bonds, especially with regards to US municipal bonds issued to finance water infrastructure. The final part of this chapter considers how insights from this scholarship and from the public policy actions that arose against the uneven implications of municipal bonds can be applied to experiences with green-labeled municipal bonds in the global South. This is something that the international academic literature on green bonds and municipal green bonds in the global South does not yet address, which emphasizes the pioneering nature of this dissertation.

5.2 Promotion of Municipal Bonds in the Global South and Green Municipal Bonds in the Global South and the United States

The adoption of municipal debt has been increasingly advocated within the global South as part of development and climate change financing agendas. This advocacy has evolved through two distinct phases. The first phase, during the 1990s and 2000s, focused on promoting municipal bonds by leveraging the extensive experience of the US as a reference model. The second phase, beginning in the 2010s and continuing into the 2020s, has seen a shift towards promoting municipal green bonds, with an emphasis on adhering to voluntary green standards. This evolution reflects a broadening in the scope of municipal debt instruments from traditional financing to include specific environmental and climate-oriented goals.

The initial promotion of municipal debt in the global South, specifically through municipal bonds, is documented through materials from development banks and cooperation agencies. Since the 1990s, development banks, aid organizations, the private sector, and academic institutions have promoted the use of municipal bonds in the global South as a strategy for accessing financial resources amid financial constraints and limited public finance availability (Chemonics International Inc., 2009; El Daher, 1997; Fay & Morrison, 2005; Leigland, 1997; Leigland, 2004; Leigland & Thomas, 1999; Goldstein, 2001; McArthur, 2006; Platz, 2009; Sood, Mays and Lindfield, 2012). The United States served as a crucial reference model in this

advocacy effort, guiding the implementation and adoption of municipal bond strategies in these regions. Historically, municipal bonds have been the financing method of choice for subnational governments in the US, with the first one issued by New York City in 1812 (Cestau et al., 2019).

In 1997, World Bank consultant James Leigland suggested that the US municipal bond market could serve as a benchmark for municipal bonds globally. He attributed this recommendation to the extensive and rich history of municipal bonds in the US, which spans over two centuries. The US municipal bond market benefits from well-established legal frameworks, accumulation of professional expertise, and robust regulatory institutions, along with comprehensive information databases and standardized practices (Leigland, 1997). These subnational bonds have financed key components of public infrastructure such as aqueducts and hospitals, with municipal bonds financing 72 percent of the country's infrastructure constructed between 2007 and 2016 (Cestau et al., 2019).

In 1997, the World Bank's "Infrastructure Notes" featured an analysis by El Daher (1997), which emphasized the necessity for municipalities in the global South to access private financial resources through municipal bonds to finance infrastructure projects. El Daher (1997) highlighted several challenges, including undeveloped credit markets, the need for strong institutions, and effective regulatory frameworks. Echoing this sentiment, USAID released the introductory guide "Enabling Sub-Sovereign Bond Issuances" in 2009, which promoted the use of municipal bonds as a financing tool in the global South. The guide showcased success stories such as the City of Johannesburg's inaugural general obligation bond and the Bogor Municipal Water Company bond in Indonesia, illustrating their effectiveness in raising funds for local development. The US Agency stated:

> "*One of the most sustainable methods for local governments to finance infrastructure is tapping local capital markets and garnering medium-term to long-term private sector investment through municipal bonds. Well-structured sub-sovereign bond issuances are often substantially larger, have longer maturities, require less collateral, and are more affordable than traditional bank loans*." (Chemonics International Inc., 2009, p 3).

The second phase of promoting municipal debt in the global South, now including the additional feature of a green label, can be illustrated by initiatives promoted by development banks and climate finance entities. Notably, during the UN Secretary General's Climate Change Summit in September 2014 in New York, the Cities Climate Finance Leadership Alliance was

established. This alliance, comprising development banks and cooperation entities,[29] aims to enhance investments in climate-related urban infrastructure through collaborative efforts. It seeks to mobilize additional capital flows, particularly from the private sector, towards cities, predominantly in the global South but also in the United States.[30] The alliance articulated that an estimated USD one trillion annually is required to rectify the deficit in climate-relevant infrastructure in low- and middle-income countries, with a strategic goal to bridge the investment gap in urban areas by 2030. The explicit aim of the alliance was to foster knowledge and investment strategies by "*engaging with other leading actors in finance, including the private sector as well as national and international public financial institutions to scale up financial products including structured finance, municipal or sector-based green bonds, and other innovative instruments*" (Cities Climate Finance Leadership Alliance, 2014, p 2).

In 2017, the German cooperation agency GIZ released the report "Challenges and Opportunities for Urban Climate Finance," authored by Tänzler and colleagues, which highlighted green bonds as pivotal in urban climate finance strategies (Tänzler et al., 2017). The report advocates for the widespread adoption of municipal green bonds in the global South but cautions that most cities in the global South lack the requisite financial capabilities to issue such bonds. It thus recommends that these cities receive technical assistance to facilitate their participation in the green bond market. The report states:

> "*Currently, the majority of green bonds are issued in China, the USA and Europe. Yet, there is great potential for cities in developing and emerging economies to issue green bonds. 20% of such cities have the required creditworthiness to raise capital in the local financial market through green bonds. The other 80% of cities struggle with low credit worthiness and other challenges that increase the (perceived) risks of urban climate*

[29] The initial partners were the African Development Bank, Bank of America Merill Lynch, C40 – Cities for Climate Action, Citibank, Cities Development Initiative for Asia (CDIA), Climate Bonds Initiative, Development Bank of Latin America (CAF), European Investment Bank, French Agency for Development (AFD), Global Infrastructure Basel (GIB), Gold Standard Foundation, ICLEI – Local Governments for Sustainability, Japan Investment Cooperation Agency (JICA), Meridiam, Standard & Poor's Ratings Services, UN Habitat, The United States, West African Development Bank (BOAD), World Resources Institute, World Bank Group, WWF (Cities Climate Finance Leadership Alliance, 2014).

[30] In 2015, the US branch of the Green City Bonds Coalition had already published *The Green Muni Bonds Playbook*, outlining the fundamental elements and issuance steps for municipal green bonds (Green City Bonds Coalition, n.d.). The Commonwealth of Massachusetts was at the forefront in the US, issuing its first municipal green bond in 2013. By 2018, the number of municipal bond issues labeled as green had risen to 3,983, representing a total value of USD28 billion (Baker et al., 2022). By the early 2020s, the US municipal bond market had grown to approximately USD3.8 trillion, with municipal green bonds constituting about 1 to 2 percent of the market (Friedland, 2020).

investments. These cities probably require external support to access local green bond markets" (Tänzler et al., 2017, p 48).

The report by Tänzler and colleagues (2017) details several initiatives aimed at promoting municipal green bonds in the global South, including the C40 Cities Finance Facility, Financing Sustainable Cities Initiative, Cities Climate Finance Leadership Alliance, Transformative Actions Program, Green Bonds for Cities, and the Global Fund for Cities Development. During the second phase of promoting municipal debt in the 2010s, the focus shifted from US municipal bond experiences to the adoption of green labels, which prioritize climate-related initiatives. Concurrently, municipal green bonds were also gaining traction in the US, reflecting a broader adoption of this financial instrument.

Whereas it may represent a novelty in the global South, the idea of municipal bonds as a way to increase access to funds by local administration is not new. On the contrary, it has been utilized in the US for over two centuries, to then being promoted in the global South by international financial institutions, development banks and aid agencies since the 1990s. Initially, these entities advocated for traditional municipal bonds and, from the 2010s onward, for municipal bonds with a green label. Consequently, it is crucial to examine what can be learned from the history of the US municipal bonds, in particular with regards to the (positive or negative) engagement with pre-existing inequalities. The following sections offer therefore a review of academic research on conventional municipal bonds in the US which has adopted a justice framework and has revealed that the use of municipal debt to finance local infrastructures (including water infrastructures) led to forms of financial and environmental mis-distributions that often overlooked the underlying socio-economic context of the communities where the projects are financed, to the point of reinforcing them.

5.3 Municipal Bonds and Racial and Environmental Injustices in the United States

Research on the municipal bond market in the US has highlighted its distributional implications, revealing how both tangible (projects) and intangible (financial repercussions) impacts have been unevenly distributed. Crucially, these impacts often perpetuate existing patterns of environmental racism (Ponder, 2021; Phinney, 2022). The focus of these studies, which blend financial analysis with empirical investigation and focus on outcomes, aligns closely with the objectives of this dissertation. Therefore, it is pertinent to extend this line of inquiry.

Historian Destin Jenkins explored the use of municipal debt in San Francisco, California, during the 1940s and 1950s, revealing that municipal bonds were primarily employed to fund public infrastructure in predominantly White suburbs while largely neglecting Black-majority

neighborhoods (Jenkins, 2021b). The author argues that the bond market play an important role in structuring racial privileges and entrenching spatial neglect (Jenkins, 2021b). Jenkins also notes that municipal debt "*unlocked profits for investment banks, built roads and streets that segregated blacks from whites, and generated interest payments for affluent bondholders*" (Jenkins, 2021a, p 187). The academic research discussed below employs quantitative, qualitative and case study methodologies to elucidate the connection between municipal debt and issues of racial and environmental justice in the US.

Quantitative research has documented that municipal bond issuances by municipal or subnational governments in the US contribute to the perpetuation of racial injustices. Yinger's study on risk ratings for general obligation bonds between 2002 and 2007 revealed that cities with higher percentages of Black residents received lower ratings, despite the infrequency of defaults (Yinger, 2010). Similarly, Ponder (2021) analyzed municipal bond issuances from 1970 to 2014 and found that the average interest rate across all cities was 5 percent, with no Black-majority city securing an interest rate below the national average. Consequently, cities with predominantly Black populations face higher financing costs for essential infrastructure due to elevated interest rates, which are influenced by the credit evaluations and standards set by rating agencies (Ponder, 2021).

Additionally,[31] Loftus and colleagues analyzed 362 municipal bonds issued by 56 tribal governments from 1992 to 2021, amounting to USD 4.9 billion. They found that tribal governments face borrowing costs 22% to 87% higher than non-tribal governments, which results in about USD 79,000 to USD 310,000 more in annual interest payments for an average tribal issuer (Loftus, Shonka, & Zhang, 2022). Similarly, Eldemire and colleagues investigated qualified municipal bonds issued by various cities and counties between 1990 and 2019, noting that racial bias can significantly increase borrowing costs, particularly in areas with high racial resentment (Eldemire et al., 2022). Furthermore, Smull and colleagues examined 712,855 municipal bonds issued up to April 2022 and discovered that racial composition influences municipal credit spreads, affecting the borrowing costs of cities. They concluded that there is a systemic mispricing of risk in the municipal bond market where racial factors affect capital costs, while climate factors do not (Smull et al., 2023).

In summary, the research on the municipal bond market in the US highlights racial injustices in the distribution of financial costs. Destin Jenkins (2021) points out that during the 1940s and

[31] Loftus, Shonka, and Zhang (2022); Eldemire, Luchtenberg, and Wynter (2022); and Smull et al. (2023) findings were discussed at the 11th annual Municipal Finance conference hosted by the Brookings Institution (Brookings Office of Communications, n.d.).

1950s in San Francisco, municipal bonds largely financed infrastructure in predominantly White suburbs, effectively excluding Black-majority neighborhoods and exacerbating segregation and economic disparities. Supporting and generalizing these observations, quantitative studies by Yinger (2010) and Ponder (2021) demonstrate that cities with larger Black populations received lower credit ratings and faced higher interest rates, resulting in costlier debt capital. Furthermore, studies by Loftus et al., (2022) and Eldemire et al., (2022) reveal that Indigenous and predominantly Black municipalities incur higher borrowing costs due to racial biases. Additionally, Smull et al., (2023) found that racial composition, rather than climate risk, influences municipal credit spreads, indicating a systemic mispricing of risk based on race in the bond market. This body of research collectively illustrates the profound impact of racial injustice on municipal finance from a quantitative perspective.

5.4 Water Infrastructures' Bonds in the United States and Climate Injustices

Municipal bonds have facilitated racial and environmental injustices in the US, particularly in the domain of water infrastructure. Issuance of municipal bonds to finance and refinance water projects led to increased water bills and restricted water access, primarily impacting Black-majority neighborhoods and cities. This financial strategy, intended to generate revenue to cover municipal debt, has concomitantly limited access to water and reduced climate adaptation capabilities in these racially discriminated areas. Cases include Baltimore, Maryland (Phinney, 2022), Detroit, Michigan (Ponder, 2021; Ponder & Omstedt, 2022; Phinney, 2018), Flint, Michigan (Pulido, 2016), Jefferson County, Alabama (Ponder, 2017; Howell-Moroney & Hall, 2011), Jackson, Mississippi (Ponder, 2021), Montgomery County, Texas (Seamster & Purifoy, 2021), and Puerto Rico[32] (Ponder, 2022; Villanueva, Cobián, and Rodríguez, 2018), and St. Louis, Missouri (Phinney, 2022). These authors examine case studies that feature the interconnectedness of racial and environmental injustices through the experience of municipal bond financing for water infrastructure projects. However, they do not explicitly apply the analytical framework of climate justice or its pillars in their analysis, which this dissertation argues could elucidate how municipal debt for water infrastructure not only raises concerns of

[32] Puerto Rico, an unincorporated territory of the United States, is authorized to issue municipal bonds within the US market. Beginning in 2015, Puerto Rico defaulted on its municipal bonds, marking the largest default in the history of the U.S. municipal bond market. In response, the United States Congress opted not to bail out the debt. Instead, it enacted the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA) in 2016 (Villanueva, Cobián, and Rodríguez, 2018). According to Villanueva, Cobián, and Rodríguez (2018), "*PROMESA seeks to stabilize the US municipal bonds market through the careful management of Puerto Rico's debt by the Congress-appointed Oversight Board, which now possesses full power to regulate the Island's troubled finances*" (p 1418).

racial injustice but also of climate injustice. The case of US municipal bonds financing water infrastructures offers a clear evidence of the climate injustice that may arise when the capital market is seen as the source of debt to finance public infrastructures.

Municipal Bonds in Jefferson County, Alabama and the Water-Finance Nexus as Local Climate Injustice

Analysis of municipal bonds financing water infrastructure in the US reveals pronounced racial and environmental injustices, especially affecting Black-majority neighborhoods and cities. Case studies from Baltimore, Detroit, Jefferson County, Jackson, Puerto Rico, and St. Louis illustrate that issuing municipal bonds for water infrastructure projects can result in increased water bills and restricted access to water services in these areas (Howell-Moroney & Hall, 2011; Ponder, 2021; Phinney, 2022). This financing strategy disproportionately affects historically discriminated communities, exacerbating their vulnerability to climate change and hindering their ability to adapt.

To illustrate this point, the case of Jefferson County is discussed briefly next to illustrate the critical linkages between incurring municipal debt and climate injustice, particularly concerning water, a vital element for climate adaptation. Jefferson County, the capital of Alabama in the southern US, faced significant environmental challenges in 1993 when the Cahaba River Society, an environmental advocacy group, publicly criticized the county's municipal wastewater management. The group highlighted that the system was discharging untreated contaminated water into the Cahaba and Black Warrior Rivers, both vital to the region's ecosystem (Howell-Moroney & Hall, 2011). Following this, the US Environmental Protection Agency supported the group in filing a lawsuit against Jefferson County for violating the Clean Water Act. The lawsuit concluded in 1996 with a consent decree that mandated significant improvements to the county's sewer systems (Howell-Moroney & Hall, 2011).

To finance necessary sewer system upgrades, Jefferson County's sewer management entity issued municipal revenue bonds, which are repaid from the revenues generated by the infrastructure, here, through water bills. According to Howell-Moroney and Hall (2011), from 1997 to 2007, there was a dramatic "*1,075 percent increase in county debt related to the sewer system*" (p 236). Consequently, residential sewer bills surged "*from $13.48 per month in 1995 to $62.90 per month in 2008, an increase of over 368 percent*" (p 237). This sharp hike in water rates led to widespread public dissatisfaction, prompting the county to negotiate 17 interest rate swap agreements between 2002 and 2004, intended to alleviate the financial burden on households.

However, the financial crisis of 2008 and subsequent interest rate hikes exacerbated the costs associated with these municipal revenue bonds, leading to further increases in water service charges. As a result, many households, particularly those from low-income backgrounds, experienced widespread service disruptions due to their inability to pay the escalated bills (Howell-Moroney & Hall, 2011).

This scenario exemplifies a form of climate injustice tied to water, an essential element for both hydration and health (UN Water, 2020). In Jefferson County, the distribution of costs and profits via municipal bond debt and financial maneuvers, such as interest rate swaps, led to heightened water-related expenses and the subsequent deprivation of this vital resource for low-income families. Jenkins (2020), conceptualize this type of situations as the underdevelopment of Black America through municipal bonds, emphasizing how communities within a developed nation like the US can be deprived of basic services such as water due to municipal debt strategies and speculation. This situation reflects profound environmental and climate injustices, impacting the most vulnerable to climate change communities.

Opening the Debate of Racial Justice in Municipal Bonds in the United States

After two centuries of the US municipal bond market's operation, issues of racial justice are increasingly acknowledged within municipal finance. On April 28, 2021, the Committee on Financial Services of the US House Of Representatives convened a session to examine the impact of municipal bonds on racial and social justice (US House Committee on Financial Services, 2021). This hearing marks a significant step towards integrating racial justice considerations into municipal finance, reflecting a growing awareness of the connections between financial mechanisms and social justice outcomes.

In 2021, the Robert Wood Johnson Foundation provided a four million USD grant to support initiatives aimed at addressing systemic racial injustices within the US municipal bond market (German, 2022). Building on this momentum, a voluntary framework titled *Municipal Bond Markets and Racial Equity* was introduced in 2023. This document highlights the significant role of the US municipal bond market in funding public infrastructure while advocating for the incorporation of a racial justice perspective to better serve historically discriminated communities. It offers a set of qualitative questions designed to help municipal bond issuers evaluate their adherence to racial justice practices, community engagement, and the effectiveness of outcomes measurement (Public Finance Initiative, 2023).

One illustrative question from the framework prompts bond issuers to consider, "*How much of the projects financed by bond proceeds will lead to improved water access for low-income residents, residents of color, or other historically marginalized groups?*" (Public Finance Initiative, 2023, p 22). This question is vital for addressing environmental and racial justice within the broader framework of climate justice. Such perspectives are often overlooked in the green labeling of municipal bonds, which finances projects in contexts of injustice, as will be discussed in subsequent chapters. In 2024, the Public Finance Initiative introduced the *Municipal Bond Racial and Social Equity Scorecard* to help issuers assess the potential racial and social impacts of their bond issuances (Public Finance Initiative, n.d.). Overall, the discourse surrounding municipal bonds and racial justice is increasingly influencing public policy in the US, a country that is a leader and reference point in the municipal bond market.

This precedent in the United States' experience with municipal bonds and racial justice is highly significant for this dissertation. The US serves as a benchmark in municipal finance with over two hundred years of experience and hundreds of thousands of bonds issued (e.g., O'Hara, 2012; Baker et al., 2022). There is a wealth of academic research, both quantitative (e.g., Yinger, 2010; Loftus et al., 2022; Smull et al., 2023) and qualitative (e.g., Jenkins, 2021a; Ponder, 2021; Phinney, 2022), demonstrating how municipal bonds can produce and perpetuate racial injustice. Furthermore, there are public policy initiatives beginning to address the nexus between municipal bonds and racial injustice (Public Finance Initiative, 2023).

The US experience with municipal bonds directly connects to the dimension of racial climate vulnerability within the framework of climate justice. This dissertation adopts this focus on race and expands it to consider other dimensions of climate vulnerability, such as income and gender. While it does not directly address additional dimensions, it acknowledges their importance, including age, ethnicity, sexuality, and non-conforming gender identities (IPCC, 2023). However, these perspectives on climate justice and the recognition of various climate vulnerability dimensions, including race, are often absent in the green labeling of municipal bonds and the implementation of financed projects. This absence is evident in the cases of Cape Town and Mexico City discussed in chapters 7 and 8. When included, these dimensions do not substantively address injustice, as illustrated in the following chapter with the case of San Francisco.

5.5 Conclusion: Learning from the Past and the Need for a Climate Justice Approach to Municipal Green Bonds

The examination of the academic literature that has engaged with US municipal bonds for water infrastructure reveals profound racial and environmental injustices, particularly in Black-majority communities. Case studies from Baltimore, Detroit, Jefferson County, Jackson, Puerto Rico, and St. Louis demonstrate that financing water infrastructure through municipal bonds leads to higher water bills and restricted access to essential water services (Howell-Moroney & Hall, 2011; Ponder, 2021; Phinney, 2022). These financial mechanisms, designed to generate revenue to service municipal debt, disproportionately impact racially discriminated communities, intensifying their vulnerability to climate change. The situation in Jefferson County is a plain example of how municipal debt and speculative financial practices can escalate water costs, resulting in widespread service cutoffs that disproportionately affect low-income families, thus illuminating significant environmental and climate injustices.

The promotion of municipal bonds in the global South has long drawn upon the extensive experience of the US. Initially, during the 1990s and 2000s, municipal bonds were advocated as a means for subnational governments in the global South to secure financial resources amidst narratives of constrained public finances. Development banks and aid agencies, referencing the well-established municipal bond market in the US, supported this approach (El Daher, 1997; Chemonics International Inc., 2009). By the 2010s, the focus had shifted towards municipal green bonds, propelled by entities such as the Climate Finance Leadership Alliance and GIZ. These organizations highlighted the importance for cities in the global South to issue such bonds to finance climate-relevant infrastructure (Cities Climate Finance Leadership Alliance, 2014; Tänzler et al., 2017). However, despite these efforts, many cities in the global South still lack the financial means to issue these bonds without substantial external technical assistance (Tänzler et al., 2017).

At least in the US, the situation seems to be moving. As mentioned in the last section of this chapter, there seems to be an increased recognition of racial justice issues within the US municipal bond market and their emerging significance in public policy discussions. Initiatives like the voluntary *Framework for Municipal Bond Markets and Racial Equity* highlight the necessity of incorporating a racial justice perspective into municipal finance (Public Finance Initiative, 2023). The inclusion of questions regarding water access and impacts on historically discriminated communities exemplifies the need to include environmental and racial justice within the broader framework of climate justice. However, this perspective is often absent from the green labeling of municipal bonds. By addressing these gaps, the framework aims to underline the interconnection between financial, environmental, and racial justices in municipal

bond markets, advancing a more comprehensive approach to municipal financing (Public Finance Initiative, 2023).

The experience with municipal bonds in the US illustrates the intertwined nature of racial and environmental injustices in the distribution of water, a critical element in environmental aspects and climate adaptation (UN, 2020). This emphasizes the importance of analyzing these financial instruments from a climate justice perspective that integrates environmental and racial dimensions of vulnerability to climate change. Yet, these critical perspectives are often overlooked in discussions promoting municipal and municipal green bonds as optimal solutions for financing climate action. This oversight highlights a gap in the current discourse on municipal green bonds, where deeper integration of climate justice principles could enhance the understanding about this climate finance instrument.

During the 1990s and 2000s, the extensive history and scale of municipal bonds in the US were promoted as a viable model for the global South. This trend evolved in the 2010s as green-labeled municipal bonds gained prominence, both in the global South and in the US. However, scholarly research in the US, both quantitative and qualitative, has documented how municipal bonds can exacerbate racial and environmental injustices, especially in terms of access to water services (Howell-Moroney & Hall, 2011; Ponder, 2021; Phinney, 2022). By 2021, there was a growing recognition among policymakers of the need to adopt a racial justice approach within the US municipal bond market (Public Finance Initiative, 2023). This development underlines the importance of advancing a dialogue between the experiences of the US and the global South regarding municipal bonds labeled green, advocating for a climate justice framework that incorporates both racial and environmental considerations.

This dissertation adopts such a framework, thereby making a novel and significant contribution to the field. In alignment with this approach, the following chapters engage with the three case studies of the municipal green bonds for water infrastructure issued by the cities of San Francisco (chapter 6) Cape Town (chapter 7) and Mexico City (chapter 8). Each case study follows the same structured inspired by the tripartite methodology discussed above (chapter 2) and the three phases of the lifecycle of a municipal green bond (labeling, implementation, and communication). All under the umbrella of climate justice as discussed before and characterized by the attention in highlighting the distributive, participatory and recognition implications of choosing municipal green bonds as the source of financing for water infrastructures, and of their materialization in the context of pre-existing socio-economic inequality.

CHAPTER 6. SAN FRANCISCO MUNICIPAL GREEN BOND: WASTEWATER DISTRIBUTION AMIDST CLIMATE INJUSTICE

6.1 Introduction

This chapter examines the case of the municipal green bond issued by the San Francisco Public Utilities Commission (SFPUC) in 2016, which allocated proceeds to wastewater management projects within the city (Sustainalytics, 2016). Analyzed through the lens of climate justice, incorporating the pillars of procedural justice, recognition, and distributive justice, this case study investigates into the documentation associated with the bond's green labeling, the implementation of the financed wastewater projects, and the context of climate and racial injustice in which the projects were deployed. The analysis particularly focuses on how these elements interplay to form the green narrative surrounding the bond.

The chapter starts with an overview of the bond's fundamentals, followed by an exploration of the specific challenges related to climate injustice in wastewater services, particularly in the Black-majority neighborhood of Bayview-Hunters Point. This examination is crucial as it situates a case from the global North in dialogue with the two cases from the global South in the following two chapters, enriching the multi-sited discussion in the concluding section. Highlighting San Francisco's favorable financial standing and the strategic green-labeling of municipal bonds, a local policy expert noted: "*You want to prioritize projects that have, like social benefits, climate benefits, and also achieve the engineering objective, you know, like replacing a pipe or whatever you need to do (...) and I think San Francisco is actually lucky we have money compared to other places*." (Interview with policy expert, January 5, 2022).

In 2016, the San Francisco Public Utilities Commission issued a USD 241 million municipal green bond for extensive upgrades to the city's wastewater infrastructure, classified as a climate change adaptation strategy (CBI, 2016c). Central to this initiative is the complete renovation of the Southeast Treatment Plant in Bayview Hunters-Point, responsible for treating 80% of the city's wastewater (SFPUC, n.d.). This neighborhood, known for its historical racial and environmental injustices (ESA, 2017), serves as the backdrop for this project which aims to replace the old facility with a larger, modernized plant. Details on the implications of this setting as a context of climate injustice are further explored later in this chapter.

The Southeast Treatment Plant, established in 1952, is San Francisco's primary wastewater facility, currently under significant renovation to enhance its infrastructure (SFPUC, n.d.). This plant, processing the majority of the city's wastewater, is strategically relevant to this case study

due to its scale and its location in Bayview-Hunters Point. This geographical and socio-political context makes the plant an essential subject for analysis under the climate justice framework. Positioned on the southeast edge of the city, adjacent to San Mateo County and the Bay to the east, the plant's location and impact provide an illustration of the junction between environmental and racial concerns.

The Southeast Treatment Plant's two principal projects, the New Headworks Facility and the new Biosolids Digester Facility, are pivotal in the plant's modernization efforts. The New Headworks Facility initiates wastewater treatment by removing debris and grit, while the Biosolids Digester Facility processes biosolids for potential use as fertilizer (Public Utilities Commission of the City and County of San Francisco, n.d.). These renovations aim to upgrade the infrastructure, minimize odors, and enhance resilience against earthquakes and rising sea levels associated with climate change (Public Utilities Commission of the City and County of San Francisco, n.d.). Importantly, the Biosolids Digester Facility's redevelopment included an environmental justice policy document acknowledging the existing conditions of environmental and racial injustices (ESA, 2017). However, this policy falls short in fully recognizing and addressing the legacy of environmental racism (Pulido, 2016), that has historically localized the primary source of San Francisco's contaminated water in a Black-majority residential area. These issues are further explored in the rest of the chapter.

6.2 Pre-Existing Context of Climate and Racial Injustices

Bayview-Hunters Point (BHP) is historically recognized as a neighborhood with a significant Black population. According to Census data from 2009-2013, 33.1% of BHP's population identifies as Black or African American, compared to 24.2% as Hispanic or Latino, 29.8% as Asian, and 7.5% as White (ESA, 2017). These figures present a contrast to the broader demographic trends of San Francisco during the same period, where the racial composition was 50.3% White, 33.3% Asian, 15.2% Hispanic or Latino, and only 5.6% Black or African American (ESA, 2017). This demographic disparity features a significant racial divide, situating BHP distinctly within the broader context of San Francisco.

San Francisco's initial zoning plan of 1921 located industrial and residential zones in BHP, thereby situating homes adjacent to pollution sources. During World War II, the expansion of the military industry in BHP attracted African Americans from the *Great Migration*, seeking refuge from the oppressive Jim Crow segregation laws of the southern states (Dillon, 2014). The BHP Navy Shipyard, active from 1940 to its closure in 1994, was a hub for military nuclear activities and the dismantling of ships contaminated by nuclear testing in the Pacific, leaving a

legacy of radioactive contamination. The community has persistently advocated for environmental justice and the remediation of this pollution. Additionally, the Hunters Point Power Station, which operated from 1928 until its closure in 2006 due to local activism, further exacerbated the area's pollution (Dillon, 2011, 2014, 2018).[33] BHP characterizes a case of environmental racism, where the burdens of pollution have been disproportionately borne by its residents (Dillon, 2018). As one Black or African American[34] resident in BHP noted:

> "*Well, I'm a third generation San Francisco resident in the Bayview, but you know, I've been here, born in San Francisco, native to the whole area. But one of the things that you know, the residents and the community was aware of is when the naval shipyards came and when they left, they left a tremendous amount of radioactive material. But, you know, in the whole city of San Francisco, you would say this is the more reasonably priced area because it's probably neglected, for the most part, or they don't see the value, so they don't use the resources, that I know the city have, to make sure everything is comfortable for the residents.*" (Interview household member, January 20, 2022).

Pulido (2016) defines environmental racism as the concentration of pollution sources in a racialized space, and Seamster and Purifoy (2021) argue that this phenomenon is instrumental for the production of White spaces at the expense of Black spaces. The zoning practices and industrial and military expansions in BHP have perpetuated historic environmental racism, from which the city of San Francisco has benefitted while BHP has borne the burden, with the local community consistently advocating for justice and recognition of alternatives to environmental racism (The Human Rights Commission of San Francisco, 2003; ESA, 2017). Compounding these issues, the Southeast Treatment Plant, established in 1952, began a major reconstruction in 2018 on its original site. This reconstruction, partially financed by the municipal green bond under scrutiny in this chapter, highlights the ongoing environmental challenges in BHP (CBI, 2016c).

The struggle for climate and environmental justice in BHP is deeply linked to a longstanding battle for racial justice, exemplified by the Hunters Point Uprising in 1966. This significant protest erupted following the police shooting of Matthew Johnson, Jr., a Black teenager, symbolizing a pivotal moment of resistance against systemic racism and injustices (The Movement, 1966; Kamiya, 2016). This enduring commitment to combating climate injustice and environmental racism is evident in the community's persistent activism. Throughout BHP, signs displayed in residential and commercial windows call for a thorough cleanup of the

[33] This represents an example of local literature analyzing the local context from a justice perspective.
[34] It is used the category "Black or African American" following the use of the ESA (2017).

persistent toxic and radioactive pollutants, a demand that features the community's determination as depicted in the figure below.

Figure 6. Environmental Justice Sign in Bayview-Hunters Point. Source: Author.

The San Francisco case is particularly noteworthy because the city's governmental entities have proactively acknowledged the need for an environmental justice policy. In October 2009, the San Francisco Public Utilities Commission adopted Resolution No. 98-0170, which declared environmental justice as "*the fair treatment of people of all races, cultures, and incomes and... [the belief] that no group of people should bear a disproportionate share of negative environmental consequences resulting from SFPUC operations, programs and/or policies*" (SFPUC, 2009, p 1). This made the SFPUC one of the first utilities in the US to implement such a policy. The subsequent renovations at the Southeast Treatment Plant thus provide a critical opportunity to assess the effectiveness of this policy and its broader implications for the community.

In 2016, California State Senate Bill No. 1000 mandated cities and other local governing entities to develop environmental justice strategies, which involved identifying disadvantaged communities for targeted health risk and impact mitigation efforts. These efforts were directed towards improving air quality, enhancing public infrastructure, and reducing exposure to pollution (California State Legislature, 2016). This legislative directive led to the implementation of the environmental justice initiatives that are discussed in subsequent sections.

In alignment with the SFPUC's environmental justice policy, the reconstruction of the Southeast Treatment Plant's new Biosolids Digester Facility included various environmental justice initiatives. These initiatives aimed to benefit historically discriminated communities and included job creation, educational opportunities, temporary art projects, and the development of new community and environmental programs. Additionally, the production of environmental justice impact reports was initiated (ESA, 2017). One of the temporary art installations is displayed in figure 7 below. Specifically, in the BHP area, the environmental justice report identified 33 critical indicators such as particulate matter levels, cancer risks, nuisances and odors, traffic density, the prevalence of brownfields,[35] proximity to hazardous waste producers and waste facilities, industrial zoning, and issues related to housing affordability, displacement, and homelessness (ESA, 2017).

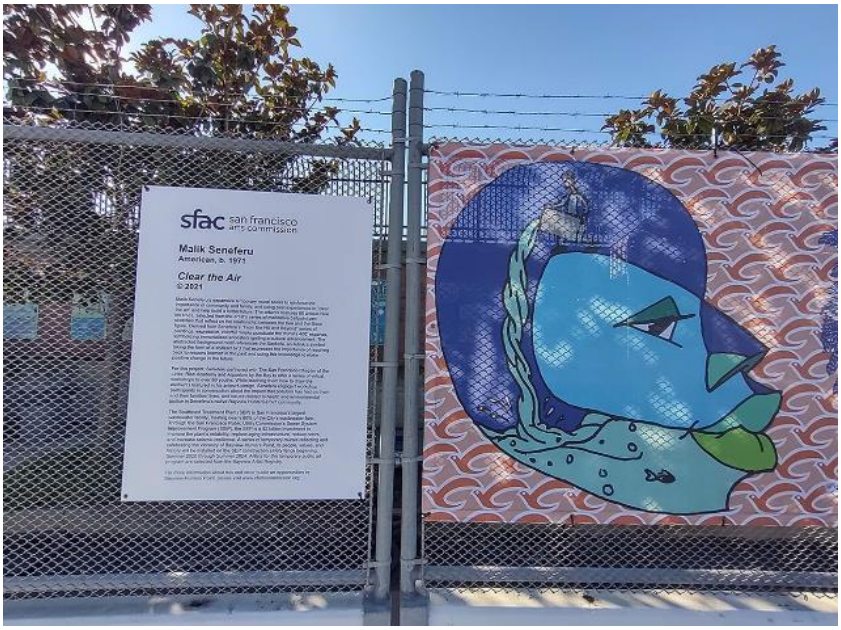

Figure 7. Temporary Art Installation at the Southeast Treatment Plant on the Security Fence. Source: Author.

Funding for the environmental justice initiatives within the Southeast Treatment Plant Biosolids Digester Facility Project was designated as a fixed percentage of the total budget for aboveground infrastructure projects, independent of the funding source. Specifically, "*2 percent of all above-ground infrastructure project costs to support arts enrichment [and] a new world class community center at 1550 Evans*" (ESA, 2017, p 139). This approach stresses the historical and political significance of environmental justice principles, illustrating a tangible

[35] Alker and colleagues provide the following definition: "*A brownfield site is any land or premises which has previously been used or developed and is not currently fully in use, although it may be partially occupied or utilized. It may also be vacant, derelict or contaminated. Therefore a brownfield site is not necessarily available for immediate use without intervention.*" (Alker et al., 2000, p 49).

commitment to integrating these values within municipal projects. Such initiatives are efforts in fulfilling the goals of climate justice by delivering community-focused projects that aim to enhance and rectify neighborhood conditions (ESA, 2017).

The legal framework for environmental justice in San Francisco and the environmental justice plan for the Southeast Treatment Plant's Biosolids Digester Facility mandated the renovation project's implementers to address these criteria. However, the project did not recognize the need for an alternative approach that would reverse the legacy of environmental racism, which has historically concentrated San Francisco's contaminated water treatment in BHP. Specifically, there was a missed opportunity during the green labelling of the bond and the total reconstruction of the plant to consider relocating it to a different area to reduce this accumulation of pollution in a Black-majority neighborhood. This issue is explored in further detail in the subsequent section on recognition.

6.3 Pillar of Procedural Justice: Whose Green Labeling?

In this dissertation, the procedural justice pillar of the climate justice analytical framework is utilized to examine the green labeling process of the San Francisco municipal green bond. This pillar focuses on the dynamics of decision-making, including transparency, access to information, and effective participation, as well as who makes decisions and on whose behalf (IPCC, 2023). The green label distinguishes this municipal bond from regular bonds issued in the San Francisco municipal debt market. However, the green labeling process for the municipal bond did not incorporate climate justice criteria either during issuance or in the monitoring of the bond. Importantly, the environmental justice plan for the Southeast Treatment Plant Biosolids Digester Facility exists external to the green labeling process (ESA, 2017).

As outlined in chapter 4 regarding the fundamental aspects of green bonds, the green labeling process for a municipal bond primarily unfolds in three stages: drafting a green bond framework document, obtaining a second opinion on this framework, and finally, preparation for issuance and subsequent monitoring. The San Francisco Public Utilities Commission initiated this procedure by creating a detailed green bond framework document. This document adheres to the four central components of the Green Bond Principles: use of proceeds, project evaluation and selection process, management of proceeds, and reporting (Sustainalytics, 2016).

The review of the green bond framework document is critical for understanding the bond's objectives and the specific projects it finances, which are relevant to the focus of this dissertation. The document states that the proceeds from the municipal green bond are allocated to projects that enhance climate change adaptation and augment the long-term sustainability

and efficiency of San Francisco's stormwater and wastewater collection and treatment systems (Sustainalytics, 2016). Notably, the framework outlines specific improvements to the wastewater treatment facilities, sewer system enhancements, and advancements in stormwater management. It specifically allocates USD 104,920,000 for general improvements to the Southeast Treatment Plant and USD 65,600,000 for the Biosolids Digester Project at the plant (Sustainalytics, 2016). A comprehensive list of documents pertaining to the green labeling process is presented in table 4 below.

Documents[36]	**Year**	**Author**
Green Bond Framework Overview and Second Opinion	2016	Sustainalitycs
Official Statement - Revenue Bonds	2016	Public Utilities Commission of the City and County of San Francisco
2016 Annual Report Wastewater	2016	
2017 Annual Report Wastewater	2017	
2018 Annual Report Wastewater	2018	
FY2018-19 Green Bond Report Wastewater Enterprise	2019	San Francisco Public Utilities Commission (SFPUC)
Wastewater Enterprise Annual Disclosure Report for the fiscal year ending June 30, 2020	2020	
FY 2020-21 Green Bond Report Wastewater Enterprise	2021	
Presentation to the California Water Commission SFPUC Green Bond Program	2021	
Wastewater Enterprise Annual Disclosure Report for the fiscal year ending June 30, 2021	2021	
Wastewater Enterprise Annual Disclosure Report for the Fiscal Year Ending June 30, 2022	2022	
SFPUC Credit Ratings as of June 30, 2023	2023	
FYE 2023 Outstanding Debt Water Revenue Bonds	2023	

Table 4. San Francisco Municipal Green Bond Documents Consulted. Source: Author.

The renovation of the Southeast Treatment Plant includes a significant project, the reconstruction of the Biosolids Digester Facility. This facility is crucial for processing biological waste and pathogens in wastewater and stormwater before they are discharged into the San Francisco Bay (SFPUC, n.d.). The reconstruction of this facility is expected to be completed by 2028. The overall goals of the renovation, with a particular focus on the installation of the biosolids digester, aim to continue to safeguard public health, the environment, and minimize odors with cutting-edge odor control technologies (SFPUC, n.d.).

After developing the green bond framework document, the SFPUC hired the firm Sustainalytics to review and provide a second opinion, ensuring alignment with the Green Bond Principles (Sustainalytics, 2016). This review emphasized San Francisco's particular challenges in managing wastewater and stormwater, heightened by climate change-driven variations such as altered rainfall patterns, sea level rise, and potential storm impacts. The second opinion detailed

[36]All consulted on January 12, 2024. See links to sources in the references at the end.

that the infrastructural adaptations planned would alleviate the effects of sea level rise, address combined sewer and stormwater backflows, improve flood management, and manage stormwater runoff more effectively (Sustainalytics, 2016). It also stressed the critical role of wastewater treatment infrastructure in promoting sustainable development and its significant influence on public health, human productivity, and overall living conditions (Sustainalytics, 2016).

The SFPUC had already adopted an environmental justice policy in 2009, and the State Government had introduced binding requirements in 2016 (California State Legislature, 2016). However, when issuing the municipal green bond in 2016, the SFPUC decided to follow the green label under the Climate Bonds Standard of the Climate Bonds Initiative (Sustainalitycs, 2016), which do not incorporate or refer to any specific recognition or strategy of climate justice within the initial framework document of the green bond.

Following the bond issuance, the SFPUC issued detailed annual reports for 2016, 2017, and 2018 that accounted for the allocation of financial resources and remaining balances (SFPUC, 2016; 2017; 2018). These monitoring reports provided annual assessments of the implementation of the municipal green bond. Starting in 2018, these reports began to reference the environmental justice regulatory framework existing within San Francisco and California as context, although environmental justice criteria were not included in the original green labeling process. The reports also connected project activities with the United Nations Sustainable Development Goals and provided metrics on wastewater treatment capacity and recycled water utilization (SFPUC, 2019; 2021). Despite these inclusions, the reports did not employ climate justice parameters to monitor the bond's implementation.

It was not until the green bond monitoring report of 2021 that specific mention was made of an environmental justice assessment for the Biosolids Digester Facility Project at BHP (SFPUC, 2021). This inclusion marks a notable development, as it was the first instance of such assessments being directly referenced in the context of the project's documentation. Importantly, this report, which highlights aspects of the environmental racism situation at BHP, did not result from the initial municipal green bond issuance or the green labeling standards initially applied. The 2021 report cites aspects of the environmental racism situation at BHP:

> "*This first-of-its-kind Environmental Justice Report is a groundbreaking example of a public utility living up to its commitments to equity while evaluating the impacts of a major public works project – the Biosolids Digester Facilities Project. It integrates census, public health, education, air and water quality, traffic and transportation,*

> *housing, and economic and workforce data to provide a snapshot of San Francisco's Bayview-Hunters Point neighborhood's burdens and opportunities, and comprehensively analyzes how the subject project could exacerbate or improve conditions in this overburdened and underserved area. This neighborhood is home to a historically large African-American population and is situated near a former Naval Shipyard and other industrial uses.*" (SFPUC, 2021, p 30).

In essence, the municipal green bond was launched without integrating specific policies or benchmarks that address climate justice dimensions such as race, gender, or income, neither in the formulation of the financial instrument nor in the operational aspects of the infrastructure to be renovated. Notably, this occurred despite the Southeast Treatment Plant having previously established an environmental justice strategy that included local employment initiatives and temporary art installations, independent of the green labeling process of the bond that financed the project (SFPUC, 2021). In the absence of explicit guidelines and standards, it becomes challenging to assess the project on its own terms. However, by applying the principles of climate justice to analyze the project and the community experiences, it is evident that the decision to rebuild the wastewater treatment plant at the same location in the BHP neighborhood, a known context of climate injustice, has perpetuated this injustice. This approach did not recognized the potential for alternative strategies that could have been developed in consultation with the community, as explained in the next section.

It is similarly concerning, within the context of the procedural justice pillar, the lack of effective avenues for participation in the green labeling process by communities directly impacted by projects financed through the municipal green bonds. This issue is evident both in the green bond framework document realized by Sustainalytics (2016) and in the annual follow-up reports by the Public Utilities Commission of the City and County of San Francisco (2016; 2017; 2018). Regarding the deficient participation in such decision-making processes, a San Francisco environmental activist commented:

> "*Power plants and wastewater treatment facilities and heavy duty industrial facilities and trash dumps are located in communities that don't have the power to fight them and, you know, they are too burdened with other things to properly fight them. (...) You're dealing with people who are working, you know, 9 until 9:00 at night and have families and things like that. So it's really hard for the public to properly participate sometimes*." (Interview with water activist, January 18, 2022).

Similarly, a household member resident in Bayview-Hunters Point remarked:

> "*Anything that needs to happen, it most likely will happen here. If it's something that's rejected somewhere else, and more so because the people that somewhere else in San Francisco got enough time to go to the Council meetings. But when you [are] blue collar and you have to work every day to pay, you don't have enough time to go to the Council meetings.*" (Interview with household member resident of BHP, January 20, 2022).

It is crucial to underline that participatory justice requires that participation is genuinely effective, particularly in contexts involving historically marginalized populations who encounter numerous barriers to effective engagement (Chu & Michael, 2019). The voices and experiences above highlight the possibility of a friction between the time, content, and instruments of green finance, on the one hand, and the need for an inclusive and accessible mechanisms of public participation, on the other hand. This is especially the case for people who are disproportionately affected by these projects and yet face significant challenges in engaging with the decision-making processes regarding the green labeling of municipal bonds and the projects they finance in their neighborhoods. The question thus raises of who decides what is green and what it really means in terms of participation.

6.4 Pillar of Recognition: Non-Recognition of Alternative Scenarios

As discussed in chapter 3, the recognition pillar in the climate justice analytical framework stresses the necessity of incorporating a diverse range of actors, perspectives, and values in climate action (IPCC, 2023). This pillar is crucial as it interlinks with procedural and distributive justice, affirming that diverse perspectives are essential for fair decision-making and the fair distribution of benefits and burdens in climate finance and action (IPCC, 2023). Recognition within climate justice demands that the needs, rights, and identities of historically discriminated communities, who are disproportionately affected by climate change, be acknowledged and addressed (Chu & Michael, 2019). In urban contexts, non-recognition often stems from the political marginalization of these groups, making it challenging for their needs and interests to be reflected in climate policies and urban planning. Additionally, discursive invisibility occurs when dominant narratives or strategies overlook or misrepresent the needs of these groups, further marginalizing them from climate discourse and actions (Chu & Michael, 2019).

In the situation described, there was a notable lack of recognition concerning the specific needs of the residents in the BHP neighborhood, a Black-majority neighborhood, affected by the pollution from the wastewater treatment plant. This oversight highlights their heightened climate vulnerability exacerbated by racial dynamics. Moreover, there was a missed

opportunity to embrace an alternative vision for climate action that included the relocation of the Southeast Treatment Plant out of BHP, taking into consideration the historical context of environmental racism. The prevailing strategy and narrative regarding the location of the treatment plant in BHP are further detailed below (Johnson, 2015), along with an example of an alternative vision that was not considered.

The prevailing narrative surrounding San Francisco's management of contaminated water is articulated by Carolyn Chiu Foon, Senior Project Manager at San Francisco Water Power Sewer, in her commentary on the reconstruction of the wastewater treatment plant at BHP: "*We can't just take it out and move it far away into some dense trees or unpopulated area, (…) we live in a dense city, and that's just not possible. It's so unusual that it is here in the middle of the community, but every city has one. Ours is just more visible.*" (Johnson, 2015, p 11).

Regarding the future of the wastewater facility, Carolyn Chiu Foon noted, "*The beauty of starting from the ground up is that you get a blank page, (…) we are designing for the future. What we've done is size the new facility for anticipated future wastewater flows for population up to 2045, but obviously they will last longer than that. In the beginning, we may not use all of the biosolids digesters. But we will eventually.*" (Johnson, 2015, p 15). This statement from the Senior Project Manager at San Francisco Water Power Sewer highlights the expectation that future generations in San Francisco will benefit from the Southeast Wastewater Treatment Plant. However, it also features that BHP community will continue to bear the burden of hosting a pollution source.

The lack of recognition must be embedded in the longer historical context of water-related interventions that date back to the 1970s. The 1971 Wastewater Master Plan initially proposed constructing the city's largest wastewater facility in the area now occupied by the Oceanside Plant, adjacent to the San Francisco Zoo and golf courses in the Lakeshore area in the southwest part of the city (see figure 8 below). However, budget and time constraints led to the abandonment of this plan. Instead, during the 1970s, it was decided to expand the Southeast Treatment Plant located in the BHP area (San Francisco Human Rights Commission, 2003). The renovations, financed by the municipal green bond, include the complete reconstruction of the biosolids digester at the Southeast Treatment Plant on its existing site. This area is mapped as having a significant environmental justice burden (see figure 8 below). The decision failed to consider potential alternative locations that could alleviate the legacy of environmental racism. Concerning the recognition of alternatives, a local resident mentioned:

> "*You know, it's not just about all the stuff that the other part of the city don't want to see because it's an eyesore. They use this district as, like a dumping ground. For the homeless, for the shelters, for the treatments, for the cement making, for the radioactive materials, they don't, you know, I would say, spread it out.*" (Interview household member resident of BHP, January 20, 2022).

Regarding the decision of building the Southeast Treatment Plant on the same site, Solis (2023) concluded that Bayview-Hunters Point continues to host a disproportionate number of locally unwanted land uses (LULU). The redevelopment of the plant does not decentralize wastewater operations, but intensifies the pressure on the same territory and the legacy of previous projects. Solis (2023) recommended that organizations dealing with this type of infrastructure in a context of environmental racism should seriously consider decentralization or relocation alternatives before redeveloping these polluting infrastructures at their existing sites, which appears to be in line with the pillar of recognition and a key concern in the case studies that have been researched.

The green labeling of the municipal bond presented an opportunity to address the legacies of environmental racism and the accumulation of pollution sources in BHP, a historically Black-majority neighborhood in San Francisco. However, this opportunity was not seized. Instead, the project financed by the municipal green bond, specifically the reconstruction of the Southeast Treatment Plant, is set to prolong the presence of this pollution source in the neighborhood for many decades. This decision perpetuates socio-environmental marginalization in an era increasingly defined by climate change, failing to leverage the potential of green finance to foster just urban space distribution and climate justice. Finally, the map in figure 8 below illustrates how BHP is at the epicenter of concentrated environmental injustice and contamination.

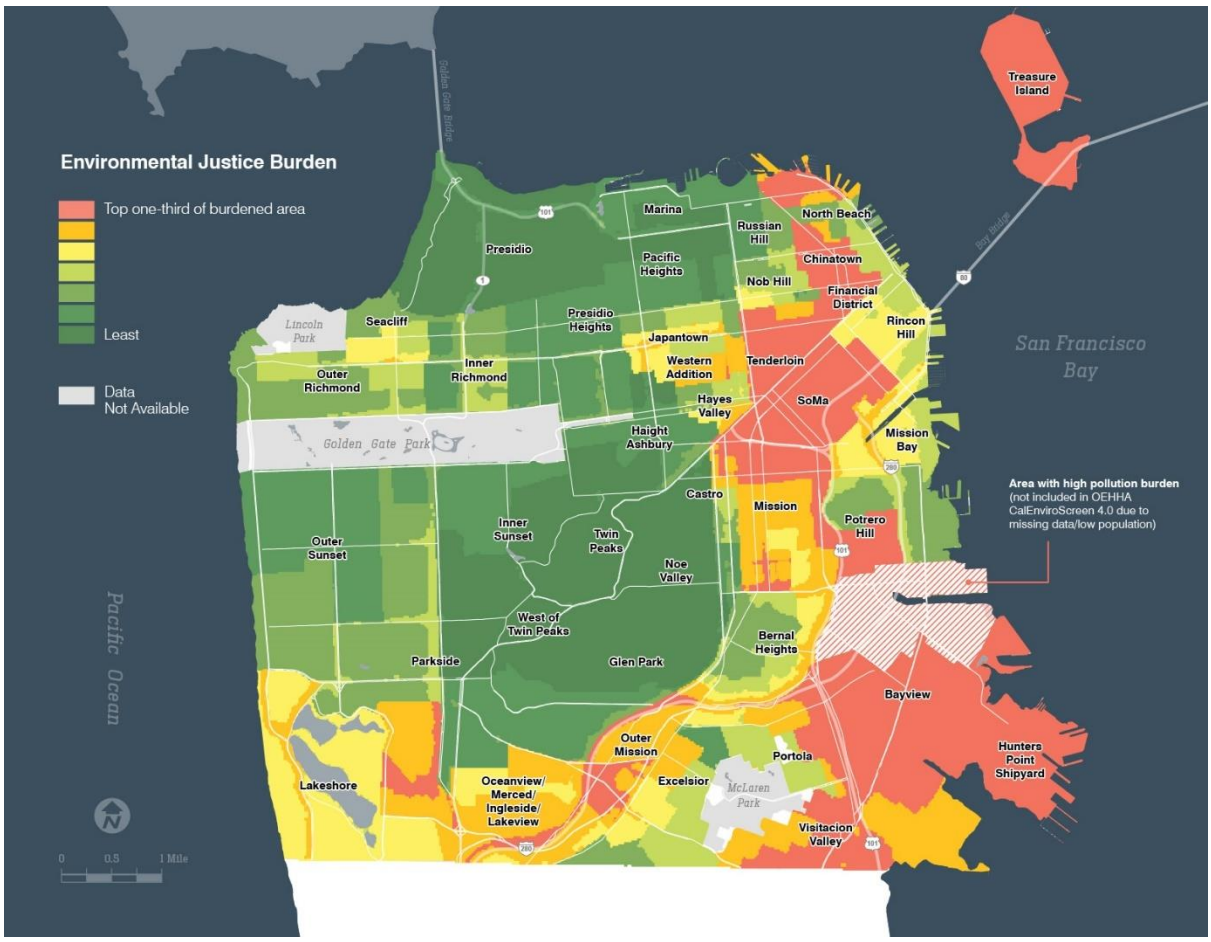

Figure 8. Environmental Justice Communities Map. Source: San Francisco Planning, 2023.

6.5 Pillar of Distributive Justice: The Socio-Environmental Cost of Wastewater Management

The concept of distributive justice within the climate justice framework critically assesses the allocation of environmental and financial burdens and benefits among various actors, focusing on individuals, communities, and intergenerational considerations (IPCC, 2023). The reconstruction of the Southeast Treatment Plant unveils a complex dynamic of both beneficial and detrimental impacts on different groups. For the broader San Francisco community, the renovation is a beneficial investment aimed at strengthening the city's climate change adaptation capacities, offering improved wastewater management that benefits future generations. However, for residents of the BHP neighborhood the same investment prolongs the presence of a significant source of pollution, thereby magnifying its disproportionate impact.

It have been shown already in chapter 5 that the US is not new to situations where the issuance of municipal bonds led to restricted access to drinking water as a result of increased water bills and service discontinuations, implemented to service municipal debt (Howell-Moroney & Hall,

2011; Ponder, 2021). These cases emphasize the necessity of scrutinizing financial costs such as water bills to comprehend the distributive impacts on Black-majority communities of municipal green debt. In contrast, this analysis shifts the focus from financial metrics to the spatial distribution of pollution sources within urban settings. Notably, such sources are heavily concentrated in BHP, a historically Black neighborhood. The decision to rebuild the Southeast Treatment Plant in its original location reinforces a long-standing pattern of distributive injustice, perpetuating environmental burdens on a community already facing disproportionate effects. This situation highlights the critical need to integrate both financial and spatial dimensions of environmental burdens in evaluating the consequences of municipal green bonds through the lens of distributive justice.

While the renovation of the Southeast Treatment Plant in San Francisco is presented as an infrastructure that will benefit current and future generations citywide by enhancing the capacity and environmental standards for treating contaminated water (San Francisco Department of Planning, 2017), it is most likely to also perpetuate harm to the residents of BHP. This neighborhood has endured a long history of environmental racism. The decision to retain and expand the plant in BHP means that the neighborhood will continue to house this significant source of pollution for decades to come, exacerbating existing environmental injustices. This highlights a complex dynamic where improvements for the broader community coincide with continued, localized harm, highlighting the need for a more just approach to environmental infrastructure planning. Racialized allocation of space and environmental pollution are significant issues in San Francisco, particularly in the BHP neighborhood, where pollution sources are disproportionately concentrated (Dillon 2011, 2014, 2018). About the unfair accumulation of pollution related to the Plant, a local resident mentioned:

> "*They don't give you a discount, just because they set up the wastewater plant here. They should, but they don't. (…) You know, money talks, still in America, even more so in San Francisco. And, in this community, we are rich in culture, but were a not getting (sic) of being a part of San Francisco equally, and that is when I would say the discrimination comes in, because, regardless, we still got a pay around the same amount of taxes.*" (Interview with a household member resident of BHP, January 20, 2022).

The reconstruction of the Biosolids Digester Facility at the Southeast Treatment Plant (see figure 9 below), while aiming to update the city's wastewater management infrastructure, has notably perpetuated the presence of a pollution source in an area already burdened by racial and environmental injustices. Research such as Vantarakis et al., (2016) and Godoi et al., (2018) have documented the adverse effects on human health and quality of life associated with

residing near contaminated water treatment facilities. This continuation of a local pollution source in the BHP neighborhood highlights a critical aspect of environmental injustice, underlining the negative impacts that such infrastructure can have on already vulnerable communities.

Figure 9. A Poster Illustrating the Details of the Biosolids Digester Facility Project Part of the Southeast Treatment Plant. Source: Author.

While the environmental and social standards of the BHP wastewater treatment plant are set to improve, the facility's ongoing presence and its associated impacts will persist in the neighborhood. This continuation prompts critical considerations about the distribution of environmental burdens and benefits across San Francisco, questioning which communities should endure the consequences of maintaining the plant in its historical location. This decision implicates not only current but future generations, who will also bear the financial obligations associated with the servicing of the municipal green debt. The picture below (figure 10), taken by the author in the residential area of Bayview-Hunters Point during direct observation, reveal the proximity of residents to the biosolids digester part of the Southeast Treatment Plant, exposing them to pollutants and carcinogens.

Figure 10. Poster Warning about the Public Health and Environmental Risks Associated with the Biosolids Digester Facility Project Part of the Southeast Treatment Plant. Source: Author.

6.6 The Narrative Surrounding San Francisco's Municipal Green Bonds

As delineated in chapter 2, the methodology has been adapted to the three distinct phases of the municipal bonds lifecycle: green labeling, implementation, and communication. The last element has been addressed by means of narrative analysis as a critical engagement with "*the representation of an event or a series of events*" (Abbott, 2008, p 13), with the aim of providing a critical tool to better understand the potential frictions between the lived experience of the communities and the way in which success of a municipal green bond is defined (Bracking, 2024; Tripathy, 2021).

Narratives go beyond the territorial context. They influence perceptions and decision-making, serving as strategic tools for actors aiming to advocate for specific actions (Curran, 2021). It is thus important to investigate the narratives that were developed with regards to the municipal green bonds and reflect on what elements were considered and what were ignored. This is done, in the case of San Francisco as in the other two cases, through a review of financial documents

and analyses of media and social media content, assessing how these narratives shape and are shaped by the broader discourses of climate justice and municipal finance.

The issuance of the SFPUC municipal green bond, aimed at financing water infrastructure improvements, advanced a narrative that conflated financial innovation with climate action. In 2017, the "Green Bond Pioneer Awards: Leadership in Green Finance" recognized market leaders, celebrating Poland for issuing the first sovereign green bond and Dutch company Obvion NV for launching the first residential mortgage-backed green bond (CBI, 2016c). In this context, San Francisco was also honored for introducing the first water-related green bond, praised for its innovative application of the water infrastructure taxonomy (CBI, 2016c). This award was directly linked to the municipal green bond discussed here, highlighting its perceived novelty and contribution to climate finance.

California State Treasurer John Chiang commented on the 2016 issuance of the green bond, highlighting his commitment to expanding this market segment, "*I am working to grow the green bond market in California and the United States. There is a great demand for environmentally related securities. Unfortunately, the supply remains tight, limiting our ability to finance critical projects for combating climate change. The San Francisco Public Utilities Commission wastewater green bonds, which have been certified as meeting the 'Climate Bonds Standard', are a step forward meeting this market need.*" (Climate Bonds Initiative, 2016, p 7). Similarly, Harlan L., Kelly, Jr., General Manager of SFPUC, stressed the importance of the 2016 bonds: "*We're upgrading our credit ratings, we're upgrading our bond standards, and most importantly, we' re upgrading our aging wastewater infrastructure.*" (Carroll, 2016, p 4).

San Francisco's engagement in the green bond market has continued to gain awards. In 2019, the SFPUC's municipal green bond, designated for financing wastewater infrastructure, was named the US Municipal Green Bond of the Year at the Environmental Finance Bond Awards (Johansson, 2019). In a landmark development in 2020, SFPUC was the first US municipal issuer of green bonds on the London Stock Exchange, further internationalizing the municipal green debt market. It received the 2021 Green Bond of the Year – US Municipal Category at the Bond Awards (SFPUC, 2021). That same year, Bank of America was honored as the Leading Green Bond Manager in the US Municipal category for facilitating San Francisco's pioneering issuance on the European exchange (Environmental Finance, 2021). The SFPUC General Manager remarked, "*The SFPUC Green Bond Program exemplifies our commitment to environmental and fiscal responsibility*" (London Stock Exchange, 2022, p 6).

In San Francisco, the awards reinforced a narrative that equated climate finance with climate action, casting the city as a leader in financial innovation. However, this narrative overlooks the underlying climate injustices associated with the projects financed by the municipal green bond. The continuation of the Southeast Treatment Plant in a Black-majority neighborhood, historically burdened by environmental racism and climate injustice, stands in contrast to the narrative of climate finance progress. While environmental and social standards at the treatment facility were indeed enhanced, these improvements stemmed not from the green bond's labeling but from existing environmental justice regulations enforced by the San Francisco Public Utilities Commission and the State of California (SFPUC, 2009; California State Legislature, 2016). Despite these advancements, the financed project still facilitated the continuation of a pollution source within a context marked by environmental racism. This discrepancy emphasizes the critical need for a climate justice perspective in the development and issuance of municipal green bonds, particularly for projects situated within contexts of climate injustice. Currently, the financial sector's criteria for green labeling do not adequately incorporate considerations of climate justice, failing to address the local contexts in which these projects are executed.

6.7 Conclusion: Financing the Reconstruction of Environmental Racism Due to the Accumulation of Wastewater

This bottom-up analysis of the 2016 municipal green bond issued by the San Francisco Public Utilities Commission (SFPUC) underlines the importance of using a the tripartite climate justice approach in assessing the way in which climate finance materializes in local communities and in the lived experience of the people. Although there were enhancements in the Southeast Treatment Plant, this case study reveals a significant oversight: the principles of climate justice were not sufficiently incorporated into either the green labeling process or the project's implementation, so that what was presented as a way of improving the climate adaptation of a community and was also labeled as green ended up strengthening existing injustices.

This is a case of procedural (in)justice, according to which transparency, access to information, and participation in decision-making processes are essential. In the case of the municipal green bond issued by the SFPUC, while adherence to the financial nature of the Green Bond Principles was evident, the integration of climate justice criteria was notably absent. The green labeling process could have represented an opportunity to facilitate significant participation from the communities most affected by the projects financed, particularly in addressing issues related to racial and climate justice during planning and implementation. But it was not the case.

Furthermore, the follow-up reports of the bond lacked explicit climate justice parameters, reflecting a critical oversight in aligning the bond's governance with broader climate justice objectives. This omission stresses the need for more inclusive and justice-focused decision-making frameworks in the structuring and monitoring of climate finance instruments.

Likewise, recognition justice emphasizes the inclusion and consideration of diverse perspectives, particularly those of historically marginalized communities. In the case of the Southeast Treatment Plant's renovation, the project perpetuated environmental burdens in Bayview-Hunters Point (BHP), a Black-majority neighborhood, by failing to explore alternative solutions that could fix long-standing environmental racism. The prevailing narratives used urban spatial constraints as justifications to maintain the plant's location, thereby neglecting more just and sustainable options. This lack of recognition for alternative scenarios illustrates a significant oversight in addressing the needs and voices of the BHP community, further entrenching the legacy of environmental injustice in the area.

This case demonstrates that social and environmental injustices not only preceded but were also perpetuated by the issuance of the municipal green bond. The bond effectively *locked in* existing injustices by financially cementing the status quo until its maturity and the service of the associated municipal debt. Such a scenario features concerns from a climate justice perspective, particularly regarding the recognition pillar. It highlights the failure to consider alternative approaches to spatial and pollution distribution in San Francisco, thereby continuing to impose environmental burdens on already disadvantaged communities. This raises critical questions about the role of climate finance in perpetuating rather than alleviating climate and environmental injustices.

For what concerns distributive justice, the allocation of environmental and financial burdens and benefits. While the entire city of San Francisco benefited (and still benefits) from the upgraded capabilities and enhanced environmental standards of the treatment plant, the project financed by the municipal green bond simultaneously perpetuated a disproportionate pollution burden on the BHP neighborhood. This historically Black-majority area, long subjected to environmental and racial injustices, continues to bear the burden of these impacts. Fieldwork and interviews emphasize that the extensive renovation has not alleviated but rather extended the presence of this pollution source within BHP. Both current and future residents of this neighborhood will endure these adverse effects, highlighting an inequitable distribution of environmental harms. This situation necessitates a critical examination of how space and water contamination are distributed and the consequent impacts on the community.

Such inequality is invisible in the prevailing narrative surrounding municipal green bonds, which stresses innovation and financial success and that in the case of San Francisco also led to the awarding of an international prize and international recognition (Johansson, 2019; Environmental Finance, 2021a; 2021b). However, the narrative of financial success significantly overlooks the ongoing climate and racial injustices impacting the BHP community. By highlighting achievements without acknowledging the adverse effects on marginalized communities, this narrative perpetuates the invisibility of these issues. It also fails to recognize alternative approaches that could mitigate the historical environmental and racial injustices faced by these communities, thereby reinforcing a narrative that excludes critical perspectives on justice.

Ultimately, the case of the San Francisco municipal green bond emphasizes the necessity of incorporating a climate justice perspective when assessing the viability or unviability of municipal green bonds in contexts marked by climate injustice. The prevalent narrative of innovation and financial success needs to be critically reevaluated to ensure it encompasses and addresses the social and environmental impacts on communities historically burdened by climate injustices. Finally, the table 5 below summarizes the climate justice analytical framework to scrutinize the 2016 San Francisco municipal green bond issued for wastewater management, highlighting the disparities in environmental and social impacts across the city.

		Climate Vulnerability Dimensions (Race)
Climate Justice Pillars	Distributive Justice	- The green bond financed the reconstruction of a wastewater treatment plant in Bayview-Hunters Point (BHP), a predominantly Black neighborhood, perpetuating environmental racism by maintaining pollution exposure in the area. - Upgrades to the Southeast Treatment Plant, including the Biosolids Digester Facility, benefited the broader city but reinforce a legacy of unjust environmental burdens by keeping the facility in BHP. - Despite improvements in environmental performance, the plant's continued operation in BHP raises concerns about fair distribution of environmental impacts, questioning who bears the costs of such decisions now and in the future.
	Recognition	- The green labeling of the bond fails to recognize and address the historical context of environmental racism and discrimination in BHP. - Justifications for maintaining the plant at its current location often cite urban spatial constraints, non-recognizing alternative solutions that could reduce environmental and climate injustices.
	Procedural Justice	-The green labeling process of the municipal bond did not incorporate climate justice criteria either during its issuance or throughout its monitoring reports. -Although the bond's proceeds were dedicated to enhancing wastewater infrastructure, regarded as a climate change adaptation effort, it failed to integrate explicit climate justice considerations. -The only mention of an environmental justice assessment occurred in the 2021 follow-up report, which was not mandated by the green labeling criteria.

Table 5. Application of the Climate Justice Framework to the 2016 San Francisco Municipal Green Bond. Source: Author.

CHAPTER 7. CAPE TOWN MUNICIPAL GREEN BOND: POTABLE WATER RESTRICTION AMIDST CLIMATE INJUSTICE

7.1 Introduction

In 2017, the Cape Town government launched its inaugural municipal green bond on the Johannesburg Stock Exchange, raising USD 75 million. The majority of these proceeds (83%) were designated for a water management devices (WMDs)[37] installation program targeting low-income households, termed "indigent" by local authorities (Moody's Investor Service, 2019). These devices, installed as part of a strategy to rationalize water use under the guise of climate change adaptation (KPMG, 2017), were intended to regulate water consumption by enforcing a daily quota. Following the South African constitution, each household is entitled to a certain amount of free water daily (Jegede & Shikwambane, 2021). Once this quota was exceeded, the devices would cut off water supply until the next cycle began the next day (City of Cape Town, 2011). What was intended as a vital minimum soon became a restrictive cap on water usage for many, leading to significant community pushback and the eventual cancellation of the program in 2021 (Scheba et al., 2021).[38]

This case study is significant as it highlights the intersection of climate vulnerability dimensions, specifically income and race, and the manifestation of environmental racism (Pulido, 2016, 2017; Seamster & Purifoy, 2021), particularly in the distribution of drinking water. This can be contextualized further in the discussion by putting into dialogue with the case of San Francisco, where environmental racism is evident in the distribution of wastewater infrastructure.

The 2017 Cape Town municipal green bond was already analyzed by Bigger and Millington (2020, 2023) who discuss the impact of financing adaptation to climate change on what they call racialized austerity in cities, which refers to the public policy measures that disproportionately affect marginalized racial groups. Bigger and Millington (2020) argue that this green bond, rather than generating transformative change, perpetuated financial and environmental risks for marginalized communities, especially people of color. In their work, the authors say that relying on debt for climate adaptation radicalizes financial and

[37] The water management devices program began in Cape Town in 2007, justified by excessive water use, debt accumulation, and negligence in addressing water leaks in low-income households (City of Cape Town, 2011; Millington & Scheba, 2021). Cape Town intensified the installation of water management devices in low-income households during the 2015-2018 drought (Millington & Scheba, 2021).

[38] This represents an example of local literature analyzing the local context from a justice perspective.

environmental risks for marginalized communities and instead argue that transformative change needs systemic updates in the way risk is distributed beyond specific fiscal strategies at the municipal level (Bigger & Millington, 2023).

Likewise, the articles by Bigger and Millington (2020, 2023) are an important point of reference for this chapter, which benefits from their insight and goes beyond their analysis by applying the analytical framework of climate justice and observing the narrative deployed around the municipal green bond. In addition, by deploying the same analytical structure for the three case studies, the dissertation facilitates the conditions to create a dialogue between the instance of Cape Town with the two other experiences of Mexico City and San Francisco, thus offering a wider and deeper understanding of patterns, similarities and limits of issuing municipal green bonds to raise capital for local water infrastructures.

7.2 Context of Climate and Racial Injustices

To fully grasp the impact of Cape Town's municipal green bond on climate justice, it is essential to consider the historical context of spatial, income, and water distribution within the city. Colonial and apartheid-era policies in South Africa enforced racial segregation through severe spatial planning laws. Notably, the Black Land Act of 1913 and the Development Trust and Land Act of 1936 restricted Africans to 13% of the land, leading to widespread evictions and spatial displacement (Strauss and Liebenberg, 2014). Non-White individuals were systematically excluded from urban centers, relocated to townships lacking basic infrastructure, including adequate drinking water and public services. Despite apartheid ending in 1994, its legacy of unequal spatial distribution continues to influence social and economic inequalities, as well as outdated planning frameworks that still permit inequitable access to land and housing (Strauss and Liebenberg, 2014). This historical backdrop is crucial for understanding the implications of distributing water management devices in low-income areas using proceeds from the municipal green bond.

Apartheid in Cape Town enforced strict racial segregation, allocating prime neighborhoods with superior infrastructure, access to public services, and enhanced economic opportunities to White populations. Conversely, non-White communities were relegated to townships—informal urban settlements marked by substandard infrastructure, housing shortages, and insufficient public services (Enqvist & Ziervogel, 2019; Turok et al., 2021). These spatial divisions created lasting disparities that continued to influence the city's social and infrastructural landscape.

Racial, environmental, and climate injustices are plainly visible in the distribution of space, neighborhoods, income, and access to essential services such as water and sanitation in South Africa. The South African Human Rights Commission (2018) highlights significant disparities, with 64% of Black Africans and 41% of ‘Coloured’ (mixed race) Africans living in poverty, compared to only 6% of Indians/Asians and 1% of Whites. These disparities stem from the enduring legacies of colonialism and apartheid, which institutionalized racial spatial segregation and resulted in unequal outcomes across various socio-economic indicators, including per capita consumption, predominantly along racial lines (World Bank, 2022).

Despite the removal of apartheid-era legal restrictions on residential areas, Cape Town remains severely divided along racial lines. High-income neighborhoods like Sea Point and Camps Bay are predominantly White, whereas low-income areas such as Dunoon and Khayelitsha are mainly Black, and Mitchells Plain is primarily 'Coloured' (City of Cape Town, 2013). The households in these low-income areas, labeled as ‘indigent’ and targeted by the water management devices financed through the municipal green bond, consume disproportionately less water, only 12% of the city's water is used by the bottom 50% of income earners. Yet, they are subjected to rigorous water management policies. In contrast, higher-income households enjoy luxurious water usage, including swimming pools and well-watered gardens, highlighting a severe disparity in water consumption and access (Savelli et al., 2023). Research by Savelli and colleagues features the injustice in water distribution in Cape Town, pointing out that the urban water crisis is exacerbated by the unsustainable consumption patterns of the elite (Savelli et al., 2021; Savelli et.al, 2023; Savelli, 2023). The map in figure 11 below illustrates the uneven and racialized spatial distribution in Cape Town.

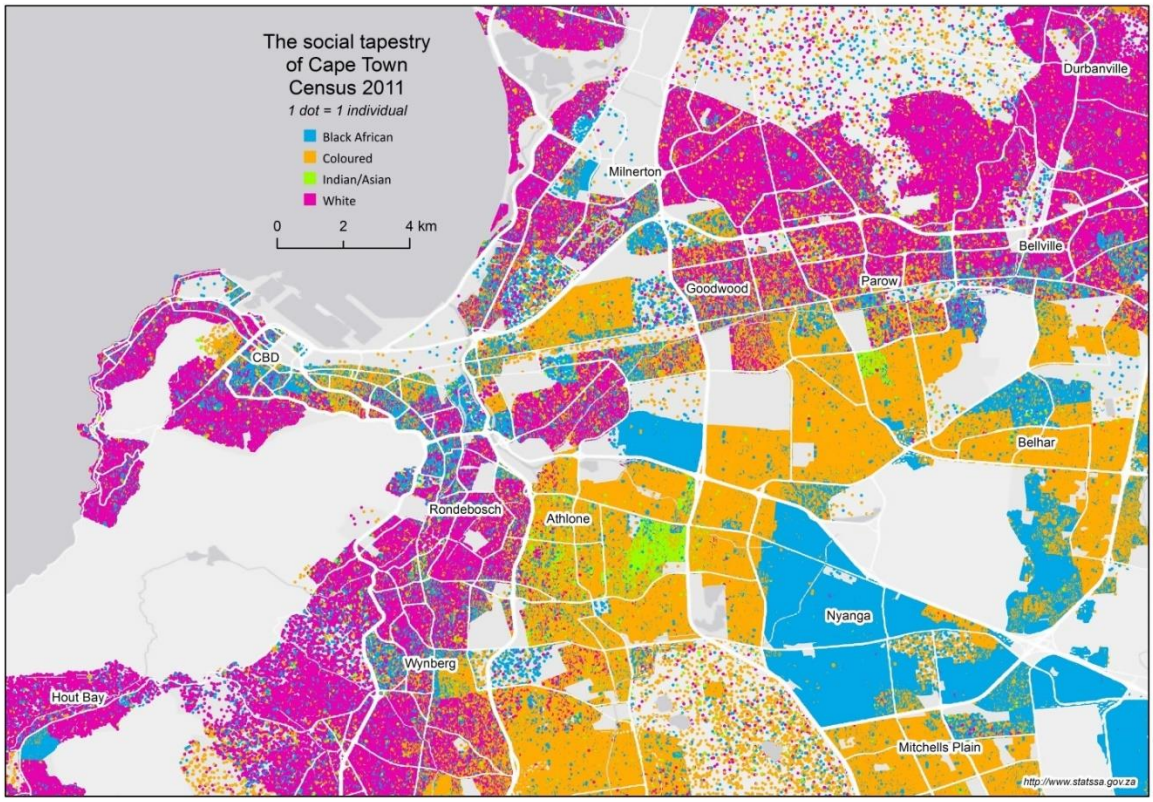

Figure 11. The Social Tapestry of Cape Town Census 2011. Source: Statistics South Africa, 2016.

7.3 Pillar of Procedural Justice: Green Labeling

The procedural justice pillar in this chapter primarily scrutinizes the green labeling process of the municipal bond, emphasizing how this label distinguishes the bond in the financial market. The Cape Town municipal green bond adhered to two voluntary standards: the Green Bond Principles and the Climate Bonds Standard (KPMG, 2017). The Green Bond Principles, outlined by the International Capital Market Association (ICMA, 2017), provides the foundational framework of green bonds, defining them as debt instruments funding environmentally beneficial projects and climate action. This standard includes four core components: use of proceeds, which are directed exclusively towards green projects; project evaluation and selection, requiring issuers to clarify the environmental objectives these projects aim to fulfill; management of proceeds, ensuring the proper allocation and usage of funds; and reporting, necessitating annual follow-up reports on project progress and environmental impacts. The Climate Bonds Standard builds on these elements and additionally details specific criteria for water-related projects and mandates third-party verification, thus enhancing the thematic attention and transparency of the green labeling process (ICMA, 2017).

The second voluntary standard utilized in the green labeling of the Cape Town municipal green bond is the Climate Bonds Standard, which establishes specific criteria by sector, specifically for water-related projects in this instance. This standard mandates third-party verification to ensure the financed water projects align with climate action and environmental sustainability goals (KPMG, 2019). The water criterion within the Climate Bonds Standard was specifically applied to ensure that projects like improved water reserves contribute to climate change adaptation and mitigation. Additionally, it verifies that these projects adhere to best practices in water management and resilience against climate change impacts, ensuring they meet sustainability criteria (KPMG, 2019).

It is necessary for municipalities to develop a portfolio of projects with the potential to be labeled as green under these standards before issuing a green bond. A policy expert highlighted the extensive preparatory work and technical expertise required to support municipalities in meeting the necessary standards for green labeling: "*There's a lot of project preparation work that has to be done and a lot of technical expertise that has to come in to actually support the municipalities to get their (…) projects to meet the necessary requirements, to determine whether the projects are bankable or not*." (Policy expert interview, October 17, 2022).

In 2017, the Cape Town government created the green bond framework document as a proposal for its municipal green bond. This framework aimed to finance projects geared towards environmental sustainability, thus enhancing the city's resilience and response to climate change challenges (City of Cape Town, 2017). The document outlined several key project areas for funding, including water management enhancements such as reservoir upgrades and water pressure management, the installation of photovoltaic systems on municipal buildings, retrofitting streetlights with energy-efficient lighting, improvements in solid waste infrastructure for sustainable waste management, and the introduction of electric vehicles for low-carbon public transport (KPMG, 2017). However, in practice, a significant portion of the bond's proceeds (83%) was directed towards installing water management devices in low-income households (Moody's, 2019). These devices were designed to restrict daily water access after a set quota was reached, as illustrated in figure 12 below.

Information is Confidential or Public	Information to be provided by potential Issuer *Note: If not all information is available at time of submission of this Form, please indicate this with "TBC" in the relevant cells*
Public	Project 4: *Taxonomy and investment area:* Water - Water distribution infrastructure *Project alignment:* Adaptation *Criteria:* The Water Criteria of the Climate Bonds Standard (V2.1), Phase 1 (evidence provided) *Basic description:* Water meter replacement with water management devices programme and leak repair program for indigent households , in order to enhance water management, influence behaviour to reduce water wastage and reduce water losses through leakage *Project Lifespan:* <20yrs (evidenced) *Location:* City of Cape Town, South Africa *Budget and period:* R 1 018 658 243.85, allocated for spend FY2015 - FY2019; USD 77 429 926 equivalent # *Phase:* In execution

Figure 12. Screenshot of the Climate Bond Information Form for the City Of Cape Town Green Bond, Submitted to KPMG for Evaluation. Source: KPMG, 2017.

KPMG, an audit firm based in Cape Town, evaluated the green bond framework both prior to and following its issuance on the Johannesburg Stock Exchange. KPMG's evaluation confirmed that the projects financed by the bond adhered to the Climate Bonds Standard, noting the projects' alignment with specified environmental objectives, adherence to internal control procedures, and the establishment of a comprehensive strategy for reporting on bond performance post-issuance (KPMG, 2017).

The principal initiative financed by the municipal green bond was the water management devices installation program, identified as a climate adaptation strategy in response to Cape Town's 2015-2018 drought, detailed further in the recognition segment of this chapter. The program was designed to replace traditional water meters in low-income households with water management devices, with the objective to "*improve water management, influence behavior to reduce water waste, and reduce water losses due to leaks*." (KPMG, 2017, p 6). The allocation for this program from the municipal green bond was approximately USD 77,429,926,[39] with implementation scheduled from 2015 to 2019 (KPMG, 2017).

KPMG released a follow-up report confirming that all aspects of the municipal green bond continued to adhere to the Climate Bonds Standard (KPMG, 2019). Additionally, Moody's assessed the municipal green bond in 2017 and 2019, giving high ratings for various aspects such as city government organization, proceeds utilization, transparency about the use of proceeds, consistent reporting, and transparency in disclosures (Moody's, 2017; 2019). For a detailed review of the green finance documents pertaining to the Cape Town case study, refer to table 6 below.

Documents[40]	**Year**	**Author**
Green Bond Framework	2017	City of Cape Town
Independent Assurance Provider's Limited Assurance Report (Green Bond – KPMG's Pre-Issuance Report)	2017	KPMG
Cape Town, City of Green Bond Assessment	2017	Moody's Investor Service
Applicable Pricing Supplement	2017	City of Cape Town
Independent Assurance Practitioner's Limited Assurance Report To the Directors of City of Cape Town (Green Bond – KPMG's Post-Issuance Report)	2019	KPMG
Cape Town, City Of Update to Green Bond Assessment	2019	Moody's Investor Service

[39] ZAR 1,018,658,243.85 (KPMG, 2017).
[40] All links consulted on January 12, 2024. See links at the end in the references.

Green Bond Reporting Framework	2021	City of Cape Town
Update Report for the Certified Climate Green Bond (CCT04) from City of Cape Town	2023	City of Cape Town

Table 6. Documentation Reviewed for the Cape Town Municipal Green Bond. Source: Author.

The voluntary standards applied to Cape Town's municipal green bond, specifically the Climate Bonds Standard, do not include explicit criteria to ensure adherence to racial, environmental, or climate justice principles. This gap is concerning, especially considering the bond's proceeds were predominantly allocated to water infrastructure projects in contexts historically marked by racial injustice in Cape Town. The standard suggests that issuers should follow best practices in human and social rights, stating, "I*n addition, any bond-issuing entity seeking certification under these Criteria is expected to be aware of and adhere to best practice guidelines or standards related to social and human rights and broader environmental considerations in the context of water development. The Criteria described in this document are intended to supplement and complement these other criteria rather than overlap and compete with them.*" (CBI, 2021c, p 11). However, this approach assumes issuers will inherently adhere to these practices without providing mechanisms for verification, which raises concerns when financing projects in areas facing local climate injustice, such as Cape Town.

The annex provided by the City of Cape Town for the verification of the *Climate Bonds Standard Water Criteria* claims that the city supports efforts against racial discrimination and fosters participation, transparency, and access to information (KPMG, 2017). However, it lacks specific details on how these principles are implemented in the context of the water management devices installed in low-income households (see figure 13). This omission raises concerns about the practical application of these commitments in projects directly affecting vulnerable communities.

City of Cape Town Green Bond

WATER CRITERIA OF THE CLIMATE BONDS STANDARD: Social and human rights and broader environmental considerations

- Inclusive city: An inclusive city promotes non-discrimination and equality to ensure citizens have access to the resources they need and to service the rights of current and future generations.
- Well-run city: Promotes the need to implement democratic and transparent processes, addressing access to information and the right to participation.

Figure 13. Screenshot of Annexure 1: "City of Cape Town Water Criteria of the Climate Bonds Standard: Social and Human Rights and Broader Environmental Considerations." Source: KPMG (2017).

The introduction of the water management devices program in communities struggling with historical racial injustices provided inadequate participation opportunities for low-income or 'indigent' households in the planning or execution phases of the water restriction program (Mahlanza, Ziervogel, & Scott, 2016). These households were also insufficiently informed about the financial implications of the municipal green bond program, which committed Cape Town to a municipal green debt obligation from 2017 to 2027 (KPMG, 2017). A resident from the Mitchells Plain neighborhood expressed their confusion about the devices, stating, "*We did not understand the device, we did not know that when the water for the day runs out, the amount they give you, the tap just shuts off*" (Water activist interview, November 24, 2022).

Additional testimonies collected by the Environmental Monitoring Group stressed the lack of transparency and informed consent in the program's implementation: "*We are not aware of any community workshop. If we sign something, we don't know what it's for; they only tell us the benefits, and none of the problems. Often it's a kid that the city gets to sign. They do not give us a copy of the form we signed. We do not believe this constitutes 'prior informed consent'*" (Environmental Monitoring Group, n.d., p 4). Regarding the need for effective participation and transparency in access to information for communities, a water activist from Khayelitsha, a Black-majority area in the city, stated:

> "*People need to be informed, like fairly informed about the change, that the changes that are to be implemented because, (…), nothing for the people without them, because you're doing this for the people, all these finances are going to you, (…) you do this for the people, water does not belong to you, only it belongs to the people. So whenever like you having this project may for example the water management system, you need to make sure that you reach to people. You need to make sure that they understand what they, there's something that you coming up with that you campaign is about, that they need to thoroughly understand that how it's going to affect them. The long, the long term effect of it, how it's going to benefit them. Fairly informed*." (Water activist interview, October 8, 2022.)

The lack of effective participation was evident in the resistance the water management devices program faced from the community. Residents and activists demanded genuine involvement in decision-making processes related to the program implementation, highlighting the negative

consequences of inadequate water supply and voicing their concerns to municipal representatives (Environmental Monitoring Group, n.d.). An adequately inclusive participatory process might have revealed the project's inadequacies and its eventual unfeasibility, potentially preventing financial waste or suggesting necessary modifications in the face of this local climate injustice. The water management devices project was discontinued in 2021, and the devices are set to be replaced by conventional meters (City of Cape Town, n.d.). As explained by Scheba and colleagues (2021):

> "*The City seems to have finally realised, after 15 years of grassroots organizing against the dreaded Water Management Device (WMD), that the system needs to go. (…) To begin with, the decision to discontinue the use of the WMD is both welcome and long overdue. Largely installed in 'indigent' and indebted homes, the instrument is designed to restrict water access above the 'Free Basic Water' (FBW) quantity by automatically cutting off water once the daily limit has been reached. Despite the City's continued efforts to portray the WMD as a significant instrument for sustainable development and responsible water usage over the last 15 years, the harsh realities of living with the instrument are well documented, earning it the name 'Weapon of Mass Destruction' among poor people in the city*" (Scheba et al., 2021, p 5).

The City of Cape Town complied with the Green Bond Principles and the Climate Bonds Standard, which includes specific criteria for water infrastructure; KPMG verified this adherence (KPMG 2017, 2019). Nevertheless, the implementation of the water management devices program financed by the municipal green bond demonstrated significant shortcomings in community participation and transparency. This deficiency highlights concerns about perpetuating existing climate and racial injustices within low-income neighborhoods where the water management devices were implemented. This scenario reflects procedural injustice by limiting meaningful community engagement and distributive injustice through the management of water resources, which disproportionately impacts low-income and racially marginalized groups. Moreover, the green bond's approach did not adequately consider alternatives to the prevailing strategy of restricting water access for low-income households, an issue further explored in the recognition pillar of this analysis.

7.4 Pillar of Recognition: Non-Recognition of Alternative Approaches to Water Management

The recognition pillar of climate justice, which emphasizes the inclusion of diverse actors, perspectives, and values in climate action (IPCC, 2023), is critical for identifying and

addressing injustices in climate finance and climate action. Despite South Africa's democratic transition and constitutional commitments to combat racial discrimination following 1994, the implementation of water management policies in Cape Town reflects a continuation of historical injustices. The city's strategy, focused predominantly on restricting water usage in low-income, predominantly Black and 'Coloured' neighborhoods, illustrates a failure to integrate broader racial and climate justice perspectives. This approach has prioritized a narrow, utility-focused vision of water management over a more inclusive, justice-oriented strategy that could address both environmental sustainability and climate justice. This segment will explore the dominant strategy around water distribution in Cape Town and critically examine the lack of recognition of alternative approaches that center on racial and climate justice principles.

In Cape Town, the water management devices program, initiated in 2007 and intensified during the 2015-2018 drought, reflects dominant strategies employed by city authorities. Initially, the justification for introducing these devices centered on implied excessive water use and negligence in managing water leaks among low-income households (City of Cape Town, 2011; Millington & Scheba, 2021). City officials argued that such households accrued substantial debts by exceeding their free monthly water allocation of 6,000 liters, provided under the 1997 Water Services Law. This law aligns with the 1996 South African Constitution, which enshrines the right to water and aims to address the historical water access disparities faced by non-White communities (Jegede & Shikwambane, 2021). The strategy of water restriction with the water management devices, while seemingly aimed at fiscal and environmental sustainability, overlooks broader socio-economic dynamics and fails to account for the systemic barriers that contribute to the disparities in water usage and access in the first place.

In Cape Town, the government's response to high water consumption in low-income households centered on installing water management devices that automatically restrict water access upon reaching a daily limit (City of Cape Town, 2011). This approach, which justifies the strategy by citing excessive use and neglected leaks, reflects a dominant perspective that places responsibility squarely on the households for their high water usage (City of Cape Town, 2011). However, this view fails to recognize several critical factors: the historical displacement of non-White communities to poorly serviced townships (Strauss and Liebenberg, 2014), the enduring economic disadvantages and lower incomes resulting from colonial and apartheid legacies (South African Human Rights Commission, 2018; World Bank, 2022), and the fact that high-income households consume a disproportionate amount of Cape Town's water (Savelli et al., 2023). Consequently, the municipal strategy of imposing water restrictions through management devices on low-income households overlooks the broader systemic issues and

does not recognize alternative strategies that might address the deep-rooted racial and environmental injustices through a climate justice lens.

Figure 14. Promotion on Social Media of the Water Management Devices Program. Source: City of Cape Town X Account [@CityofCT] (2018).

Households installing water management devices were offered debt forgiveness for outstanding water bills and free leak repairs as incentives. However, water consumption beyond the allocated free quota was subject to charges. If households failed to meet debt payment deadlines, their water access would be automatically restricted to only the minimum daily quota. This policy, intended to manage water use and address debt, inadvertently transformed the *vital minimum* of water into a rigid upper limit, penalizing households by limiting access to the essential liquid whenever financial obligations were not met (City of Cape Town, n.d.). According to academic analysis, such approach to water accessibility risks exacerbating water scarcity for financially vulnerable and historically discriminated households (Mahlanza, Ziervogel, & Scott, 2016).

The debt accrued by the city council may not be the only form of debt relevant to this case, but would rather compound or intensify existing debt at the family level. According to Mahlanza et al. (2016), the City of Cape Town implemented the distribution of water management devices as a strategy primarily targeting households with significant debt, particularly those with large amounts of unpaid water bills. This also included households eligible for the free water quota under the city's indigent policy, a situation that Mahlanza and colleagues (2016) considered to

lack legitimacy, given that these residents often live in townships affected by the legacy of poor urban planning and substandard infrastructure, leading to recurrent leaks and substantial water bills. In practice, the water management policy funded by green debt unevenly impacted lower-income households and stressed the private debt that they had already contracted.

Moreover, during 2015-2018 Cape Town experienced an unprecedented period of drought, which revealed the city's vulnerability vis-à-vis the intensification of climate change and the need to make the city and its population more adaptive. Among all the possible policy options, the government emphasized the need to reduce and rationalize water use to combat the drastic decline in the city's water reserves due to prolonged dry periods. The campaign aimed to prevent *Day Zero*, a scenario where water services could potentially be halted across much of the city. As part of this strategy, the installation of water management devices was promoted as a means to limit water consumption, reduce waste, and avert the imminent crisis of *Day Zero* (Enqvist & Ziervogel, 2019; Millington & Scheba, 2021). This strategy, financed with the proceeds of the municipal green bond, was framed as a critical component of the city's climate adaptation efforts, positioning the devices not just as utilities management tools, but as vital elements in the broader strategy of climate action.

The "Day Zero" narrative obscured the ongoing water scarcity experienced by low-income communities well before the drought period, where unreliable water access was a persistent issue (Mihaloupoulos, 2021). Despite these disparities, the municipal green bond directed 83% of its proceeds towards installing these devices in low-income households under the guise of promoting behavioral change to reduce water misuse (KPMG, 2017, p 6). This approach unfairly targeted these communities for water conservation, despite the fact that the highest water consumption rates were recorded in high-income areas (Savelli et al., 2023), revealing a misalignment in the application of conservation efforts and the burden of climate adaptation measures.

The recognition pillar of climate justice, which calls for including diverse perspectives in climate action, highlights shortcomings in Cape Town's approach to water management. Despite post-apartheid policies addressing racial discrimination, the city's strategies have effectively ignored the deeply ingrained racial and income disparities. The water management devices program, rationalized by perceived water overuse and leak negligence in low-income households (KPMG, 2017), implemented restrictive water access that disproportionately impacted Black and 'Coloured' communities, exacerbating existing inequalities (Bigger & Millington, 2020).

When considering that a municipal bond could be green by supporting the implementation of water meters, the public authority and all the other actors involved failed to consider the historical context of apartheid and inadequate infrastructure that predisposed these communities to water issues.[41] Instead, they agreed on the combination between public policies and private funds to restrain supposed excess water use, channeling the majority of municipal green bond proceeds into installing water management devices in these marginalized areas rather than in alternative interventions based on the primacy of climate justice. This perpetuated patterns of injustice rather than addressing them through inclusive and reparative strategies and indicates a significant oversight in recognizing and incorporating alternative visions that prioritize redressing historical injustices in water access.

7.5 Pillar of Distributive Justice: Financing Uneven Access to Potable Water and More Public Debt

The distributive justice pillar within the climate justice framework is pivotal for examining how environmental and financial burdens and benefits are allocated among individuals, communities, and across generations (IPCC, 2023). In Cape Town, the municipal green bonds financed the installation of water management devices in low-income households that perpetuated existing injustices in water distribution. This policy choice disproportionately affected low-income, predominantly Black and 'Coloured' communities, further entrenching the city's historical racial injustices. These devices, which were justified as a measure to manage water consumption during a severe drought, instead reinforced barriers to essential water access for those already vulnerable (Scheba et al., 2021). By not considering the intersection of income and race, as climate vulnerabilities, the strategy failed to address or alleviate the broader context of injustice within Cape Town, exacerbating disparities rather than alleviating them.

The implementation of a free water quota for low-income households in Cape Town, initially intended to guarantee a minimum daily water supply, paradoxically transformed into a consumption cap. This policy disproportionately affected low-income, predominantly Black and 'coloured' households, where financial constraints often meant exceeding the quota due to larger family sizes or infrastructure issues like leaks, leading to accrued debts and targeted restrictions (Enqvist & Ziervogel, 2019; Bigger & Millington, 2020; Millington & Scheba, 2021). This approach failed to consider the broader context of historical and ongoing racial

[41] For more details on the negative experience with water management devices in Cape Town, refer to Mahlanza et al. (2016), Enqvist & Ziervogel (2019), Bigger & Millington (2020, 2023), Scheba et al. (2021), Millington & Scheba (2021), and Scheba (2022).

injustices, where these communities are frequently situated in areas with inadequate infrastructure and economic disparities. Instead of addressing these deep-seated inequalities, the quota system reinforced them, reflecting a significant oversight in the application of distributive justice within the framework of climate justice (Environmental Monitoring Group, n.d.).

The issuance of the municipal green bond in Cape Town directed significant amount of proceeds into water management devices, ostensibly as a measure of climate adaptation. This financial strategy redistributed fiscal responsibilities for adaptive climate policies in a way that bond investors on the Johannesburg Stock Exchange profited, tax payers in Cape Town were burdened with a USD 75 million municipal green debt plus interest over ten years until 2027 (see figure 15 below), and low-income families were the most affected by the measures implemented of water restrictions.

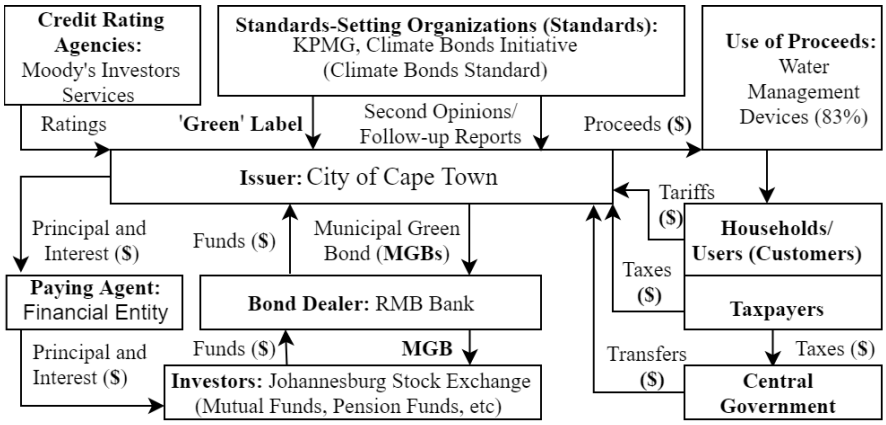

Figure 15. Capital Circulation in the Cape Town Municipal Green Bond. Source: Author.

The water restriction program financed by Cape Town's municipal green bond resulted in a significant, inequitable redistribution of water resources. By imposing uniform water management devices across diverse low-income households, the program inadvertently exacerbated existing inequalities and reinforced the city's long-standing patterns of racial and economic segregation (Scheba et al., 2021). This approach highlights the need for more nuanced and just water distribution policies that truly recognize and address the specific needs and climate vulnerabilities within these communities. The water management devices program in Cape Town led to adverse effects on the distribution of drinking water. These effects varied significantly at least under two circumstances, based on household size and the specific health conditions or ages of its members, as explained next.

First, some households faced inadequate water quotas due to discrepancies between the officially recorded and actual numbers of residents, a situation exacerbated by a housing

shortage that led to multiple families residing within a single social housing unit (Environmental Monitoring Group, n.d.). This was particularly common in 'backyarders', where additional families live in the courtyard of a primary housing unit (see figure 16) (Mahlanza, Ziervogel & Scott, 2016) (See more information on 'destitute' households by neighborhood in Cape Town, 2013). These circumstances often affected communities in neighborhoods like Khayelitsha, Mitchells Plain, and Dunoon, where housing density is high and social housing configurations are complex (Mahlanza, Ziervogel, & Scott, 2016). A resident of Mitchells Plain highlighted the issue, stating, "*They know another family lives here. And inside that house, there are 2 or 3 other houses living there*" (Water activist interview, November, 24, 2022). A water activist from Khayelitsha described the struggle with restricted water access: "*We just don't know how to survive on that small amount of water, and I remember in 2017 our water was cut off while I was staying here in Khayelitsha. They cut off our water between 30 and 50 liters a day.*" (Water activist interview, October 08, 2022).

Secondly, the water quotas allocated proved insufficient for households with members needing special considerations, such as those with health conditions, the elderly, or minors. A water activist from Dunoon noted the particularly harsh impacts on vulnerable populations, stating, "*The elderly or people with health problems sometimes don't even have a glass of water to take their medicine with. And children are affected too; they miss school because they can't wash and are told, 'No, you can't go to school without washing*'" (Water activist interview, November 17, 2022). This quote illustrates the daily challenges faced by these households, where even basic necessities like water for medication or hygiene are not reliably accessible.

The impacts of the water management devices program on low-income households produced significant community resistance from the beginning (Scheba et al., 2021; Environmental Monitoring Group, n.d.). A water activist in Cape Town described how "*workers took their lunch break to join the strike against the water management devices... people effectively resisted.*" (Water activist interview, November 24, 2022). By 2021, this community opposition resulted in the cancellation of the program, after years of resistance to the restrictions it imposed on water access. Subsequently, the water management devices were reverted to function as standard water meters (City of Cape Town, n.d.).

Figure 16. ‘Backyarders’ in the Western Cape Province, near Cape Town, 2022. Source: Author.

7.6 The Narrative Around the Cape Town Municipal Green Bond

The Cape Town Government framed its municipal green bond issuance as a pivotal part of its strategy for adapting to climate change, particularly in response to the drought from 2015 to 2018 and the imminent threat of *Day Zero*, which could have led to widespread water shutdowns. Daniel Sullivan, the director of Cape Town's Strategic Policy Division and a key figure in the municipal green bond issuance, emphasized the symbolic value of the bond: “*We aimed to showcase our commitment to sustainability, and the green bond was an effective tool for demonstrating our green credentials. It also enabled us to engage with a broader range of stakeholders than usual*” (Climate Bonds Initiative, 2017, minute 17).

Sullivan also highlighted the appeal of the municipal green bond as a financially stable investment, noting, “*Cape Town is generally seen as a stable investment within the South African context, and the addition of a green aspect enhances its attractiveness significantly*” (Climate Bond Initiative, 2017, minute 19). He further connected the issuance of the green bond to Cape Town's efforts to manage its water crisis, explaining that "*in the period when we issued the bond we had a major water crisis in Cape Town, so many of the projects were associated with many of the capital-intensive projects we were completing were related to water losses and reinforcing our water supply*” (Daring Cities, 2020, minute 46).

This narrative gained substantial momentum when the City of Cape Town was honored with the *Green Bond of the Year* award in the local authority category for its municipal green bond issuance, receiving considerable positive media attention within South Africa (Environmental Finance, 2018). Further recognition came when it secured the *Bronze Green award* in 2018 (Head, 2018). Cape Town Mayor Patricia de Lille highlighted the significance of this achievement, stating: *"[o]ur inaugural R1 billion Green Bond received a bronze green award (...). I am extremely proud of this milestone as it represents South Africa's first green bond issued to finance projects combating climate change. #cities4clima*" (de Lille [@PatriciaDeLille], 2018). Her statement features the narrative that equates climate finance with tangible climate action, despite concerns that the financed initiative restricted access to drinkable water for low-income, racially marginalized communities in Cape Town.

The narrative surrounding the municipal green bond during Cape Town's drought framed climate finance as directly equivalent to climate action, overshadowing the underlying climate and racial injustices perpetuated by racially biased water restrictions financed by the bond. This narrative promoted water management devices as efficient water-saving measures and crucial adaptations to climate change. However, this portrayal was contradicted by significant community antagonism, leading to the ultimate cancelation of the water management devices program in 2021 following communities' resistance (Scheba et al., 2021). This outcome highlighted the disconnect between the promoted narrative and the lived experiences of the affected communities.

The narrative equating climate finance with climate action, advanced through the issuance of green bonds, unfolds in two stages: the attainment of a green label for the municipal bond and the presentation of this labeled bond issuance as a benchmark for climate action. This narrative predominantly showcases the mobilized capital, adherence to green standards, and awards received in climate finance, while insufficient attention is given to the actual implementation of the financed projects or their impacts on communities. This narrative is actively constructed through media engagement, participation in relevant events, and the accumulation of green finance awards. The Cape Town government has effectively leveraged this approach, promoting its green bond issuance through press releases that garnered media coverage and highlighted its initiatives at various forums, culminating in awards such as the *Green Bond of the Year* and the *Green Bronze Award* (Environmental Finance, 2018; Head, 2018).

In conclusion, there is a clear dissonance between the narrative that equates climate finance with climate action through green bonds and the actual implementation of projects in Cape Town, a context marked by climate injustice. The municipal green bond experience in Cape

Town continues to be heralded as a success story and a benchmark for municipal climate finance both in the global North and South, promoted in platforms like the Cities Climate Finance Leadership Alliance, the World Economic Forum (Rai & Raizada, 2023), and the Florence School of Banking and Finance (Falchi, 2023). Despite such endorsements, critical issues remain inadequately addressed. Main among these is the obligation of Cape Town's taxpayers to service the bond's debt until 2027. This debt was incurred to fund water management devices that constituted 83% of the bond's proceeds and were intended to enforce water restrictions. This project not only perpetuated racial and environmental injustices but was also discontinued in 2021 due to community opposition (Scheba et al., 2021).

7.7 Conclusion: Financing Water Restrictions in 'Indigent' Households

Water, essential for hydration and sanitation, is a critical environmental element (UN Water, 2020). In Cape Town, the municipal green bond financed a water management devices program, which effectively conditioned water access on the financial status of households. From a perspective of distributive justice, this approach is particularly contentious within the backdrop of South Africa's historical socio-economic disparities and the legacy of apartheid. The program's imposition of restrictive water access measures disproportionately affected low-income, racially marginalized communities, further complicating the equity of water distribution in the city.

The water management devices program in Cape Town, initiated in 2007, was already under scrutiny for perpetuating injustices in water distribution before the introduction of the municipal green bond (Mahlanza et al., 2016). However, the financing through this bond not only continued but exacerbated these disparities by locking in funds that could have otherwise been used to explore fairer water distribution strategies. This situation persists throughout the 10-year duration of the bond, preventing the financing of more equitable water management solutions. The patent contrast between the bond's optimistic narrative and the harsh realities of its implementation underlines the need for a critical evaluation of green bonds within a climate justice framework, particularly in contexts marked by ongoing climate injustice. This evaluation is essential to ensure that financial instruments like green bonds do not merely continue past injustices under a facade of green.

The Cape Town case exemplifies how municipal green bonds can finance projects within contexts of climate injustice, potentially ingraining these inequities during the bond's repayment period. This is accentuated by a narrative that equates climate finance with climate action, which overlooks over the racial and environmental injustices linked to the financed

projects. Similar to the San Francisco case, Cape Town's use of green bonds has accumulated climate finance awards, raising concerns from a climate justice perspective. This instance not only echoes the misalignment between financial incentives and climate justice seen in San Francisco but also highlights a deeper issue: how financing and debt can exacerbate environmental racism under the guise of addressing climate change. This raises critical questions about the ethical implications of using green bonds in contexts loaded with historical and ongoing climate injustice.

Therefore, insights from this case suggest that when assessing municipal green bonds through a climate justice lens, it is essential to conduct a preliminary evaluation that examines whether the projects financed will actively address existing injustices within the context. Additionally, it is crucial to consider and recognize alternative, more equitable, and systemic approaches that could potentially redress long-standing disparities. This ensures that the financing does not merely perpetuate historical injustices but contributes meaningfully to their resolution.

		Climate Vulnerability Dimensions (Race and Income)
Climate Justice Pillars	Procedural Justice	-In 2017, Cape Town issue its first municipal green bond on the Johannesburg Stock Exchange. A significant portion of the proceeds (83%) was allocated to installing water management devices in low-income households, justified as a climate adaptation measure (KPMG, 2017). -The green labeling process for Cape Town's municipal bond did not incorporate explicit racial and climate justice criteria, despite the critical importance of these considerations in the post-apartheid context. - The project and its green label lacked meaningful participation and prior consent from the affected communities, who were not adequately informed about the program's implications. This exclusion led to community resistance and ultimately resulted in the project's cancellation in 2021 (Mahlanza et al., 2016; Scheba et al., 2021).
	Recognition	-Post-apartheid South African regulation recognized racial injustice; however, Cape Town's water management devices program failed to consider alternatives that address racial and income climate vulnerabilities. This program, which was justified by claims of excessive water use and leak neglect in low-income households, imposed restrictive measures that disproportionately impacted Black and 'Coloured' communities. -This program, financed by the municipal green bond, prioritized controlling perceived overconsumption without recognizing historical injustices, infrastructure deficiencies, or alternative solutions (Environmental Monitoring Group, n.d.).
	Distributive Justice	-In Cape Town, the water management devices program targeting low-income households, financed by the municipal green bond, failed to address the intersecting climate vulnerabilities of income and race. -The program disproportionately impacted low-income Black and 'Coloured' communities by imposing a water consumption ceiling rather than ensuring a minimum supply. -The program neglected the needs of larger households and individuals with specific health and age-related requirements, exacerbating existing injustices (Mahlanza et al., 2016). - This program overlooked the nuanced climate vulnerabilities of low-income households, reinforcing environmental racism and climate injustices instead of addressing them. -Community resistance against the program led to its cancellation in 2021 (Scheba et al., 2021).

Table 7. Application of the Climate Justice Framework to the Cape Town Municipal Green Bond. Source: Author.

CHAPTER 8. MEXICO CITY MUNICIPAL GREEN BOND: WATER REGULATION AMIDST CLIMATE INJUSTICE

8.1 Introduction

This chapter examines the municipal green bond issued by the Mexico City government in 2016, with 36% of the funds raised allocated to improving water infrastructure in response to the ongoing hydric challenges faced by certain areas of the city (Carbon Trust, 2018b). As in the previous empirical chapters, the analysis is conducted within the three pillars of climate justice as outlined by the IPCC (2023): procedural justice, recognition, and distributive justice. The chapter follows a tripartite structure: first, it reviews the green certification process of the bond; next, it assesses the implementation of key water infrastructure projects funded by the bond; and finally, it explores the narrative constructed around the bond's impact and significance.

This case is substantial because it introduces a Latin American perspective to the analysis on municipal green bonds, complementing the cases from Africa and the United States. It features the issue of environmental racism in water distribution, which, although present, is less visible compared to the other two cases. This chapter provides a thorough analysis of this phenomenon, prompting reflection on how to address the climate vulnerability dimension of race within urban climate finance in Latin America. Additionally, it emphasizes the importance of considering the gender dimension of climate vulnerability, raising critical questions about how to enhance its visibility in discussions surrounding green bonds.

The chapter draws inspiration from the work of Hilbrandt and Grubbauer (2020), who analyzed the efficacy of green standards in the context of municipal green bonds in Mexico City. They concluded that while the standards themselves have a minimal direct impact on project outcomes, the political and market structures they foster are significant. According to the authors, these structures facilitate green bonds' market expansion and their political support backing through activities such as technical assistance and event organization. However, the consolidation of the green municipal debt market and its sustained political support remain challenging and uncertain. This is particularly the case, as the authors note, given the limited actual effectiveness of municipal green bonds in addressing climate change adaptation and mitigation (Hilbrandt & Grubbauer, 2020).

Hilbrandt and Grubbauer's (2020) work serves as a critical reference for this chapter. This dissertation makes a novel contribution by applying a climate justice framework to examine the implications of Mexico City's 2016 green bond. Additionally, it contrasts these findings with municipal green bond cases in Cape Town and San Francisco. This juxtaposition and transversal analysis bridges experiences across the global South and North, enriching the discussion on the impact of municipal green bonds in urban contexts characterized by climate injustice. Furthermore, it extends the critical perspectives identified in existing academic work (e.g., Jones et al., 2020; Bigger & Millington, 2020; García-Lamarca & Ullström, 2020).

In 2016, Mexico City became a pioneer in Latin America by issuing the region's first municipal green bond, raising USD 53.28 million[42] (MXN one billion) [43] on the Mexican Stock Exchange. The bond proceeds were allocated to fund sustainable transport projects (58%), water infrastructure (36%), and energy efficiency initiatives (6%), as reported by Carbon Trust (2018b). A significant portion of the funds was directed towards water infrastructure improvements. Specifically, USD 8 million (MXN 136.86 million)[44] was allocated to the Vicente Guerrero Regulatory Infrastructure, designed for floodwater management, while USD 5.4 million (MXN 92.71 million) [45] was directed to the Selene water treatment plant, which focuses on purifying groundwater. [46]

The Vicente Guerrero Regulatory Infrastructure in the Iztapalapa borough and the Selene water treatment plant in the Tláhuac borough are both located in the eastern part of Mexico City. These areas are known for high concentrations of low-income households and limited access to drinking water (e.g., Beane, 2015; Gonzalez Quintero, 2017; [47] Montero, 2020), marking them as contexts of climate injustice. This chapter specifically focuses on these two projects because of their significant role in proceeds allocation and their critical functions within Mexico City's hydrosocial water cycle, a concept that describes the interdependent transformation of water and society through space and time (Linton & Budds, 2014). The Selene plant is involved in the initial stages of the hydrosocial cycle, focusing on the filtration of groundwater, while the

[42]Approximate amount for the year in which the bond was issued, based on the average exchange rate according to information from the central bank.
[43] The 2016 Mexico City municipal green bond, identified as GCDMXCB16V, was issued on December 9, 2016, with a maturity of five years, a coupon (interest rate) of 6.02%, an oversubscription of 2.5 times, acting on HSBC bank as placement agent. (Climate Policy Initiative, 2023). More information about the emission process is available at Climate Policy Initiative (2023).
[44]Converted to USD on August 14, 2023.
[45]Converted to USD on August 14, 2023.
[46] The Vicente Guerrero water infrastructure project was publicly announced in January 2015, predating the issuance of the green bond in 2016 (Obras, 2015).
[47] This represents an example of local literature analyzing the local context from a justice perspective.

Vicente Guerrero infrastructure plays a key role in managing floodwaters towards the end of the cycle (see figure 24). This dual focus highlights the projects' integral roles in shaping the socio-natural dynamics of water management in the city.

8.2 Pillar of Procedural Justice: Challenges in Information Accessibility and Community Participation

In 2016, the Mexico City government produced a green bond framework document aimed at financing environmental and climate action projects across the city (Sustainalytics, 2016). The framework was developed in accordance with the voluntary standards set by the Green Bond Principles of the International Capital Market Association (ICMA), which are organized around four core pillars: the use of proceeds, the project selection and evaluation process, the management of proceeds, and the generation of follow-up reports (ICMA, 2016).

The projects that were identified as green and thus designated for funding via the proceeds of the bond included sustainable transportation initiatives, such as investments in mass transportation systems, and energy efficiency projects, like the installation and maintenance of LED lighting in public areas. A significant portion of the financing was directed towards water management, where the allocated resources supported the construction and maintenance of floodwater regulation and water treatment facilities. According to the investors' prospect, these infrastructures would enhance the water quality in Mexico City by reducing losses and improving the overall quality of available water (Sustainalytics, 2016).

The Mexico City government hired the international consultant Sustainalytics[48] to assess whether the municipal green bond framework aligned with the Green Bond Principles. In their evaluation, Sustainalytics scrutinized aspects such as project selection, the transparency of financial management, and the effectiveness of results indicators. This analysis provided a critical second opinion on the bond proposal, affirming that the framework was "robust, credible, and transparent," though it also noted that its evaluation served merely as an advisory tool, leaving the responsibilities for implementation and monitoring to the Mexico City government (Sustainalytics, 2016, p 10). Subsequently, a year after the bond's issuance, another international consulting firm, Carbon Trust, was hired to conduct a follow-up analysis. This report confirmed that the proceeds raised through the bond were indeed allocated effectively to

[48] Sustainalytics (n.d.) describes itself as a firm that "*provides high-quality, analytical environmental, social and governance (ESG) research, ratings and data to institutional investors and companies.*"

projects that yielded verifiable positive environmental and climate impacts (Carbon Trust, 2017).

Carbon Trust conducted an examination of the public and official information regarding the municipal green bond issued by Mexico City and determined that "*the resources of the 2016 Green Bond are traceable and were intended to finance projects with environmental and climate impact*" (Carbon Trust, 2017, p 5). To assess the impact of the groundwater and floodwater management projects financed by the bond, annual quantitative indicators were employed. These indicators included the number of people benefited and the volume of water managed or improved, measured in cubic meters (Carbon Trust, 2017). In its subsequent monitoring report in 2018, Carbon Trust elaborated on the specific quantitative criteria used to measure the positive impact of the water infrastructure projects financed by the green bond. The criteria are two-fold: firstly, the number of people who benefited from the projects, which reflects the direct human impact and enhancement in community services; secondly, the quantity of water, measured in cubic meters, which indicates the scale of environmental impact through improved water management and infrastructure efficiency (Carbon Trust, 2018b). As explained in the follow-up report:

> "*DRINKING WATER MANAGEMENT*
>
> *NUMBER OF PEOPLE BENEFITED*
>
> *The number of people benefiting is an estimate made by SACMEX [Mexico City Water Company] based on the volume of drinking water generated by the project per day, considering an average consumption per person of 250 liters per day.*
>
> *DRINKING WATER VOLUME (M3)*
>
> *Measurement provided by SACMEX based on the installed capacity of the water treatment plant or the constructed well*." (Carbon Trust, 2018b, p 11).

The follow-up report provided detailed evaluations of both the Vicente Guerrero project and the Selene water treatment plan. In particular, it stresses that the former consists in an infrastructure with the capacity of 90,000 cubic meters and to serve approximately 145,000 residents of the Iztapalapa borough, and that, the Selene water treatment plant has a capacity of 120 liters per second and can produce 10,368 cubic meters of potable water daily, for the benefit of 41,472 individuals primarily in the Tláhuac borough (Carbon Trust, 2018b). Figure 18 below illustrates these quantitative results, as measured by Carbon Trust (2018b).

A continuación, se presentan los resultados de cada proyecto por categoría[8]:

ADMINISTRACIÓN DE AGUA Y AGUAS RESIDUALES

Núm. Registro	Nombre del Proyecto	Solución tecnológica	Tiempo de vida del proyecto	Capacidad Instalada (l/s)	Volumen de agua potable (m³/dia)	Número de Beneficiados
159010010	Construcción de la planta de bombeo y laguna de regulación con capacidad de 90,000 m3 en la U.H. Vicente Guerrero.	Planta de bombeo (5 m³/s) Laguna de regulación (90,000 m³)	30 años	No Aplica	No Aplica	145,000
159010011	Proyecto Integral de construcción de la Planta Potabilizadora Selene, en la Delegación Tláhuac.	Planta potabilizadora	15 años	120	10,368	41,472

Figure 18. Screenshot of the Follow-Up Report on the Municipal Green Bond Source: Carbon Trust (2018b).

As it is evident, the Carbon Trust's report elucidates the positive environmental outcomes of the water infrastructure projects financed by the municipal green bond through two key quantitative indicators: the volume of water processed and the number of local residents impacted (Carbon Trust, 2017). Additionally, the report emphasizes the socio-economic context of these projects, noting briefly their implementation in neighborhoods "*with a high index of vulnerability, and where the water resource is precarious and deficient, making it necessary to rehabilitate or replace drainage systems, pipes and drinking water plants*." (Carbon Trust, 2017, p 27). Likewise, the follow-up report affirms the traceability of the municipal green bond proceeds, confirming their allocation to projects that not only address environmental benefits but also yield tangible climate action results (Carbon Trust, 2017).

Once gathered, the green labeling documentation was made publicly accessible online (refer to table 8). However, it appears evident from the examined documents from Sustainalytics (2016) and Carbon Trust (2016, 2018) that they did not address the provision of participatory opportunities for communities to engage effectively during the process of assessment, nor to access information in comprehensible and pertinent formats, or to express their approval or objections to the proposed projects. Additionally, there is a notable absence of any mechanisms allowing community members to offer insights on project design and implementation or to influence strategies for the equitable distribution of environmental (water-related) and financial impacts and benefits. The positive or negative nature of the projects, their quantitative assessment and their realization were all defined on the basis of a stand point that was external to that of the community.

The public authority and the consultants looked at the needs and solutions through their lenses, and the municipal green bonds and the two infrastructures were promoted. As explained by Scott (2020), modernization projects implemented by states with the goal of positively transforming society can often fall into the trap of oversimplification and abstract models of social organization that overlook the complexities of human behavior and environmental conditions. This frequently leads to negative consequences, social resistance, and the failure of these projects, which makes Scott (2020) recommend a more participatory approach that values local knowledge and practices. Mexico City's municipal green bond can thus be read through the lenses of what happens when a state, intermediaries, and investors look at climate action through climate finance lens rather than (also) through the complexity and needs of the territories and its inhabitants.

In order to adopt a vocabulary that was easily legible by the government officers and the potential investors, the green labeling process for Mexico City's municipal bonds primarily focused on quantitative indicators such as the number of residents in the projects vicinity and the volume of water stored or filtered (Sustainalytics, 2016; Carbon Trust, 2017; 2018). Although this approach made the investment rational and easily adaptable to the needs of the issuer and the buyer, it overlooked critical dimensions of climate vulnerability, such as income, gender, and race, which are significant for the communities affected by the projects financed by the bond. As in the previous cases already analyzed, the lack of attention to these dimensions of climate vulnerability points to a crucial gap in addressing the broader impacts of climate finance and to the need for a more inclusive approach, which is further elaborated in the subsequent section on recognition.

Document[49]	**Year**	**Author**
Reference framework of the Mexico City green bond. Sustainalytics Second Opinion.	2016	Sustainalytics
Monitoring and evaluation of the issuance of the 2016 green bond of Mexico City. First follow-up report.	2017	Carbon Trust
Monitoring and evaluation of the 2016 green bond issuance of Mexico City. Second follow-up report.	2018	
Evaluation of the 2018 green bond of Mexico City. Second Opinion.	2018	

Table 8. Documentation Reviewed for the Mexico City Municipal Green Bond. Source: Author.

[49]All in Spanish and consulted on April 1, 2024; links available in the references at the end.

8.3 Pillar of Recognition: Non-Recognition of the Climate Vulnerability Dimensions of Income, Race, and Gender

One of the ways in which the recognition pillar of the climate justice has been interpreted stresses the importance of acknowledging and integrating a diverse array of actors, perspectives, and values in climate action initiatives (IPCC, 2023). From the textual analysis and the engagement with key actors, it appears evident that the green labeling of the Vicente Guerrero and Selene water projects, located in the Iztapalapa and Tláhuac boroughs, did not integrate evaluation and monitoring criteria that adequately considered race, gender, and income. Nor did the realization of the two projects. This despite the fact, as explained hereafter, that these boroughs are home to significant populations of low-income households, women, indigenous people, and Afro-Mexicans. These dimensions of vulnerability can intersect within individual lives and households, making a nuanced approach essential for effective climate action.

According to the 2020 Mexican National Census, Mexico City has a population of 9,209,944, with 186,914 people self-identifying as Afro-Mexican (approximately 2%) and 289,139 belonging to indigenous households (INEGI, 2021). Iztapalapa, the most populous borough of Mexico City, hosts the largest number of Afro-Mexicans (33,313) and indigenous language speakers (28,716) in the city. The Tláhuac delegation, though smaller, still has significant numbers of these groups, with 7,289 Afro-Mexicans and 4,826 indigenous language speakers (INEGI, 2021). However, these demographic figures are likely underestimated. The discrimination against darker-skinned populations, both Indigenous and Afro-Mexican, may compel individuals to identify with other, less stigmatized racial categories (Torre Cantalapiedra, 2019; Cohen, 2020 cited in Hoffman et al., 2024). This misrepresentation in data collection underlines the need for project evaluations that are sensitive to the actual demographic makeup and vulnerabilities of the project areas, ensuring that all community members' needs and rights are considered in climate adaptation strategies.

It can thus be concluded, that the boroughs where the municipal green bond financed projects were implemented, have a relevant presence of Afro-Mexicans and Indigenous groups. Several academic accounts exist that highlight how these populations often face underrepresentation due to the prevailing ideology of ‘mestizaje’, which promotes a mixed-race identity while frequently obscuring underlying racial discrimination (Torre Cantalapiedra, 2019; Cohen, 2020 cited in Hoffman et al., 2024). The Green Bond Principles, which guide the standards of the municipal green bond, emphasize transparency and environmental integrity but fail to

incorporate considerations of racial justice (Hoffman et al., 2024). However, the evaluation of the impact of the green bond did not account for any racial disparities in access to water resources, nor addressed the pervasive effects of structural discrimination.

A resident of Iztapalapa shared her perception of this phenomenon, highlighting how discrimination based on phenotype intersects with discrimination related to cultural practices and ethnic origin, making it a complex and intersectional issue:

> "*Yes, there is racism, I say there is, though not as pronounced as in other countries. (...) And I believe it is much more among ourselves, towards our indigenous people. For example, someone might say, 'I don't even understand how he speaks his dialect,' and then, 'He doesn't even have shoes,' and then, 'Look at how he dresses.' I would say that this is indeed the case.*" (Household member interview, March 14, 2022).

The Imperative of the Recognition of Gender-based Climate Vulnerability in Green Labeling and Implementation

One aspect that drew the author attention when engaging with the material implications of the municipal green bonds in the community, was the way in which the bond intervened in a context where gender-based climate vulnerability intersects with race and income climate vulnerabilities. Such analysis, completely overlooked in the preparatory documents and the reports that followed the bond (see table 8) is closely linked with the intersectional and multi-layered understanding of climate justice that is used in this dissertation, and offers a clear example of the way in which financial and policy perspectives may converge and at the same time depart from the reality and the needs on the ground.

The complex interconnection between financial mechanisms and water distribution in Mexico City is highlighted by the unfair allocation of water resources across different neighborhoods (see map in figure 23), as well as the unrecognized and uncompensated water-related labor predominantly undertaken by Women. This labor disparity leads to what UN Women (2020) terms *time poverty*, where the extensive burden of unpaid domestic and caregiving responsibilities significantly diminishes women's time for paid employment, formal education, personal care, and rest. This situation not only limits women's economic opportunities and adversely impacts their health but also perpetuates gender inequalities (Hyde, Greene, & Darmstadt, 2020).

Although the inequitable distribution of water in Mexico City disproportionately impacts women throughout the city, this is particularly the case in neighborhoods like those in the Iztapalapa borough where water access is intermittent (see map in figure 23). In these areas, it is predominantly women who are burdened with the additional responsibilities of carrying, storing, filtering, and recycling water, a significant time commitment that detracts from other potential activities (Household member interview, March 14, 2022; Water activist interview, March 3, 2022). Delving further into the repercussions of this issue, a water activist highlighted the broader socio-economic impacts: "*Women end up dedicating more time and even spending money to secure water supply, time that could otherwise be used to generate additional income or pursue educational opportunities*" (Water activist interview, March 3, 2022). This scenario stresses the need for targeted interventions that not only address the physical infrastructure of water supply but also consider the social dynamics that burden women disproportionately. Recognizing and alleviating this burden could lead to more just outcomes and empower women within these communities.

In Iztapalapa, water access is notably unreliable; tap water flows intermittently, and water delivery from trucks is inconsistent. Women frequently spend several hours each day waiting for water to emerge from the taps or seeking water trucks to fill their domestic water tanks ("tinacos," in Spanish) a common sight in the urban landscape (see pictures in figures 19 and 20 below).

> "*When the City Government sends water trucks, it is still a waste of time between calling, managing, waiting, the time spent filling the cistern, or distributing the water among neighbors, because sometimes they send one truck for several blocks, carrying buckets. All of that is time spent just to bring water home, when that time could be used by women to generate another source of income, to study, to engage in important activities*" (Water activist interview, March 3, 2022).

When water is available, it often arrives with insufficient pressure, requiring patience to fill storage tanks (Montero, 2020, p 317). Additionally, the water quality is frequently substandard, necessitating further efforts to filter or boil it before use. The significant amount of time and labor that women invest in collecting and managing water is neither acknowledged as an economic activity by governmental entities nor recognized as a disproportionate burden placed upon them. Yet, this labor is essential for sustaining the hydrosocial cycle and underpins the

broader economy of Mexico City. Addressing this issue requires policy interventions that recognize the economic value of domestic water management and implement measures to alleviate this injustice, thereby supporting the overall well-being of women in these communities.

Figure 19. Water Tanks ("*Tinacos"* in Spanish) in Iztapalapa. Source: Author.

Figure 20. Water Truck with the Inscription: "The Truck is Free, Water is your Right" ("La Pipa es Gratuita el Agua es tu Derecho" in Spanish). Source: Author.

Despite the critical implications of time poverty of women, they are largely overlooked within the realm of social policy in Latin America, pointing to a pressing need for more focused and comprehensive attention (Gammage, 2010). Addressing these disparities requires integrating gender perspectives into policy frameworks to ensure that water distribution and financial policies do not further entrench gender-based disadvantages and climate vulnerability but rather promote gender equity and recognition of all forms of labor.

The following is an extensive quotation from a policy expert interview, illustrating the intersection between income, race, and gender in the context of Mexico City and the adaptation to climate change, particularly in terms of water management.[50]

> "*Mexico City and in general the entire country has a historical debt with the most vulnerable people. All the urbanization policies that have been made in Mexico City have always been about relegating the poorest people to the periphery. And above all*

[50] While the detailed complexities of race and ethnicity extend beyond the scope of this dissertation, they represent a relevant avenue for future research within a climate justice framework for climate adaptation.

here in Mexico City two things are combined, on the one hand the issue of racism and classism. That is, the people with the lowest income are those who also have the same skin tone, and are generally people who are of indigenous descent or "coppery" [Darker-skinned]. So, these people are expelled from the city by gentrification processes, or they arrive as migrants and settle in the periphery, and then for twelve years they try to belong to the city and then they have to negotiate with politicians for the implementation of services, and in this case it would be the water service. And now we also have another layer of information that would be how this type of population functions on a social level, and as you well know, there is also the issue of machismo. So in the end there are processes where help is given, non-governmental organizations help people to be able to settle and to bring their housing conditions to adequate housing and in the end the woman of this family unit is the one who participates the most in the process of regularization of this home and in the end it decides that the person who has to have the name on the property title is the man, due to a matter of machismo. So they are vulnerable not only from the outside at the government level, (sic) but also from the inside and there is their own condition that is repeated. So it's quite complex. (…)" (Policy expert interview, March 04, 2022).

As other climate-related vulnerabilities in San Francisco and Cape Town, the criticality of gender-based climate vulnerability was not recognized in the green labeling process associated with the municipal green bond. Moreover, the gender dimension was overlooked in the subsequent follow-up reports produced by the consulting firm Carbon Trust (2017, 2018). This oversight stresses a significant gap in green-labeled bonds in addressing the intersection of gender with other climate vulnerability dimensions such income or race. Recognizing and integrating gender-specific impacts and labor contributions in project planning, execution, and reporting are crucial for achieving comprehensive climate justice and enhancing the effectiveness of climate finance instruments. These oversights in recognizing the dimensions of climate vulnerability related to race, gender, and income also manifest in the unjust distribution of water-related benefits and harms in Mexico City, which will be further discussed in the subsequent point on the pillar of distributive justice.

8.4 Pillar of Distributive Justice: Floodwater and Groundwater

This section first examines the circulation and distribution of capital initiated by the municipal green bond issued by Mexico City in 2016 through the lenses of distributive justice, in particular with regards to the allocation of positive and negative impacts (financial and non-financial)

across different constituencies. Using the same idea of *circulation* it then moves from the financial realm to the material realm of water, and examines the circulation and distribution of water within the city, providing a detailed exploration of the consequences linked to the realization of the *green infrastructure*. This dual analysis is crucial for understanding the intersecting financial and environmental dimensions of distributive justice. It assesses not only how resources are allocated but also who ultimately benefits from or bears the cost of such allocations. The examination of these cycles highlights the broader implications of municipal green bonds and the essential role of fair distributions of material and immaterial elements in making sure that climate change mitigation and adaptation align with the principles of climate justice.

The Capital Circulation Cycle in Connection with the Water Hydrosocial Cycle

The issuance of the Mexico City municipal green bond in 2016 facilitated a specific flow of financial resources between the issuer (the Government of Mexico City) and its national and international creditors. This bond was issued on the Mexican Stock Exchange with a value of one billion MXN, equivalent to USD 53 million.[51] It has a maturity of five years and an annual interest rate of 6.02%, with HSBC acting as the intermediary. Of the total amount, 36% was allocated to water infrastructure (Carbon Trust, 2017; Climate Policy Initiative, 2023). The financial arrangement concluded with the support of international consultancy firms Sustainalytics and Carbon Trust, involved the usual financial elements associated with a bond, with the addition of the designation of the use of the proceeds for a series of infrastructural projects that were defined as green and therefore created a biunivocal relationship with the bond: the bond was green because of the infrastructures that were selected, which would be funded as a consequence of the issuance of a green bond. As a result, the municipal green bond created a nexus between the Government of Mexico City, the financial markets, and the city's hydrosocial water cycle (see figure 23).

The financing mechanism establishes an indissoluble link between the immaterial realm of financial structures, the actors involved, and the material realities of climate action, as illustrated by the capital and hydrosocial cycles in figures 21 and 22. In practice, to promote climate adaptation, bond purchasers earn interest on their investment by imposing a financial obligation on the municipality to service the debt incurred from the bond over a five-year period

[51] See table 3 for further details.

(Carbon Trust, 2018b). Meanwhile, bond dealers generate profit by facilitating the placement and purchase of the bond within the financial market.

Differently from cases where the underlying infrastructure pays for the principal and the interests, in the case of Mexico City the underlying agreement would produce a connection between the fiscal policies of the municipality (tax imposition and the use of public revenues), private profit and environmental initiatives within the urban infrastructure framework. Public policies, financial decisions, and climate outcomes are kept together by the municipal green bond. On the side, and often invisible, there are the community impacts.

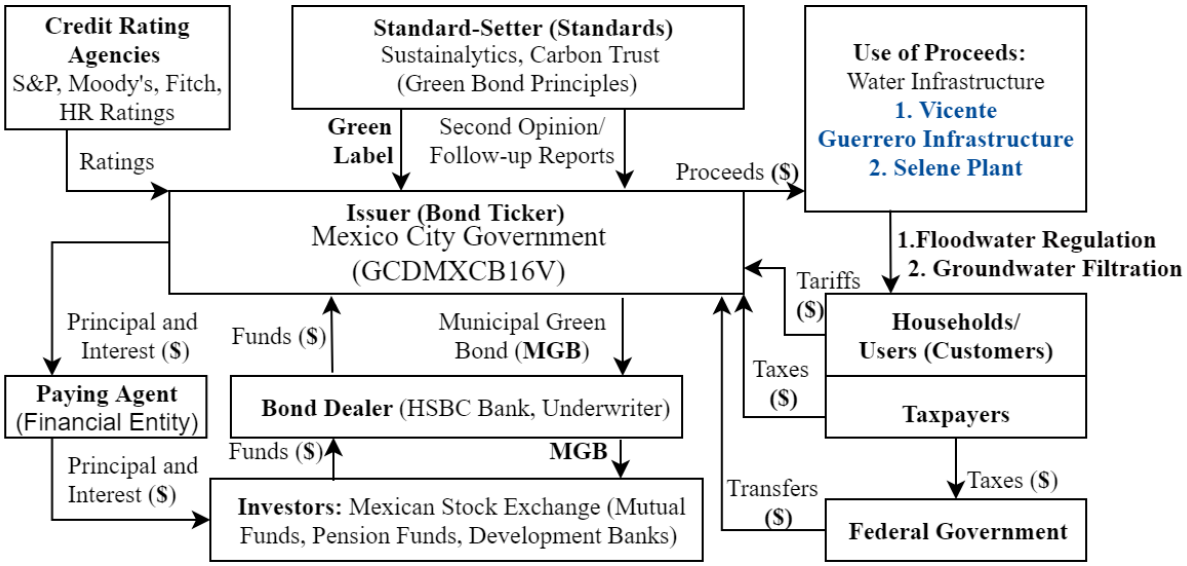

Figure 21. Interrelation of Capital and Water Circulation through Mexico City's Municipal Green Bond. Source: Author, Partially Based on O'Hara (2012).

To provide a systemic analysis of the distribution of financial and environmental burdens related to the municipal green bond in Mexico City, it is crucial to consider the spatial distribution of access to water within the city and the way in which the service is provided. Given that the public water service in Mexico City is heavily subsidized, water rates are not typically raised to service the municipal green debt, nor is service generally discontinued for non-payment (Morales-Novelo et al., 2018). As articulated by a resident of Iztapalapa: "*Water service has never been cut off for me or for anyone I know.*" (Household member interview, March 14, 2022). Consequently, access to water is predominantly determined by geographical location, with central areas typically having better access compared to more peripheral areas, which often correspond to lower-income neighborhoods (see map in figure 23).

As illustrated in the map in figure 23, the reflection on the municipal bonds and the projects located in the peripheral boroughs of Iztapalapa and Tláhuac cannot be dissociated by the consideration of the low-income background of most of the communities living in these areas. This spatial and economic context is critical for understanding the distribution of financial and environmental benefits and harms that arose by the combination between the municipal bond and the realization of the infrastructures. In particular, by tracing the hydrosocial cycle of water throughout the city (see figures 21 and 22) and by acknowledging how infrastructural investments were financed, it is possible to define whether the latter exacerbated or alleviated disparities in water access and associated financial burdens across different community actors.

The Water Hydrosocial Cycle in Connection with the Capital Circulation Cycle

The hydrosocial cycle in Mexico City is an intricate process that begins with the collection of water from diverse sources. Approximately 29.32% of the city's water is sourced from the Cutzamala dam system, which diverts water from reservoirs located to the west. Another 13.68% is derived from the Lerma system, drawing water from wells beyond the city's boundaries. Significantly, 54.07% of Mexico City's water supply is extracted from its own overexploited aquifers (SACMEX, n.d., cited in Caracheo Miguel, 2021). Following collection, the distribution of water manifests through various channels such as pipelines, water trucks, bottled water, and, to a lesser extent, systems for harvesting rainwater. These distribution methods are supported by a mix of public and private initiatives, reflecting the city's complex infrastructure for managing water. The cycle completes with water being discharged into the drainage system, complemented by natural processes of evaporation and infiltration. This sequence and its components are depicted in figure 22 below, illustrating the comprehensive flow of water through urban infrastructure and natural processes within the city.

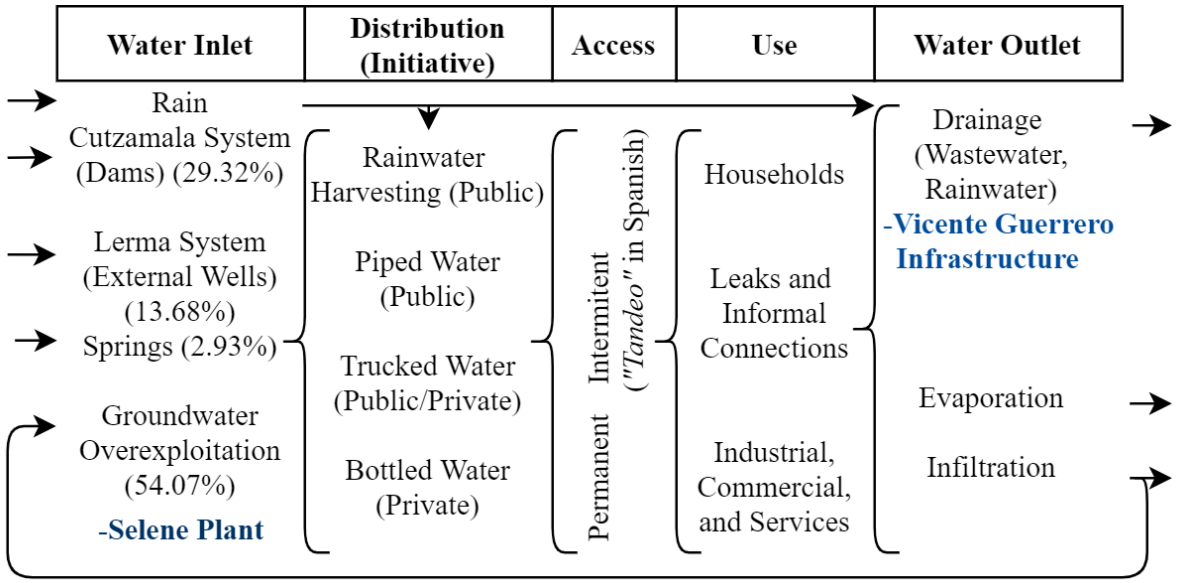

Figure 22. Hydrosocial Cycle of Mexico City and Water Infrastructure Associated with the Municipal Green Bond. Source: Author.

The hydrosocial cycle in Mexico City is characterized by three interconnected structural issues that are critical to understanding the challenges faced by the city: intermittent access to water, leading to scarcity; urban flooding, indicative of excess; and the gradual collapse of the surface, a consequence of groundwater overexploitation. These enduring problems are deeply rooted in the city's historical and spatial water configuration, which dates back to colonial times. Originally, the Spanish settlers initiated the draining of lake areas to establish what are now modern neighborhoods, fundamentally altering the natural landscape (Candiani, 2014; Vitz, 2018). These structural issues are further aggravated by the ongoing climate crisis, which exacerbates water shortages during dry seasons and increases water surpluses in rainy seasons, highlighting the city's vulnerability to fluctuating climate conditions. This complex interplay of historical manipulation of natural water systems and contemporary environmental challenges underlines the urgent need for integrated water management strategies that address both the legacies of injustice of the past and the climate pressing issues of the future.

Structural issues within the hydrosocial cycle of Mexico City significantly influence the distribution of water, impacting both spatial and temporal dimensions for its residents. Water distribution, along with its associated benefits and challenges, is intricately linked to the geographic location of households relative to water sources. Higher-income boroughs in the central-west part of the city, such as Benito Juárez and Miguel Hidalgo, which are closer to the Lerma-Cutzamala system, enjoy consistent access to water. Conversely, low-income areas on

the city's periphery, notably the Iztapalapa and Tláhuac boroughs, where the projects financed by the municipal green bond are located, experience intermittent and often inadequate water supply, as depicted in figure 23 below.

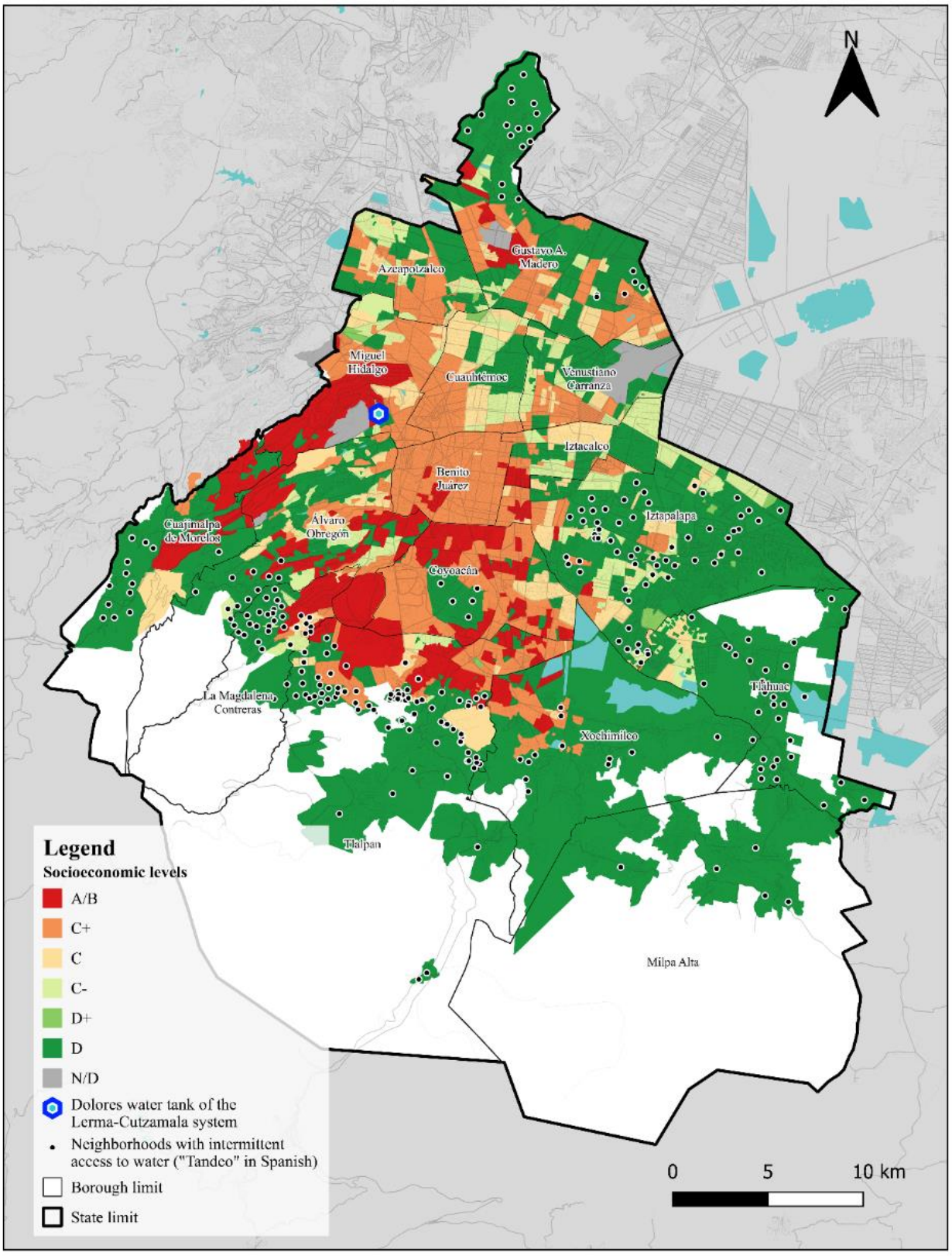

Figure 23. Distribution of Neighborhoods In Mexico City by Socioeconomic Levels and Intermittent Water Access (“Tandeo” in Spanish). Concept: Author. Mapping: Diana Carolina Salazar Galindo.

This geographic disparity manifests in significant consumption inequalities: households in the highest income quintile consume more than 42% of the city's subsidized drinking water, which is six times the amount utilized by the lowest income quintile, who use approximately 7% (Morales-Novelo, Rodríguez-Tapia, and Revollo-Fernández, 2018). Such disparities highlight the need for targeted policies that address not only the physical infrastructure but also the socioeconomic factors that exacerbate water access inequalities in Mexico City.

Residents of low-income neighborhoods in Mexico City, such as those in Iztapalapa and Tláhuac, face significant economic burdens as they are compelled to allocate additional financial resources to secure water from alternative sources like bottled and trucked water due to the intermittent availability of tap water (Wunderlich et al., 2021) (see pictures in figures 24 and 25 below). These areas are not only challenged by water scarcity but also endure heightened vulnerability to environmental hazards. Specifically, they are more susceptible to major flooding events (Mac Gregor-Gaona et al., 2021) and surface collapse triggered by the overexploitation of groundwater (Cigna & Tapete, 2021; Sosa Rodríguez, 2010).

Figure 24. Automated Distribution Point of Water. Source: Author.

Figure 25. Bottled Water Business in Iztapalapa. Source: Author.

The eastern region of the city, which includes these neighborhoods, stands as the epicenter of the impacts stemming from this unjust distribution of water and space. This ongoing struggle

is highlighted in the words of a female member of household from Iztapalapa during an interview: "*Iztapalapa has always been characterized by the fight for water. Here, the struggle isn't for land or other material things; it's for water*" (Household member interview, February 22, 2022).[52] This statement features the critical nature of water as a fundamental and contested element within these communities, illustrating the profound socio-economic and environmental challenges they face daily.

At first glance, the financing of the Vicente Guerrero infrastructure and the Selene plant located in low-income boroughs, might seem like beneficial initiatives for climate change adaptation and climate justice. However, the issuance of this bond created a debt relationship between the financial markets and the Government of Mexico City, linking the city's hydrosocial cycle to financial dependencies. Despite their potential, the two projects proved to be insufficient responses that merely deferred more comprehensive solutions. As a result, these interventions have perpetuated the existing patterns of climate injustice in water distribution within Mexico City. This continuation of the status quo underlines the need for a deeper examination of how such financial instruments are structured and implemented, ensuring they genuinely address and rectify the root causes of climate injustice in terms of water. The following analysis delves into these issues in greater detail.

In Iztapalapa, the Vicente Guerrero infrastructure plays a crucial role in the exit segment of the hydrosocial cycle by regulating floodwater. It stores floodwater in artificial lagoons, thereby alleviating flooding during the rainy season (Carbon Trust, 2018b). However, while it mitigates immediate flooding impacts, the construction of the infrastructure alone fails to address the underlying issue facing low-income households located in high-risk flood areas in the eastern part of the city (Mac Gregor-Gaona et al., 2021). Rather, the focus on flood control diverts attention from the need for more comprehensive solutions that tackle the recurrent nature of these floods. Effective long-term strategies could include implementing fairer urban planning practices that allocate residential areas in less flood-prone zones, establishing separate drainage systems for rainwater and wastewater to improve efficiency, and reducing the extent of paved surfaces that impede groundwater infiltration. These types of discussions are precisely the ones that can take place in effective participatory spaces, which are currently absent in the green labeling process of the municipal bond, as previously explained.

[52]All interview quotes from Mexico City are originally in Spanish.

Moreover, the green labeling process of the bond not only fell short in terms of participation and recognition, but it also overlooked the opportunity to recognize diverse perspectives on water management that account for and respond to climate vulnerabilities influenced by dimensions, such as income, race, and gender. This oversight highlights the necessity for a more inclusive approach in designing and implementing infrastructure projects that address the multifaceted nature of climate justice.

Likewise, the Selene plant in Tláhuac represents a key component of the entry segment of the hydrosocial cycle of Mexico City, functioning as a short-term and insufficient solution that contributes to the ongoing issues of groundwater overexploitation. By filtering groundwater for consumption, the plant aims at addressing immediate water scarcity but at the same time it intensifies the depletion of aquifers, which in turn leads to surface collapse above these aquifers (Ovando Shelley, 2018; Sosa-Rodríguez, 2010) (see figure 22). This process of groundwater overexploitation has significant implications, causing subsidence that adversely affects the local communities, particularly impacting the long-term viability of the environment for future generations in Tláhuac (Cigna & Tapete, 2021).

> "*It is estimated that over 457,000 properties and 1.5 million inhabitants of the Valley of Mexico Metropolitan Area (ZMVM) are in zones at high to very high surface faulting risk, mainly in Iztapalapa, Tláhuac, Chimalhuacán and Chalco.*" (Cigna & Tapete, 2021, p 112).

Moreover, similar to the Vicente Guerrero infrastructure, by focusing on groundwater extraction and filtration, the Selene plant may inadvertently detract from pursuing more comprehensive and sustainable solutions to water distribution challenges. Such solutions might include developing alternative water sources, implementing water conservation and reuse strategies, and enhancing the regulatory framework to prevent over-extraction. These broader approaches are crucial for addressing the root causes of water scarcity and ensuring equitable and sustainable water management in Tláhuac. Additionally, the over-extraction of groundwater reduces future generations' adaptive options to climate change, particularly regarding the use of aquifers as a source of drinking water.

From the perspective of distributive justice, the two projects financed via the municipal green bond in Mexico City fell short of effectively addressing the critical challenge of fairly

redistributing water and spatial resources to mitigate flood risk, ensure adequate water access, and prevent surface collapse above aquifers. At the same time, the green label served to create a narrative of climate action, as explained below, which obscures the perpetuation of the local climate injustices previously mentioned.

Overall, the way in which the municipal green bond intervene in the redefinition of the financial and hydrosocial cycles of Mexico City illustrates an example of multiple climate injustices that arise from the convergence between the financial vision and the policy desire for funds, which creates simplistic understanding of the complexity of the reality on the ground and leaves significant elements outside of the picture. By promoting infrastructural solutions to climate change adaptation, the municipality of Mexico City could access the global arena of *green* and *sustainable* capital and raise funds. However, an approach based on identifying projects that can be funded by creditors may have perpetuated existing injustices and obscured the underlying climate injustices, all under the banner of a green label that suggests that climate considerations and climate responsibilities had been assessed. The frictions created by the territorialization of global capital via the municipal green bonds appear even more evident when we focus on the narrative that were deployed to communicate and define the financial operation.

8.5 Green Narrative Around the Municipal Green Bond of Mexico City

The actors involved in the issuance of the municipal green bond, including the Government of Mexico City and the standard setters, framed this financial instrument as a significant measure of climate action and as evidence of the city's commitment to environmental sustainability (Mancera, 2017; SEDEMA, 2018). The issuance of the municipal green bond in 2016 mostly generated positive publicity rather than mobilizing new financial resources or initiating previously unscheduled projects. In fact, this bond did not introduce any additional funding beyond what was already accessible through other debt instruments, questioning the validity of the claim that the municipal green bond had any specific role to play in the climate plan of the city. As a matter of facts, Mexico City had favorable credit ratings and extensive experience with regular municipal bond issuances and agreements with commercial and development banks (Secretary of Administration and Finance of Mexico City, 2018). The label may have not been the crucial element to guarantee access to finance, as evidenced by the fact that the Vicente Guerrero infrastructure project, financed by this bond, had already been publicly announced in January 2015, well before the green bond's issuance in 2016 (Obras, 2015). Given the role that narratives and communication play in promoting the expansion of these financial instruments

and the idea that private capital will fill the 'climate finance gap', the example of Mexico City suggests that more critically analysis is needed in order to better understand the role that the green label may have, or not, with regards to the production of additional financial and environmental impacts that would have not otherwise been achieved.

Despite the possible lack of financial and climate additionality, the narrative that the bond represented a key element of the city's climate action was actively promoted by the Mexico City government during and after the issuance of the municipal green bond. And reinforced by the international actors that populate the *green finance* arena. In 2017, under the leadership of Mayor Miguel Ángel Mancera, Mexico City was awarded the Environmental Finance's *Bond of the Year in the Municipal Category* for its 2016 issuance of the municipal green bond (Development Finance, 2017; Environmental Finance, 2017). This recognition highlighted the bond as the first of its kind in Latin America, setting a significant precedent and becoming a frequent reference point in subsequent discussions and documents related to green bonds (Climate Policy Initiative, 2023). In its intervention, Mayor Mancera emphasized the city's commitment to financing climate initiatives, stating, "*Innovation in financing climate action is a commitment that Mexico City has made, and in December 2016, we became the first city in Latin America to issue a green bond*" (C40, 2017, p 6). This statement reflects the city's strategic use of the bond as both a financial instrument and a tool for enhancing its environmental reputation.

Similarly, the then Treasury Secretary reinforced the narrative of success by putting the accent on the significant local reception of the municipal green bond. In his words:

> "*The public impact that the green bond had in the Mexican press, in the Mexican media was astonishing... We never had this type of press attention with regular bonds in Mexico City. It was like it was a celebrity. We were very surprised by the reception that the green bond received in the press*" (C40, 2017, minute 18:13).

In 2018, the Secretary of the Environment's YouTube channel published a promotional video about the municipal green bond, which garnered 267,431 views.[53] The video included the following statement:

[53] As of June 7, 2024.

> "*To promote environmentally friendly urban development projects, Mexico City needs a significant amount of money, which is why the green bond is a great ally... It was the first time a local government in Latin America issued a green bond, made possible because the city has solid and healthy finances and a portfolio of environmentally friendly projects*" (SEDEMA, 2018, minute 0:37).

This narrative highlights that the issuance of the municipal green bond was made feasible by the city's robust financial capacity and its lineup of ready-to-implement eco-friendly projects that would be aligned with the needs of the investors. In so doing, the Secretary of the Environment disclosed two of the intrinsic limits of municipal green bonds, which may make them less of a transformative tool for climate change mitigation and adaptation: the importance of a strong credit scoring when accessing international debt and the need to identify projects that are at the same time aligned with the international climate standards and with the financial interests of the investors. Cities with an uncertain financial profile and communities whose climate priorities cannot be translated in the vocabulary of investors may find this pretty discouraging.

From the perspective of the financial sector, the Head of Debt Capital Markets at HSBC Mexico, which facilitated the placement in the financial market of the municipal green bond in 2016, commented on the significant media coverage and political goodwill the bond gathered:

> "*The press coverage you received and all that political goodwill you received to keep doing good things and good environmental projects is priceless I think. It pays its investment many times over*" (C40, 2017, minute 38:08).

During the 2017 inauguration of the Vicente Guerrero infrastructure, then Mayor Miguel Ángel Mancera also highlighted the practical outcomes of the bond's investments, stating: "*From word to deed there is a long road, but what we are showing you today is that the investment is here, in Iztapalapa*" (Mancera, 2017, minute 2:22). Mancera positioned the water infrastructure as a key achievement in climate adaptation, emphasizing its role in enhancing the boroughs' capacity to manage rainwater during the flood season. This event also attracted significant press attention, further elevating the profile of the project and its associated municipal green bond (e.g., Rodríguez, 2017; Romero, 2017). No consideration and no reference was made on the actual capacity of the infrastructure to address the structural and intersectional experiences of

the local communities, nor on the possibility that the project would intensify existing hydrological problems.

The narrative surrounding the municipal green bond shifted significantly with the election of Claudia Sheinbaum as mayor of Mexico City for the 2018-2024 term. Sheinbaum, elected President of Mexico for the period 2024-2030, publicly voiced her skepticism about the financial efficacy of the municipal green bond, characterizing it as "*a terrible deal for the city*" (Milenio, 2019, minute 1:02).[54] The reasons behind her statements are manifold, including the fact that, despite previous awards and significant media attention, the issuance of the municipal green bond in Mexico City did not effectively address climate change mitigation or adaptation, and climate vulnerabilities dimensions such as income, gender, or race. The application of a green standard in the municipal bond had minimal impact in the projects implementation (Hilbrandt & Grubbauer, 2020). Instead, the issuance of the municipal green bond may have contributed to obscuring underlying climate injustices within the city's financial and hydrosocial cycles, all facilitated by the application of the green label and the promotion of a green bond narrative. This scenario emphasizes a critical disconnect between the municipal green bond's celebrated climate action and its actual impact on (not) addressing deeper systemic climate injustices.

8.6 Conclusion: Distributive Injustice in Floodwater, Potable Water, and Groundwater Across the Climate Vulnerabilities of Income, Race, and Gender

This chapter has explored the municipal green bond issued by Mexico City in 2016 and its material and immaterial links with two water infrastructure projects it financed (Vicente Guerrero in the Iztapalapa borough and the Selene plant in the Tláhuac borough) and with the people who live in those areas. The analysis followed the tripartite structure of climate justice (IPCC, 2023) and raised several concerns.

Under the pillar of procedural justice, it is evident that the green labeling process for the municipal bond was deficient in participatory mechanisms. This oversight resulted in a lack of inclusion for the perspectives and needs of the communities directly impacted by the financed projects. Such exclusion undermines the integrity of the green labeling process and limits its

[54] In 2018, the then Mayor of Mexico City, Claudia Sheinbaum, announced a review of green bonds during the first year of her administration, questioning the advantages of their interest rates and arguing that they did not significantly differ from other debt instruments traditionally used by the City (Heraldo de México, 2018).

effectiveness in promoting climate action with a climate justice perspective.

Under the recognition pillar, the water infrastructure projects financed by the municipal green bond in the Iztapalapa and Tláhuac boroughs, areas characterized by a high concentration of low-income households and significant Afro-Mexican and Indigenous populations (INEGI, 2021), failed to acknowledge or address the racial, income, and gender-specific dimensions of climate vulnerability. Additionally, the projects overlooked the disproportionate burden of water management that typically falls on women in these communities. This oversight rendered such forms of climate injustice invisible, effectively masking them with a green narrative that accompanied the promotion of the municipal green bond. This gap highlights a critical need for integrating gender, income, and racial perspectives in project planning and implementation to ensure that climate justice extends to all community members affected by these initiatives.

Under the distributive justice pillar, the water infrastructure projects financed by the municipal green bond failed to effectively tackle the fundamental issues plaguing the hydrosocial cycle of Mexico City, including intermittent water access, flooding, and groundwater overexploitation. These structural problems persist, disproportionately impacting low-income communities in Iztapalapa and Tláhuac, thus exacerbating existing climate injustices. Furthermore, while the green narrative surrounding the municipal green bond projected a positive image, it did not accurately represent the real-life challenges faced by these communities, particularly in addressing issues of climate justice related to income, race, and gender. This dissonance between the promoted narrative and the actual impacts highlights a significant gap in achieving true distributive justice, underlining the need for more inclusive and fair approaches in environmental and climate-related projects.

In summary, the 2016 issuance of the Mexico City municipal green bond marked a significant milestone as the first of its kind in Latin America and a pioneering initiative in the global South (Climate Policy Initiative, 2023). Despite its innovative nature, the green standard application in the bond had minimal impact in the implementation of the projects (Hilbrandt & Grubbauer, 2020). Notably, the bond's implementation and subsequent monitoring fell short in adequately addressing the income, race, and gender dimensions of climate vulnerability. This oversight led to the masking of underlying issues under the ostensibly progressive green facade of the bond, thereby perpetuating existing climate injustices. Specifically, this failure has continued to affect the distribution of water resources, disproportionately impacting the city’s most vulnerable communities. This situation stresses the critical need for integrating comprehensive climate

justice considerations in the planning and execution of climate finance instruments and the corresponding climate action initiatives, whether of adaptation or mitigation.

		Dimensions of Climate Vulnerability (Race, Gender, Income)
Climate Justice Pillars	**Procedural Justice**	-In 2016, Mexico City issued its first municipal green bond guided by the voluntary Green Bond Principles, aiming to finance projects in sustainable transportation, energy efficiency, and water management. The alignment with these principles was verified by Sustainalytics (2016), which assessed the project selection process and financial transparency, concluding that the bond was robust and transparent. -Carbon Trust released follow-up reports in 2017 and 2018, confirming that the funds were effectively allocated to projects with environmental benefits, including water infrastructure improvements in vulnerable areas. -The green labeling process lacked community participation and failed to consider climate vulnerabilities related to income, gender, and race. This highlights a lack of inclusivity in decision-making and an uneven distribution of environmental and financial benefits.
	Recognition	-In Mexico City, the Vicente Guerrero infrastructure and Selene plant water projects, financed through the 2016 municipal green bond, failed to account for climate vulnerability dimensions related to race, gender, and income. Implemented in the boroughs of Iztapalapa and Tláhuac, these projects overlooked the specific needs of lower-income, Afro-Mexican, and Indigenous populations prevalent in these areas. -Women in Mexico City bear a disproportionate burden in water management, which impacts their time and economic opportunities. This critical dimension of climate vulnerability was not recognized in the green labeling of the municipal bond. -The exclusion of gender, race, and income considerations in the implementation and monitoring of the municipal green bond reinforces existing patterns of climate injustice.
	Distributive Justice	-In this context, Mexico City's municipal green bond, which financed the Vicente Guerrero water infrastructure and the Selene plant, highlights the complex interactions between government actions, financial markets, and the hydrosocial cycle of water. These initiatives predominantly affect low-income communities in Iztapalapa and Tláhuac, located in the eastern part of the city. -The Vicente Guerrero water infrastructure is designed to manage floodwaters through the construction of artificial pools. Although this provides temporary mitigation against flooding, it fails to address the deeper issue of uneven access to flood-free spaces across the city. -The Selene plant intensifies the overexploitation of groundwater for human consumption, contributing to surface subsidence above the depleted aquifers. This approach does not address the fundamental problem of the uneven distribution of potable water resources throughout Mexico City, perpetuating climate injustice that affects both current and future generations.

Table 9. Application of the Climate Justice Framework to the 2016 Mexico City Municipal Green Bond. Source: Author.

CHAPTER 9. DISCUSSION AND CONCLUSIONS

9.1 Introduction

As presented in the first chapter, the main goal of this dissertation was to address the following question: "How do municipal green bonds, as a climate finance instrument, engage with climate action (both adaptation and mitigation), and interplay with local and global climate injustices?" After having provided the methodological (chapter 2) and analytical framework (chapter 3), and having extrapolated concrete elements from the three case studies (chapters 6 to 8), the present chapter is meant as a space for critical reflection on the empirical insights derived from the three case studies and the application of the climate justice framework to all the phases of the municipal green bonds.

This discussion begins with an exploration of the potential dialogues between the global South and North regarding urban climate finance, in particular on the possibility that previous academic discussions of the municipal bonds experiences in the United States, introduced in chapter 5, offer to help understand the ongoing and future experiences in Africa and Latin America, with a particular emphasis on racial justice perspectives. Following the triangular structure of the dissertation, the subsequent sections are organized around the three pillars of climate justice, offering insights into the commonalities that emerge when juxtaposing the three empirical cases. It then shifts to the narratives surrounding municipal green bonds as observed in the three case studies and proposes a critique of the strategy advocating for municipal green bonds as a success while indebting cities, municipalities and, in general the public. Finally, the conclusion of the chapter delineates how adopting a climate justice perspective on municipal green bonds can contribute to the current international academic literature on green bonds and climate finance, setting the stage for future research avenues.

As discussed in the second chapter, the three municipal green bonds were selected due to their financial and teleological similarities. However, the dissertation has also acknowledged the distinct historical, sociopolitical, cultural, and contextual differences that exist among the cases of San Francisco, Cape Town, and Mexico City. These differences point out the challenges and inappropriateness of directly transplanting lessons from one context to another (Legrand, 1997). Undoubtedly, the three municipal bonds reproduced a similar lifecycle that encompasses three critical phases: the green labeling, the implementation of the water infrastructure projects, and the promotion of narratives surrounding the bond. At the same time, the green debt instruments were used (also) to finance water infrastructure projects as climate change adaptation measures

(SFPUC, 2016; KPMG, 2017; Carbon Trust, 2017). However, the individual specificity of each circumstance cannot be overestimated.

Despite that, the author is convinced of the added value of juxtaposing the different experiences and the learnings that have been discussed in the previous chapters. In particular, the three cases give the opportunity to integrate the analysis of the financial instrument with its material implications and the narratives that were used to promote them locally and internationally. The interdependence between the infrastructure projects and their green labeling is significant and suggests that it is impractical nor accurate from a climate justice perspective to consider the municipal green bond in isolation from the infrastructure it finances. Similarly, focusing solely on the project without considering the broader context of the climate financing mechanism used to secure the necessary capital would be inadequate for the purpose of this dissertation.

In a context where the immateriality of the financial instrument and the materiality of the infrastructure are indissoluble and equally connected with the rent produced by global finance and the lived experience of local people and communities, the examination of the three empirical cases revealed that the quality and characteristics of the project was essential for the bond to receive its green label. Likewise, the green label was crucial in securing financial resources which were subsequently allocated for the development of infrastructure, thereby supporting the narrative of climate action associated with both the green bond and its issuers. This does not mean that all cases are the same, but that a systemic approach that keeps together financial and non-financial, local and global, must be adopted when thinking about the impacts of green debt tools and their capacity to advance or hinder climate justice objectives.

The comprehensive analysis of three municipal green bonds initiates a dialogue between cases situated in diverse global contexts. This juxtaposition, that is not a comparison, prompts a reflection on the historical continuity and specificity of utilizing municipal green bonds as a mechanism for climate adaptation financing across both the global South and North. Such an approach enriches the discussion, allowing for a nuanced interpretation and reinterpretation of municipal green bonds as critical instruments of climate finance and water infrastructure as a vital component of climate adaptation efforts. Following the review of the foundational elements of each case study, the sections below engage in a systemic analysis of the central themes and learnings that originated from the combination between the theoretical framework and the empirical studies that aims to enhance the understanding of the varied applications and implications of municipal green bonds in promoting climate action.

After an initial section dedicated to the importance of learning from academic work that has already unpacked the socio-economic implications of debt in the global North (9.2), the following three sections are structured around the pillars of climate justice and the crosscutting learnings that arise from the case studies (sections 9.3-9.5). Then, section 9.6 offers a reflection on narratives and proposes a critical understanding of what a 'successful' municipal green bond is and invites academics to be involved in the reappropriation and redefinition of the concept along with the people and communities whose lives are directly shaped by the material and immaterial flows triggered by the municipal green bonds. Finally, the remaining sections provide broader reflections on the role of debt in the green transition (section 9.7), and the contribution of the whole dissertation to the international academic debate on just climate finance (section 9.8).

9.2 Dialogue Between the Global South and the Global North on Municipal Green Bonds

Engaging in a dialogue about experiences with municipal green bonds in both the global North and South helps identify similarities and differences and highlight important considerations for the emerging municipal green bond market in the global South. This exchange draws on the extensive history of the municipal bond market in the US, which spans over two centuries (Cestau et al., 2009; O'Hara, 2012), while recognizing the unique characteristics of each regional context.

The experience of more than two centuries with municipal bonds in the US has been promoted by development banks and cooperation agencies as a model for encouraging municipal bonds in cities in the global South (e.g., Leigland, 2004; Chemonics International Inc., 2009). This highlights the potential for meaningful dialogue and exchange of experiences between the global North and South. The US, with its well-established municipal bond market, offers a wealth of evidence that has been utilized not only to assess the practical financing of public utility infrastructure but also to examine aspects of racial injustice associated with these bonds, as detailed in chapter 5 (e.g., Yinger, 2010; Smull et al., 2023).

Research has demonstrated how municipal bonds in the US have exacerbated racial injustice by making access to municipal debt more costly for municipalities with predominantly Black and Indigenous populations (Ponder, 2021; Loftus et al., 2022). Jenkins (2021a) also, in his work about municipal bonds in San Francisco in the 1940s and 1950s, illustrates how municipal financing mechanisms have contributed to structural underdevelopment and racial inequality in these communities. This perspective provides a critical lesson that aligns with the findings from

the three case studies in this dissertation, emphasizing the importance of examining how municipal bonds in the global South might generate and perpetuate patterns of climate injustice.

In particular, it is relevant to consider the increased costs associated with accessing the municipal bond market, which can disproportionately impact marginalized communities. This concern directly relates to the climate justice framework, specifically the distributive justice pillar, which focuses on the equitable distribution of financial benefits and harms. By scrutinizing these dynamics, stakeholders in the global South can develop strategies to mitigate potential injustices and ensure that municipal green bonds contribute to both environmental sustainability and social equity.

The issue of higher costs to access debt, correlated with dimensions of climate justice, also presents an important area for further research on green bonds from a climate justice perspective. Such studies could provide deeper insights into how financial mechanisms, while designed to facilitate development and address environmental challenges, must also be critically evaluated for their impacts on justice. Ensuring that these mechanisms do not inadvertently reinforce existing injustices is crucial. Future research could explore the extent to which green bonds, intended to promote sustainability, might perpetuate inequities in financial burdens and benefits, thus advancing the understanding of how to implement just climate finance solutions.

In brief, this suggests that the dialogue between the global North and the global South must attend to the nuances and variations in the experiences of municipal bonds and municipal green bonds, particularly those observed in the US, as illustrated in the case of San Francisco in chapter 6, and in the US experience with municipal bonds and municipal water infrastructure bonds in chapter 5. Notably, the US, which has the most extensive experience with municipal bonds, has started addressing the issue of racial justice within the municipal debt market. Initiatives include the hearing held by the House Committee on Financial Services of the US Congress on April 28, 2021, which examined the impact of municipal bonds on racial and social justice (US House Committee on Financial Services, 2021). Additionally, in 2023, the *Municipal Bond Markets and Racial Equity* voluntary framework was introduced to further this cause (Public Finance Initiative, 2023).

9.3 Pillar of Procedural Justice: Challenges in Information Accessibility and Community Participation

As delineated in chapter 3, procedural justice constitutes a fundamental pillar of climate justice, centering on the dynamics of decision-making, specifically, who makes decisions and how

these decisions are made (IPCC, 2023). This pillar emphasizes several critical criteria, including transparency, the respect for participants' rights, and effective participation in decision-making processes (IPCC, 2023). Furthermore, the IPCC (2023) highlights that decision-making processes which are more diverse and inclusive are likely to yield more effective outcomes. This assertion is supported by research that demonstrates the benefits of inclusivity in decision-making (Hong & Page, 2004; Landemore, 2013; Singer, 2019 cited in IPCC, 2023). This focus on procedural justice highlights the importance of ensuring that all affected communities have access to understandable information and can actively participate in decisions that impact their lives. These elements are essential for fostering justice in the implementation of climate-related policies and actions.

Municipal green bonds are distinct from conventional municipal bonds due to their green label, which specifically designates them as investments geared toward environmental sustainability and climate action initiatives. As such, the procedural pillar of this dissertation, thoroughly examined in chapter 4, is devoted to the green labeling process. This process adheres to the Green Bond Principles of the International Capital Market Association (ICMA), which are organized around four core components: the use of proceeds, the project evaluation and selection process, the management of proceeds, and reporting (ICMA, 2014).

Each case study detailed in chapters 6, 7, and 8 illustrates the Green Bond Principles in action. The governments of Cape Town, Mexico City, and the San Francisco Public Utilities Commission (SFPUC) have each developed a green bond framework document that outlines these elements. Furthermore, to enhance credibility and transparency, these entities hired consulting firms to provide second opinions on the framework documents. Specifically, SFPUC partnered with Sustainalytics, Cape Town with KPMG, and Mexico City initially with Sustainalytics followed by Carbon Trust. These partnerships serve to have external reviews of the green bond criteria, thereby signaling to the financial market that the bonds contribute to sustainable environmental and climate-related projects.

Additionally, in the case of San Francisco, the water infrastructure criteria outlined in the Climate Bonds Standard of the Climate Bonds Initiative (CBI) were adhered to. It is crucial to clarify that while the Climate Bonds Standard incorporates the four fundamental elements of the Green Bond Principles, it extends further by specifying taxonomies of projects eligible for green labeling across various sectors, such as water infrastructure. Moreover, it mandates the involvement of an external reviewer to enhance credibility and transparency (CBI, 2021b). This

leads to two critical discussion points relevant to the pillar of procedural justice in the analysis of the three cases: the transparency with the communities and accessibility of information, and the effectiveness of communities participation. These aspects are fundamental in evaluating whether the green labeling processes in these case studies align with the principles of procedural justice, ensuring that affected communities are not only informed but are also actively involved in decision-making processes.

Regarding transparency and access to information, the Green Bond Principles articulated by the International Capital Market Association (ICMA, 2016) advocate for a high level of transparency to effectively communicate the expected or achieved impacts of financed projects. The 2021 update of these principles further emphasizes the need for comprehensive green bond frameworks and external reviews to enhance transparency (CBI, 2021), elements which are present in the green labeling processes of the three case studies. In San Francisco, Cape Town, and Mexico City, both the green bond frameworks and follow-up reports are publicly accessible online, as detailed in tables 4, 6, and 8, in the respective chapters.

However, while these documents are available online, they often employ financial and technical jargon that can be challenging for non-specialists to understand. This issue points to a gap in procedural justice: accessibility of information does not merely involve making documents available on internet but also ensuring they are understandable. In all three cases, there is an evident need for these documents to be socialized in pedagogical terms that are accessible to the communities impacted by the projects financed through municipal green bonds. Furthermore, although municipal green bonds are promoted as instruments of climate action, as will be discussed later under the narrative section, this promotion often lacks detailed explanations about the financial, environmental, and climate implications of the projects and the financial instrument itself. Importantly, such promotional efforts typically happen post-issuance, which can limit meaningful community engagement and input into the decision-making process. This sequence of events highlights critical areas for improvement in aligning the issuance and management of green bonds with the pillar of procedural justice.

Regarding effective participation, the existing documentation related to the green bond frameworks and follow-up reports in the three case studies does not explicitly reflect mechanisms for engagement with the communities impacted by the projects financed through municipal green bonds (SFPUC, 2016; KPMG, 2017; Carbon Trust, 2017). This lack of outlined participatory processes in the green bond documentation highlights a gap in procedural justice, where the affected communities' ability to influence or engage in project decisions remains limited.

In the case of San Francisco, there is a specific instance where an environmental justice report was prepared for the southeast treatment plant area in Bayview-Hunters Point. This report highlighted issues of environmental racism and was developed in response to the environmental justice policy of the San Francisco Public Utilities Commission (SFPUC) (ESA, 2017), not as a direct outcome of the green labeling of the municipal bond. This indicates that while environmental justice assessments are conducted, they are not inherently integrated or mandated by the green bond standards themselves. Moreover, the Climate Bonds Standard does acknowledge the importance of respecting community human rights within its criteria for water infrastructure, yet it falls short of specifying or mandating mechanisms to ensure that these rights are actively defended (Carbon Trust, 2017). This suggests a significant discrepancy between the recognition of community rights in theory and the practical implementation of measures to guarantee these rights in the processes surrounding municipal green bonds. Such discrepancies underscore the need for more robust frameworks that not only recognize but also actively enforce community engagement and participation in projects financed by green bonds.

In the case of Mexico City, the documentation associated with the green labeling process lacks detailed information on how communities surrounding the Vicente Guerrero infrastructure in the Iztapalapa borough and the Selene plant in the Tláhuac borough were consulted or involved in the decision-making process (Carbon Trust, 2017; 2018). This omission highlights a critical gap in ensuring procedural justice through effective community engagement.

In Cape Town, the issue of inadequate community participation becomes even more pronounced. The installation of water management devices in low-income households, financed through the municipal green bond, faced significant resistance from the local community. This resistance was so impactful that the program ultimately had to be discontinued in 2021 (Scheba et al., 2021). The cancellation of this program underlines the consequences of neglecting effective community consultation and participation, illustrating how top-down decisions without communities involvement can lead to ineffective and unpopular outcomes.

In summary, achieving transparency with the communities in the green labeling process entails more than merely posting information online. It requires ensuring that such information is genuinely accessible to the communities affected by the projects to be financed, presented in clear, understandable language, and made available at critical times to facilitate informed participation. Moreover, regarding the effective participation of communities, although it is not a mandated criterion within the voluntary standards set by the Green Bond Principles and the

Climate Bonds Standard, the experiences of the three case studies underline the importance of effective participation.

9.4 Pillar of Recognition: Addressing the Non-Recognition of Climate Vulnerability Dimensions Such as Income, Race, and Gender

As detailed in chapter 3, the recognition pillar within the climate justice analytical framework emphasizes the critical importance of acknowledging and respecting the diversity of actors, perspectives, cultures, and values relevant to climate justice (IPCC, 2023). This pillar acts as a crucial link between procedural justice and distributive justice. By ensuring that diverse actors and their perspectives are included in decision-making processes, there is an enhanced potential for a fairer distribution of both the environmental and financial benefits and harms that arise from the issuance and management of municipal green bonds.

The IPCC underscores the interconnectedness of recognition with procedural and distributive justice, stating, "*Without recognition, actors may not benefit from the other two aspects of justice*" (IPCC, 2023, p 160). This highlights that without proper recognition, the effectiveness of procedural and distributive justice measures can be significantly diminished, as unrecognized groups may be systematically excluded from the benefits of justice-oriented policies and initiatives. Thus, addressing the non-recognition of key dimensions such as income, race, and gender is not only a matter of ethical importance but also a practical necessity to ensure the comprehensive effectiveness of climate justice efforts.

Equally relevant is the IPCC's definition of climate vulnerability as "*the propensity or predisposition to be adversely affected, encompassing a variety of concepts and elements, including sensitivity or susceptibility to harm and the lack of capacity to cope and adapt*" (IPCC, 2023, p 5). The IPCC further elucidates that the impacts of climate change disproportionately affect economically and socially marginalized populations, who thus experience heightened climate vulnerability. These populations have historically faced discrimination based on factors such as income, race, gender, class, ethnicity, ability level, sexuality and non-conforming gender orientation (IPCC, 2023). Recognizing and incorporating these dimensions of climate vulnerability into decision-making processes is essential for ensuring that climate action is just.

In a climate justice analysis, recognizing a broad range of actors and perspectives is crucial, as the climate justice criterion is neither rigid nor narrow. For the purposes of analyzing the three selected cases of municipal green bonds in this dissertation, the dimensions of climate

vulnerability related to income, race, and gender have been identified as particularly pertinent. The following paragraphs will elucidate the importance of these dimensions and the consequences of their lack of recognition in the context of climate vulnerability.

Firstly, the economic income of an individual or household is a critical dimension of climate vulnerability as it can significantly influence access to environmental resources and the ability to adapt to climate change. This was evident in the case of Mexico City, discussed in chapter 8, where the two projects financed by the municipal green bond, the Vicente Guerrero infrastructure and the Selene plant, are situated in boroughs predominantly composed of low-income neighborhoods. These areas often experience intermittent access to drinking water (as illustrated in the map in figure 23). Despite the clear link between low income and increased climate vulnerability, the green bond framework document (Sustainalytics, 2016) did not set specific objectives related to addressing income disparities. Similarly, the monitoring documents (Carbon Trust, 2017; 2018) did not include criteria for assessing the impact of the projects on these income-related vulnerabilities. This omission highlights a significant gap in the recognition and integration of economic dimensions of climate vulnerability within the planning and evaluation of these green bond-funded projects.

In the case of Cape Town, detailed in chapter 7, 83% of the proceeds from the municipal green bond were allocated to the water management devices installation program in 'indigent' or lower-income households. This initiative aimed to enhance water management, influence behavior to reduce water waste, and decrease water losses through leakage (KPMG, 2017). The term 'indigent' is used by the Cape Town Government to refer to low-income households (Cape Town, 2010).

This focus on 'indigent' households also intersects with the climate vulnerability dimension of race. In Cape Town, the legacy of apartheid and colonialism has resulted in the majority of low-income households being concentrated in Black-majority neighborhoods like Khayelitsha and Dunoon, as well as 'coloured' or mixed-race neighborhoods such as Mitchells Plain (Cape Town, 2013). Despite this intersection, the green labeling process for the municipal green bond did not recognize or address the climate vulnerability dimensions of income and race within the green bond framework document (Cape Town, 2017) or the pre-issuance and post-issuance reports (KPMG, 2017; 2019). This case highlights the necessity of acknowledging and addressing the interconnected dimensions of income and race in the context of climate vulnerability. Failure to do so can undermine the effectiveness of climate action initiatives and exacerbate existing inequalities, demonstrating the critical need for a more inclusive approach in the green labeling process.

Regarding the climate vulnerability dimension of race, it was observed to be relevant in all three cases but was not acknowledged as such in the green labeling processes of the municipal bonds. In San Francisco, the dimension of race was absent from the green bond framework document (Sustainalytics, 2016). However, the San Francisco Public Utilities Commission (SFPUC) later addressed environmental racism through its environmental justice public policy in the 2021 monitoring report (SFPUC, 2021). This acknowledgment was not a direct result of the green labeling process but rather part of the SFPUC's broader environmental justice initiatives.

Within the southeast treatment plant project in Bayview-Hunters Point, the environmental justice document for the biodigester plant specifically recognized the issue of environmental racism in this Black-majority neighborhood. It detailed several environmental and public health impacts resulting from the biodigester plant and the historical concentration of pollution sources in the area (ESA, 2017). This recognition by the SFPUC highlights the importance of the race dimension in San Francisco, even though it was not included in the green labeling process of the municipal bond. This case highlights a significant disconnect: while the SFPUC has acknowledged the critical role of race in environmental justice, this criterion was not integrated into the municipal bond green labeling framework. This omission points to a broader issue within the green bond issuance process, where essential dimensions of climate vulnerability, such as race, are overlooked, potentially undermining the fairness and effectiveness of climate finance initiatives.

In the case of Mexico City, the climate vulnerability dimension of race was not acknowledged in the green labeling process (Sustainalytics, 2016; Carbon Trust, 2017; 2018). However, this dimension is highly relevant for the implementation of water infrastructure projects financed by the municipal green bond due to the likely undercounted presence of Afro-Mexican and Indigenous populations in the boroughs where the projects were implemented (Torre Cantalapiedra, 2019).

The most significant water infrastructure project financed by the municipal green bond is the Vicente Guerrero infrastructure in the borough of Iztapalapa, which has the highest population density in Mexico City. According to the 2020 official census, Iztapalapa is home to 33,313 Afro-Mexicans and 28,716 Indigenous language speakers (INEGI, 2021). The second major project, the Selene plant, is located in the borough of Tláhuac, which, although smaller in population, includes 7,289 Afro-Mexicans and 4,826 Indigenous people (INEGI, 2021). However, these figures likely underestimate the actual Afro-Mexican and Indigenous populations due to systemic racism in Mexico and the limitations of the 2020 census, where

some individuals may not have self-identified as Afro-Mexican or Indigenous (Torre Cantalapiedra, 2019).

In addition to race, in the green labeling documents for Mexico City's municipal green bond, the climate vulnerability of gender was not recognized. This omission is significant, given the widespread issues of intermittent and inadequate access to drinking water in the city, where the burden of obtaining and managing household water falls predominantly on women, as detailed in chapter 8. This phenomenon, referred to as *time poverty* by UN Women (2020), highlights the disproportionate impact on women's time and labor.

The Selene plant in the Tláhuac borough, which filters groundwater for human consumption, directly influences access to drinking water (Carbon Trust, 2018b). However, there was no recognition or monitoring of the plant's gender-specific impacts, whether positive or negative. This lack of consideration fails to address the specific challenges faced by women in managing water resources. Similarly, in the cases of San Francisco and Cape Town, the gender dimension of climate vulnerability was also overlooked in the green labeling processes (SFPUC, 2019; KPMG, 2019). This consistent omission across all three cases underlines a significant gap in the green labeling process, highlighting the need for a more inclusive approach that recognizes and addresses gender-specific vulnerabilities to ensure fair climate action outcomes.

In summary, based on the observations in this dissertation, the climate vulnerability dimensions of income, race, and gender were not recognized in the green labeling framework documents or as evaluation criteria in the monitoring reports for the municipal green bonds of San Francisco, Cape Town, and Mexico City. Based on the findings of this dissertation, in the cases of Mexico City and Cape Town, the climate vulnerability dimension of income is highly relevant. The dimension of race is pertinent in all three cases, and in Mexico City, the gender dimension is also crucial. These omissions highlight significant gaps in the green labeling processes, emphasizing the need for a more comprehensive and inclusive approach that addresses these critical dimensions of climate.

9.5 Pillar of Distributive Justice: Reproduction of Environmental Racism in the Distribution of Potable Water, Wastewater, Floodwater, and Groundwater

The distributive justice pillar within the climate justice analytical framework examines the distribution of environmental and financial benefits and harms across various dimensions of time and space (Islam, 2022).

Water is a fundamental environmental element essential for sustaining life (UN Water, 2020). Every individual, regardless of income level or cultural background, requires a basic amount of water for hydration, food preparation, sanitation, and other daily needs (WHO and UNICEF, 2000; cited in Martínez Moscoso et al., 2018). The organization of society plays a crucial role in determining how available water resources are distributed. This distribution is conceptualized through the hydrosocial cycle, which describes the dynamic relationship between water and society (Linton & Budds, 2014; Boelens et al., 2016).

In all three case studies it was evident that water infrastructure financed by municipal green bonds is situated within contexts of existing climate injustice related to water distribution. These infrastructures, despite being financed by green bonds intended to promote environmental sustainability, are embedded in and potentially exacerbate pre-existing inequalities in water access. These inequalities are likely to be further intensified by the impacts of climate change.

The hydrosocial cycle highlights the importance of understanding how societal structures influence the distribution of water resources. In these case studies, the placement and impact of water infrastructure projects reveal the perpetuation of environmental racism (Pulido, 2016), where discriminated communities disproportionately bear the burdens of wastewater treatment, floodwater excess, groundwater overexploitation, and potable water scarcity. Addressing these injustices requires a thorough examination of how water resources are allocated and managed, ensuring that infrastructure projects financed by green bonds do not perpetuate existing disparities but instead contribute to more fair and sustainable water distribution.

At the individual level, the distributive justice pillar underlines that the allocation of burdens and risks related to climate change should not disproportionately impact any particular individual or group of individuals. This ensures that the adverse effects of climate change are equitably shared and do not exacerbate existing inequalities. Additionally, it is crucial to consider the impact on future generations, ensuring that today's climate actions do not compromise their ability to meet their own needs.

In the context of the three case studies (San Francisco, Cape Town, and Mexico City) the examination of distributive justice highlights how water infrastructure projects, financed through municipal green bonds, interact with existing climate injustices. These projects must be scrutinized to ensure that they do not perpetuate or exacerbate environmental racism and other forms of inequality, but rather contribute to a fairer and more sustainable distribution of water resources.

In the case of San Francisco, the projects financed by the municipal green bond resulted in the perpetuation of environmental racism (Pulido, 2016; Seamster & Purifoy, 2021) and distributive injustice concerning polluted water. The complete reconstruction of the southeast treatment plant in Bayview-Hunters Point, financed by the municipal green bond, perpetuates this pollution source in a Black-majority neighborhood. This neighborhood's demographic composition includes 33.1% Black or African American, 24.2% Hispanic or Latino, 29.8% Asian, and 7.5% White residents (ESA, 2017). In contrast, the broader city of San Francisco, which benefits from the treatment of the water, has a majority White population: 50.3% White, 33.3% Asian, 15.2% Hispanic or Latino, and 5.6% Black or African American (ESA, 2017).

This situation illustrates environmental racism, where pollution sources are disproportionately located in Black-majority areas (Pulido, 2016; Seamster & Purifoy, 2021), benefiting the city of San Francisco in general. Despite the existence of an alternative proposal to reconstruct the treatment plant in Oceanside, a location surrounded by golf courses (San Francisco Human Rights Commission, 2003), the decision to rebuild in Bayview-Hunters Point persisted (see map in figure 23). In summary, the municipal green bond financed an unjust distribution of contaminated water in San Francisco, thereby reproducing a scenario of environmental racism. The impacts associated with the southeast treatment plant continue to disproportionately affect a Black-majority neighborhood, while the broader city reaps the benefits of the treated water.

In Cape Town, the municipal green bond financed a program to install water management devices that restrict access to drinking water in 'indigent' or low-income households, predominantly occupied by Black and 'Coloured' or mixed-race individuals (City of Cape Town, 2013). These communities have been historically marginalized and racialized (Strauss and Liebenberg, 2014). This initiative effectively restricted access to a fundamental environmental element, drinking water, in these racialized households, exemplifying a situation of environmental racism (Pulido, 2016). On the contrary, the largest consumers of drinking water in Cape Town are high-income households (Savelli et al., 2023), which tend to be mainly White in this city (City of Cape Town, 2013). This highlights the disparity in water access, where wealthier and Wither households continue to consume more water while low-income, predominantly Black and mixed-race households face restrictions. In summary, the municipal green bond in Cape Town financed a program that perpetuated climate injustice in the distribution of drinking water, reproducing a scenario of environmental racism.

In Mexico City, the two water infrastructure projects financed by the municipal green bond, the Selene plant in the Tláhuac borough and the Vicente Guerrero infrastructure in the Iztapalapa borough, have perpetuated existing injustices in the distribution of drinking water and

floodwater, as detailed in chapter 8. The distribution of drinking water in Mexico City is marked by significant distributive injustice. Central neighborhoods with high-income households tend to overconsume water (Morales-Novelo et al., 2018; Wunderlich et al., 2021), while peripheral, low-income neighborhoods in Iztapalapa and Tláhuac experience deficient and intermittent access to drinking water (see map in figure 23).

The Selene plant, which filters drinking water for the Tláhuac borough, fails to address the underlying issue of unfair water distribution in the city. While it may temporarily increase the volume of available drinking water, it exacerbates long-term problems by reinforcing groundwater extraction, leading to the overexploitation of groundwater and subsequent land subsidence. This situation highlights distributive injustice at both the individual level and for future generations. Similarly, the Vicente Guerrero infrastructure aims to mitigate flooding by storing excessive water in artificial pools. However, it fails to address the root cause of the unequal spatial distribution of flood risk, where the areas most affected by floods in Mexico City are predominantly low-income neighborhoods (see map in figure 23). In summary, the municipal green bond in Mexico City financed projects that maintained the status quo of water distribution injustices. The Selene plant contributes to long-term environmental degradation, while the Vicente Guerrero infrastructure does not solve the core issue of unequal flood vulnerability. These projects reflect ongoing distributive injustices at both the present and future levels, reinforcing environmental inequities rather than resolving them.

A key reflection across the three cases is that observing distributive justice requires more than legal recognition or economic allocation; it necessitates attention to spatial dynamics as well. In Cape Town, the intersection of income and race dimensions is evident in the concentration of low-income households in predominantly Black and ‘Coloured’ neighborhoods (Cape Town, 2013). This spatial distribution highlights how historical and socio-economic factors continue to shape current injustices.

In Mexico City, water is heavily subsidized (e.g., Morales-Novelo et al., 2018), reducing the likelihood of increased water rates to service municipal green debt or water service cutoffs for non-payment, unlike some cases of municipal bond-financed water infrastructure in the US (e.g., Ponder & Omstedt, 2022; Phinney, 2022), as detailed in chapter 5. The distributive injustice of water in Mexico City is bluntly illustrated by the spatial organization: central areas with high-income households enjoy permanent access and excessive consumption of water, while peripheral, low-income areas suffer from deficient and intermittent access (see map in figure 23).

In San Francisco, examining the southeast wastewater treatment plant in isolation might suggest a positive impact on the neighborhood due to improved environmental standards in the new construction. However, considering the spatial context reveals a concentration of pollution sources in a Black-majority neighborhood (ESA, 2017). This spatial analysis highlights the persistence of environmental racism despite nominal improvements. In summary, to effectively review the distributive justice pillar within the climate justice analytical framework, it is crucial to consider spatial dynamics. These dynamics reveal deeper, systemic inequities that are not immediately apparent through legal or economic analysis alone. Recognizing and addressing these spatial injustices is essential for achieving distributive justice.

In all three cases, while the projects financed by municipal green bonds are promoted as beneficial on a city-wide scale, the localized impacts tell a different story. These projects exacerbate pre-existing environmental and social injustices, underscoring the need for a more nuanced approach in the planning and implementation of infrastructure projects financed through climate finance instruments. Specifically, these municipal green bonds financed projects that perpetuated environmental racism and water distribution injustices, rather than mitigating them. This observation highlights the critical importance of integrating a deeper understanding of local contexts and justice considerations into the deployment of climate finance to ensure that such initiatives do not inadvertently reinforce existing disparities.

Given the complexity of the climate justice approach and the corresponding three pillars of procedural justice, recognition, and distributive justice, it is beneficial here to summarize these points of discussion before transitioning to the subsequent discussion on narrative.

In San Francisco, the municipal green bond financed the complete reconstruction of the southeast treatment plant, which processes most of the city's wastewater. This plant remains in Bayview-Hunters Point, a Black-majority neighborhood, thereby maintaining the concentration of pollution sources in this area while benefiting the entire city.

In Cape Town, the municipal green bond financed the installation of water management devices that restricted access to drinking water for racialized low-income households. This initiative disproportionately affected Black and mixed-race households, thereby reinforcing existing racial and economic disparities.

In Mexico City, the municipal green bond financed the Vicente Guerrero floodwater regulation project, which offers an insubstantial solution for the deeper issue of low-income households being concentrated in flood-prone zones in the Iztapalapa borough and the uneven distribution of flood-free areas in the city. Additionally, the municipal green bond financed the Selene plant

in the Tláhuac borough, which filters groundwater for human consumption. This project exacerbates the long-term problem of land subsidence due to groundwater overexploitation and fails to resolve the intermittent access to drinking water in low-income neighborhoods in the long term, particularly impacting future generations.

In both the Cape Town and Mexico City cases, water infrastructure projects financed by municipal green bonds are located in low-income areas, which at first glance suggests a relevant investment prioritizing vulnerable populations. However, as extensively illustrated throughout this dissertation, in the case of Cape Town, the water management devices program restricted access to potable water precisely for the lowest-income population. In Mexico City, the infrastructure financed in low-income neighborhoods in the boroughs of Iztapalapa and Tláhuac provided short-term benefits by regulating floodwater and increasing the availability of potable water extracted from aquifers. Nevertheless, these projects perpetuated long-term injustices in the distribution of areas less vulnerable to flooding and potable water. Furthermore, the over-extraction of aquifer water risks triggering land subsidence in the borough of Tláhuac, disproportionately affecting low-income neighborhoods located above these aquifers.

In all three cases, the projects financed by municipal green bonds inadvertently perpetuated environmental racism and water distribution injustices. This highlights the necessity for a more nuanced and equitable approach in planning and implementing infrastructure projects through climate finance instruments.

9.6 Narrative of Municipal Green Bonds as Successful and Climate Action

The concept of narrative is both simple and powerful, serving as a useful tool for analyzing the issuance and implementation of municipal green bonds. A narrative represents the portrayal of one or several events (Abbott, 2008). From the perspective of the climate justice analytical framework, narratives are instrumental because they can shape the interpretation of facts and data to advance specific interests or agendas (Curran, 2021).

In the cases examined in this dissertation, a narrative of success and climate action was constructed around the municipal green bonds by their issuers and other stakeholders involved in their promotion and circulation. This narrative emphasizes the positive aspects and achievements of the projects financed by the bonds, as discussed in the concluding parts of chapters 6, 7, and 8.

However, this constructed narrative often overlooks or downplays the localized environmental and social injustices exacerbated by these projects. The broader portrayal of these bonds as

unequivocal successes in climate action can obscure the nuanced realities on the ground, where marginalized communities may continue to bear disproportionate environmental burdens. Recognizing and critically examining these narratives is crucial for a more comprehensive and just evaluation of municipal green bonds and their impacts.

In all three municipal green bond cases, a consistent narrative of success and climate action was observed. This green narrative was constructed in two distinct stages. Initially, the issuer obtains a green label for the municipal bond, establishing a foundation for the debt issuance to be presented as a significant achievement in climate action. This first stage involves securing the green label, which lends credibility and marketability to the bond.

The second stage of narrative construction involves public relations efforts, including press coverage, participation in key events, and the receipt of various green awards (Environmental Finance, 2017; 2018). These activities are designed to reinforce the perception of the municipal green bond as a successful and impactful climate action initiative. By engaging with media and participating in high-profile events, the issuers and stakeholders promote the bond's benefits and achievements, further entrenching the narrative of environmental success.

This constructed narrative, while promoting the bonds as green successes, often overlooks the localized climate injustices that can be exacerbated by these projects. Therefore, it is essential to critically examine these narratives to ensure a more nuanced and equitable evaluation of the impacts of municipal green bonds.

Each city actively promoted its green bond issuance through press releases and participation in high-profile events to highlight its pioneering efforts. Cape Town was recognized with the *Green Bond of the Year* award and the *Green Bronze* award (Environmental Finance, 2018). Mexico City received the *Bond of the Year* award in the municipal category, while San Francisco was honored with the *Green Bond of the Year* award in the United States municipal category (Environmental Finance, 2017; Johansson, 2019). These awards served to further validate and amplify the narrative of success and climate action associated with their municipal green bonds.

In conclusion, there is a notable dissonance between the promotional narratives adopted by cities and the actual impacts of their actions and policies. These green narratives often equate the positive aspects of climate finance with the adoption of climate action, sidelining important questions of justice. This dissonance highlights the necessity of critically examining the expansion of the green bond market through a climate justice lens. It is essential to ensure that

the promotional narratives of green bonds align with the realities of project implementation, particularly in contexts marked by climate injustice.

The analysis then suggests that when a project financed by a municipal green bond is identified as causing negative impacts in terms of climate justice, the associated green narrative should be critically re-evaluated and potentially halted to prevent it from masking local climate injustices. This was illustrated in the case of Cape Town, where the negative impacts of the municipal green bond have been documented since at least 2020 (Bigger & Millington, 2020). Nevertheless, this municipal green bond experience continues to be promoted as a positive example of climate action and finance (e.g., Rai and Razada, 2023; Falchi, 2023).Therefore, it is important that academic work is realized to promote alternative understanding of what a success is, so that new narratives are developed that accurately reflect the impacts of green debt and green bond-funded projects on the lived experience of people, but also on the financial performances and dynamics of the authorities that have issued such debt.

9.7 Indebting Global South Cities as a Questionable Climate Finance Strategy

The analysis realized so far has made it evident that local realities offer a geographically focused space for research and analysis. Through municipal green bonds, cities become pivotal political arenas where global climate finance and local climate action (adaptation and mitigation) dynamics intersect with local climate injustices. Considering municipal green bonds provides the opportunity to connect various levels and decision-making centers, encompassing financial markets, standard setters, and local governments. This approach fosters a more nuanced understanding of how climate finance mechanisms, such as municipal green bonds, function and impact actors at different governance levels. Such analysis can reveal disparities in resource allocation and help ensure that climate finance strategies are implemented in ways that promote climate justice, particularly for the most vulnerable populations. Attention to the dynamics of debt expansion in cities and municipalities of the global South as a climate financing strategy is therefore crucial. This perspective also opens up the possibility for exchanging lessons and experiences on municipal green bonds between the global South and the global North, as explored in the beginning of this chapter.

As detailed in chapter 4, green bonds are debt securities or financial instruments with a green label, indicating to the financial market that the funds raised are intended for projects or initiatives related to environmental sustainability and climate action. Municipal green bonds, specifically, are issued by city or municipal governments, meaning they represent municipal green debt. A growing trend is observed in promoting climate financing strategies in cities and

municipalities in the global South (Hilbrandt and Grubauer, 2020). However, this trend rises concerns about increasing debt burdens in cities, particularly for those already facing significant financial risks (Ferrando et al., 2022).

The experience of the three municipalities discussed in this dissertation and the growing reliance on municipal green bonds in the global South prompt several critical considerations. Cities in the global South often have limited financial strength and may already be struggling with substantial debt burdens (Tänzler et al., 2017). Increasing their indebtedness through green bonds, while intended to support environmental projects, can exacerbate financial vulnerabilities and create vicious cycles of indebtedness that could lead to default, a significant reduction of the fiscal space for public policies or an increase in the contribution required by citizens to access services, including essential ones like water (see the case of Cape Town in chapter 7). This strategy might not always be suitable, particularly if the long-term financial sustainability of these cities is compromised.

The use of debt by cities or subnational governments is not new. However, the promotion of municipal green bonds marks a new phase in encouraging debt among local governments in the global South. As explained in chapter 5, regular municipal bonds were already being promoted in the global South during the 1990s and 2000s as a strategy to enable cities to access investment resources through borrowing (e.g., El Daher, 1997; Fay & Morrison, 2005; Leigland, 1997). Since the 2010s, green-labeled bonds have been promoted as a means for cities to finance their climate adaptation and mitigation efforts (Climate Finance Leadership Alliance, 2014; Tänzler et al., 2017), as detailed in chapter 5.

Additionally, there are specific programs promoting green debt in Africa and Latin America, such as those by the Inter-American Development Bank[55] (n.d.) and the African Development Bank Group[56] (n.d.). For instance, the municipal green bond issued by the city of Agadir City in Morocco in 2023 was supported by the European Bank for Reconstruction and Development (EBRD) (Zgheib, 2022). These programs aim to facilitate the issuance of green bonds by providing technical assistance and financial support to cities in these regions.

Despite the exponential growth of the green bond market worldwide (CBI, 2021a) and the significant expansion of the municipal green bond market in the United States (Baker et al., 2022; Friedland, 2020), the adoption of municipal green bonds in Africa and Latin America has been limited. In Africa, only three municipal green bonds have been issued: in Johannesburg

[55] For example the Green Bond Transparency Platform (GBTP) (Inter-American-Development Bank (IDB), n.d.).
[56] For example the Green Bonds Program (African Development Bank Group, n.d.).

and Cape Town, South Africa, and Agadir City, Morocco (see table 3 in chapter 4). In Latin America, only six municipal green bonds have been issued: in the Rioja Province, the Province of Jujuy, the City of Córdoba, and the Municipality of Godoy Cruz (Argentina), as well as in Mexico City in 2016 and 2018 (Mexico) (see table 3). This suggests that the municipal green bond market in Africa and Latin America is not experiencing the same level of growth as seen in other regions. This raises important questions, beyond the scope of this dissertation, about the potential and viability of such financial instrument to fill the 'climate finance gap' in the global South and the cost of doing so. The slower adoption may be attributed to various factors, including financial risk, market readiness, and institutional capacity, all of which warrant further investigation to understand the barriers and opportunities for expanding the municipal green bond market in these regions, but also the possibility of exacerbating existing inequalities between and within cities. The case of Mexico City, where the Mayor clearly indicated the good credit rating as instrumental to accessing climate finance (see chapter 8), suggests that this financial tool may not be available to everyone, and certainly not at the same conditions.

Additionally, indebtedness may last longer than any policy or project that is financed by such debt. A negative experience in that sense is represented by the 2017 municipal green bond of Cape Town. The city will continue to service this debt until 2027 (KPMG, 2018) despite the failed water management devices project, which was canceled in 2021 following community opposition (Scheba et al., 2021). Similarly, in Mexico City, the 2016 municipal green bond financed the Vicente Guerrero and Selene water infrastructure projects (Carbon Trust, 2018b). These projects failed to address the substantial issues related to floodwater management and potable water distribution (see chapter 8), but the debt continued to be service for five years until 2021 (Carbon Trust, 2018b).

Furthermore, the experience of the three municipalities highlights the fact that municipal green bonds come to a cost (due to the role of third party experts and brokers) but they may not be financially additional, for example they may not be bringing new and different resources to the local administration different from those that they would have obtained with the issuance of non-labeled bonds. Although this is a consideration that transcends the scope of this dissertation, the empirical work suggests that the green label may represent a way to redistribute local resources from the global South to global financial and non-financial intermediaries who are involved in the certification, labeling, promotion, and brokering of the products. Given the importance of a legitimate assessment and validation of the projects, and given the role that global North actors have played in setting up and gatekeeping the sector, this flow of funds from the South to the North appears an inherent element of the financial articulation.

Moreover, the cases discussed in the previous chapters and the friction between the infrastructures and the needs of people (particularly visible in the context of Cape Town, but also of Mexico City), suggests that the use of green debt to finance climate action may lead to a subordination of the projects to the parameters and desires of the investors. This may create an issue in terms of direction and content of the climate actions, and reinforce a question of climate injustice with regards to all the alternatives and the possible actions that would not be financed because they are not aligned or incompatible with the vision of the investors and the intermediaries. This problem, which is well known when it comes to lower funding for climate adaptation, may become a reality also in the case of climate mitigation. Policies, actions and infrastructures that are not easily quantifiable or that do not easily fall within the green or climate matrix developed by the certifying companies, would be excluded from the poll of fundable activities, and therefore may be abandoned or let aside.

A critical examination of green bonds or green debt and their success narrative reveals potential diversion from other essential financing mechanisms for the green transition and climate action that do not rely on debt. By deconstructing the success narrative of green bonds to explore their tangible impacts on the lived-experiences of communities affected by financed projects, the debate on climate finance can be grounded in the realities of neighborhoods and municipalities. This shift would enable actors in climate finance to move beyond the "climate finance gap talk" framework, which emphasizes the amount of capital mobilized rather than the concrete outcomes in terms of community adaptation and mitigation efforts (Bryant & Webber, 2024). The current narrative centered on green debt success neglects critical issues such as subsidies, loss and damage, and repair and restoration. Integrating these considerations would put into dialogue the IPCC's (2023) definition of climate justice with concepts of reparative and restorative justice within the context of climate finance and climate action (Perry, 2021; Webber et al., 2022).

Finally, although it lies outside the scope of this dissertation, there is a promising avenue for future research: analyzing the circulation of capital triggered by the issuance of municipal green bonds, as illustrated in figures 5, 15, and 21. In the figure 5 of chapter 4, the basic cycle of capital circulation is represented, while figure 15 of chapter 7 illustrates this process specifically for the case of Cape Town, identifying key actors from the issuer to standard setters. Figures 21 and 22 in chapter 8 correspondingly depict the circulation of capital triggered by the issuance of the 2016 municipal green bond in Mexico City, alongside the hydrosocial cycle of water and its connection with the infrastructure financed by the green bonds, highlighting the interplay between the circulation of water and capital. In this latter case, could be analyze how the

circulation of a tangible environmental element, such as water, is altered by the circulation of an intangible element that symbolizes value, like capital. The dynamics of capital circulation activated by green bonds and its entanglement with climate and environmental cycles constitute a valuable area for further investigation that goes beyond the focus of this dissertation.

9.8 Contribution to the Literature on Green Bonds and Climate Finance from a Climate Justice Perspective and Possible Avenues for Further Exploration

The analysis presented in this dissertation illuminates the fact that municipal green bonds are much more than a relationship between a borrower and a creditor, and that the interdependence between the financial instrument and the infrastructural project is also a connection between the global and the local, and no element should be obliterated. Moreover, the adoption of an extended understanding of climate justice to municipal green bonds, shows the importance of questioning the common definition of *successful* green bond and that a narrow focus on financial considerations may not be enough to perceive the multi-layered and complex implications of indebting the climate transition at the local level.

Overall, this dissertation makes significant contributions to two primary bodies of international academic literature. The first body of literature pertains to green bonds, which is thoroughly examined in chapter 4. This literature is divided into two clusters addressing practical challenges (Liaw, 2020 and McAskill et al., 2021 cited in Cortellini & Panetta, 2021) and political concerns (Jones et al., 2020). This dissertation specifically contributes to the second cluster, which focuses on the political dimensions of green bonds. By analyzing the intersection of green bonds with issues of justice, the dissertation offers new insights into the political implications and challenges associated with these financial instruments. It examines procedural justice, emphasizing effective participation, recognition of diverse dimensions of climate vulnerability, as well as distributive justice, highlighting the fair distribution of environmental and financial burdens and benefits.

The second body of literature approaches climate finance using the climate justice framework, as detailed in chapter 3. This literature is categorized into two main analytical clusters: the first examines the distribution of climate finance burdens between countries (e.g., Khan et al., 2020; Dafermos, 2023), while the second analyzes experiences with various climate finance instruments (e.g., Vanderheiden, 2015; Baird & Green, 2020). This dissertation enriches the latter cluster by providing empirical evidence from case studies that highlight the climate justice issues associated with municipal green bonds.

The literature on climate finance from a climate justice perspective typically focuses on the national level, particularly on the distribution of the burdens associated with climate finance (Dafermos, 2023). This dissertation, however, highlights the importance of examining the distribution of these financial burdens at the subnational level, including within different neighborhoods and areas of the same city. Furthermore, this dissertation argues that focusing merely on the financial distribution of climate finance is insufficient. Instances of climate injustice become more evident when considering the spatial distribution of environmental benefits and harms. This is illustrated through the three case studies under study.

Moreover, while the existing literature on climate finance from a climate justice perspective includes case studies of various climate finance instruments, such as the Green Climate Fund (Vanderheiden, 2015) and the Clean Development Mechanism (Baird & Green, 2020), this dissertation expands the diversity of case studies by analyzing municipal green bonds through the lens of climate justice. By expanding the scope of climate finance literature to include the subnational and intra-urban levels, this dissertation enhances the understanding of how climate finance mechanisms can be designed and implemented to promote just outcomes. It also highlights the importance of considering spatial dynamics and other non-financial factors in assessing climate justice.

Future research could explore several promising areas related to municipal green bonds in Latin America, particularly those focused on climate change mitigation projects such as solar and wind energy initiatives in Argentina (see table 3 in chapter 4). This would expand the understanding of how municipal green bonds are being utilized in different regional contexts and their effectiveness in promoting renewable energy projects.

Another intriguing area for future research is the concept of financial and environmental additionality of municipal green bonds. Financial additionality refers to the funding of new or additional projects beyond those already planned (Jones et al., 2020). Investigating whether municipal green bonds are truly providing additional financial resources for new projects or merely replacing existing funding could offer valuable insights. Similarly, examining the environmental additionality, whether the projects financed by these bonds provide genuine environmental benefits beyond what would have occurred without them, would be critical for assessing the true impact of these financial instruments.

Furthermore, the suitability of green-labeled debt as a strategy to finance climate action in regions such as Africa and Latin America warrants further investigation. Such studies could

help determine whether green bonds are the most appropriate mechanism for advancing climate action in these regions or if alternative financing strategies might be more effective.

This observation stresses the need for a deeper understanding of how green bonds influence climate justice outcomes at both local and global levels. Future research should aim to analyze the specific mechanisms through which green bonds impact communities and the environment. Such analysis would provide data and insights that can guide policymakers, practitioners, and academics in the fields of climate finance and climate justice.

It is essential to understand how climate injustices materialize and persist through the implementation of climate finance instruments, particularly municipal green bonds. Additionally, the dialogue around the implications of municipal green bonds for climate justice needs broader exploration, especially considering the increasing use of this mechanism and its significant role in environmental and financial distributions, as evidenced by the water distribution challenges discussed in this dissertation.

The climate justice analytical framework can offer profound insights and make significant contributions to the growing fields of green bonds and climate finance. Researchers and policymakers are encouraged to conduct additional qualitative, quantitative, and mixed methods research from a climate justice perspective. This approach will enrich the understanding of these intricate dynamics and effectively address the interrelated issues of climate finance, climate action, and climate justice.

Finally, it is pertinent to acknowledge that the concept of climate justice is complex, interconnected, and influenced by other concepts of justice, such as environmental justice and racial justice. Future research on climate finance from a climate justice perspective can also benefit from these and other justice frameworks. Particular attention should be given to the concept of multispecies justice (see Tschakert, 2022; Srinivasan, 2022), which expands the perspective to address the impacts of climate change on beings beyond the human.

9.9 Final Reflections on the Interrelation Between Climate Finance, Climate Action, and Climate Justice

Addressing the climate crisis necessitates a global and local reorganization through climate action that encompasses both adaptation and mitigation, guided by the allocation of financial resources through climate finance. This process holds the potential either to reproduce or to dismantle existing structures of injustice and marginalization along dimensions of income, race,

and gender, among others. Historical systems of oppression and marginalization, including patriarchy, racism, and colonialism, have contributed and continue to contribute to these injustices. In times of climate crisis, these historical forms of discrimination and socioeconomic exclusion manifest as dimensions of climate vulnerability, therefore a justice-oriented approach to climate finance and climate action is needed.

The rationale for a climate justice approach to climate finance and climate action lies, among other reasons, in the origins of anthropogenic climate change and the dimensions of climate vulnerability. Historically, countries of the global North emitted the majority of greenhouse gases during their industrialization processes (Hickel, 2020), while countries of the global South, which emitted significantly less, now face higher levels of climate vulnerability, with extreme cases such as small island states (IPCC, 2023). Indeed, the international climate policy debate on climate finance focuses on the level of responsibility of countries, guided by the principle of *common but differentiated responsibilities* (UN, 2015). This has evolved into what Bryant and Webber (2024), building on Knuth (2015), defined as the climate finance 'gap talk,' where the focus is on capital mobilization targets and the growth of mobilized capital rather than on improvements in the quality of life of communities adapting to climate change, particularly those with higher levels of climate vulnerability. Simultaneously, development banks and cooperation agencies have promoted the need for subnational and local actors to participate in the mobilization of climate finance (Tänzler et al., 2017). In this context, municipal green bonds have emerged as an opportunity to extend the mobilization of climate finance at the subnational level.

This dissertation has analyzed the experience of three municipal green bonds in San Francisco, Cape Town, and Mexico City through the three moments of green labeling, implementation, and narrative promotion, under the three pillars of procedural justice, recognition, and distributive justice within the analytical framework of climate justice. In terms of procedural justice, it was observed that transparency is limited to governmental and financial actors, with no transparency towards the communities where the financed projects are located, this in terms of accessible information beyond posting the green bond framework and monitoring reports online. Similarly, communities did not have effective participation in the green labeling process of municipal bonds. This is a shortcoming that needs to be addressed.

In terms of distributive justice, the evidence shows that international actors investing in municipal green bonds are extracting a profit, while, on the other, the general public has to service the municipal green debt regardless of whether the project succeeds or fails, or whether it reproduces or reverses local climate injustices. In terms of water and space redistribution, the

implemented projects in San Francisco and Cape Town redistributed wastewater and potable water, in ways explicitly reproducing environmental racism. In Mexico City, the financed projects redistributed floodwater and groundwater in low-income areas in the eastern part of the city, where race and gender dimensions are likely relevant, although not recognized in the green labeling process. In both projects, the impact is positive in the short term but negative in the long term, as the floodwaters infrastructure do not address the underlying issue of unequal distribution of non-floodable land, and the treatment plant reinforces the overexploitation of groundwater, which in the long term depletes this water source and causes surface collapse.

Parallel to and disconnected from the local context of climate injustice, the three cases promoted narratives of success and climate action around the municipal green bonds. This highlights the dissonance between the bonds green narrative and the financed project and their local contexts. In all three cases, narratives of success and climate action were promoted in a way that appears completely disconnected from the local context of climate injustice and what the people on the ground would define a success. This reveals the dissonance between the green narrative surrounding the bonds and the actual outcomes when the financed project fails to deliver, as seen with the water management devices in Cape Town, or perpetuates a source of pollution in a Black-majority neighborhood, as occurred in San Francisco, or provides short-term solutions that exacerbate long-term problems, as observed in Mexico City. The green label effectively served to mask local climate injustice.

Under the logic of the climate finance 'gap talk,' the mobilization of capital in climate finance has become an end in itself, with climate action becoming a means to promote or justify this capital mobilization. This dissertation argues that the logic should be reversed: climate finance should be a means to achieve just climate action focused on fair and reparative transformations in local territories, with transparency towards communities, effective participation, and recognition of the multiple dimensions of climate vulnerability.

The extensive reorganization that the Earth will undergo in the 21st century due to climate action, oriented in part by climate finance, presents an opportunity to reverse existing structures of discrimination and exclusion or, conversely, to perpetuate or even intensify them. Therefore, it is crucial to approach climate finance and climate action from a climate justice perspective. This ensures that these efforts genuinely address and rectify historical injustices, promoting just and inclusive solutions rather than exacerbating existing disparities. It is essential to advocate for urban climate finance that prioritizes the positive transformation of neighborhoods above all.

CHAPTER 10. POLICY RECOMMENDATIONS

10.1 Introduction

This chapter will present five public policy recommendations that translate the dissertation findings into actionable advice for those involved in implementing municipal green bonds, climate finance professionals, social organizations monitoring climate and development finance issues, and communities affected by the implementation of municipal green bonds.

10.2 First Policy Recommendation: Open Spaces for Debate and Participation with Communities Before Issuing Municipal Green Debt

Based on the findings of this dissertation and within the analytical framework of climate justice, it is evident that municipal green debt, or municipal green bonds, have long-term repercussions and trigger economic and environmental redistributions. Therefore, decisions regarding municipal green debt are of public interest for the communities, neighborhoods, and cities that will incur the debt and be impacted by the financed projects. It is essential to establish spaces for debate and prior participation, allowing these communities to be adequately informed and to express their views, acceptance, or rejection of debt as a financing mechanism for climate action, whether for adaptation or mitigation.

This recommendation is justified by the observations from the case studies. Cape Town: The water management devices project in low-income households faced significant community opposition. This opposition was not considered during the decision-making process, ultimately leading to the project's cancellation. Nevertheless, the public will continue to service the municipal green debt until 2027 (KPMG, 2018). Mexico City: There were no participatory spaces for communities to discuss the municipal green debt strategy, despite the projects affecting multiple neighborhoods and the city's economy. Taxpayers and fee payers are ultimately responsible for the debt.

This recommendation is directed at municipal or city governments, organizations, and social movements interested in public economy, climate finance, and development finance. It is particularly relevant for citizen movements, as citizens will ultimately bear the financial burden of municipal green debt and be impacted by the financed projects. Increasing municipal green debt or adopting debt as a strategy for climate and development finance in municipalities or

urban settlements in the global South, where populations and vulnerabilities to climate change are increasingly concentrated, warrants more research and discussion (IPCC, 2023).

To implement this recommendation effectively, several key actions can be taken. First, it is essential to establish participatory forums where relevant communities can engage in discussions about the implications of municipal green debt. These forums should be inclusive, transparent, and accessible to ensure broad community participation. Second, public consultations should be organized to gather input from residents, particularly those in neighborhoods most impacted by the proposed projects. Third, providing comprehensive information is crucial; all relevant details about the municipal green debt and associated projects, including potential risks, benefits, and long-term financial obligations, should be made available in an accessible format. Furthermore, facilitating community involvement in decision-making is vital. Municipalities should incorporate community feedback into the decision-making process, ensuring that residents' views and concerns are considered before finalizing any debt issuance. By adopting a participatory approach, municipalities can ensure that the decision to issue green debt is informed by a thorough understanding of its implications and has the consent and support of the affected communities. This approach fosters transparency, accountability, and climate justice in the financing of climate action projects.

10.3 Second Policy Recommendation: Ensure Accessible Information and Effective Participation for Communities in the Green Labeling of Municipal Bonds

Based on the findings of this dissertation and within the analytical framework of climate justice, it is recommended to guarantee accessible information and effective participation for communities in relation to the green labeling process of municipal bonds. Publishing the green bond framework document and follow-up reports on the internet is not sufficient. It is necessary to disseminate this information in a manner that is accessible to the communities impacted by the projects financed with municipal green debt. This enables the second part of this recommendation: ensuring effective participation in decision-making related to the municipal green bond and its financed projects, which depends on communities being adequately informed.

The justification for this recommendation arises from the observations in the three case studies: San Francisco: In the issuance of the municipal green bond that financed the reconstruction of the southeast treatment plant, there were no mechanisms for accessible information and

effective participation. Communities were not adequately informed about the project's implications and its financing through municipal green debt, nor about potential alternatives such as relocating the treatment plant to another part of the city. Cape Town: Effective participation from the communities affected by the installation of water management devices in low-income households would have allowed them to voice their concerns and potentially reject the project before the city incurred municipal green debt to finance it. The project was ultimately canceled in 2021 due to community opposition (Scheba et al., 2021), yet the municipal green debt will continue to be serviced by Cape Town taxpayers until 2027 (KPMG, 2019). Mexico City: There was no evidence of effective community participation in the green labeling process of the municipal bond (Carbon Trust, 2017; 2019). In all three cases, a narrative of success and climate action was promoted without adequately reporting on the real implications of the projects financed by the municipal green bonds.

The target audience for this recommendation includes municipal green bond issuers and subnational government entities that have issued or are considering issuing these types of bonds. Consulting firms and organizations that promote voluntary green standards should also incorporate criteria for accessible information and effective participation in their standards and practices. The political implications of implementing this recommendation are significant. It would provide municipal governments with more tools to better prepare their municipal green bond issuance strategy and allow communities to be better informed and involved in decision-making related to municipal green bonds. Given that municipal bonds are typically repaid through general tax revenue or specific household fees, this approach would ensure greater transparency and accountability. It would also create an opportunity for the potentially impacted communities to reject municipal green debt and the associated projects if they are considered unsuitable.

10.4 Third Policy Recommendation: Recognize Income, Race, and Gender Dimensions of Climate Vulnerability in the Green Labeling Process

Based on the findings of this dissertation and within the analytical framework of climate justice, it is recommended to explicitly recognize the dimensions of climate vulnerability, specifically income, race, and gender; during the green labeling process of municipal bonds and throughout the implementation of financed projects. While this dissertation focused on these three dimensions, it is important to acknowledge that other dimensions of climate vulnerability, such as age, ethnicity, ability level, and non-conforming gender orientation, are also relevant as

highlighted by the IPCC (2023) (see figure 3 in chapter 3). Each context is unique, and various forms of climate vulnerability intersect differently based on historical patterns of discrimination and socio-economic exclusion.

Municipal bonds need to expand their focus beyond the conventional green labeling to incorporate a climate justice approach that integrates both the foundational pillars and the dimensions of climate vulnerability. The three case studies analyzed in this dissertation illustrate the consequences of failing to do so. This part of the recommendation is particularly directed at standard-setting organizations and bond issuers. Additionally, qualitative socioeconomic indicators should be included into the municipal green bond follow-up reports, as quantitative metrics (such as those employed in the Mexico City case) fail to reveal who benefits, the nature of these benefits, and the impacts on quality of life in both the short and long term. An initial and important precedent for incorporating qualitative monitoring indicators in municipal bond issuance, with a particular emphasis on the race dimension, has been established in the United States (Public Finance Initiative, 2023).

This recommendation is justified by observations from the three case studies. The income dimension was significant in Cape Town, where the financed project involved water management devices targeted at low-income households, and in Mexico City, where two water infrastructure projects were located in low-income neighborhoods. The race dimension was relevant in all three case studies. The gender dimension was evident in Mexico City, highlighting its importance. While the data collected primarily emphasized income and race, it does not imply that gender is irrelevant in Cape Town or San Francisco, nor does it dismiss the significance of other dimensions such as ethnicity or age. Future research could provide a more comprehensive analysis of these additional factors.

The implementation of this recommendation aligns with the three pillars of climate justice: procedural justice, distributive justice, and recognition. Recognizing and addressing relevant dimensions of climate vulnerability ensures that projects financed by municipal green bonds potentially contribute to climate justice. The primary audience for this recommendation includes municipalities or city governments considering the issuance of municipal green bonds. Consulting firms specializing in green bond certifications could also enhance their criteria by incorporating these dimensions of climate vulnerability. Furthermore, organizations, social

movements, and government entities focused on combating various forms of discrimination can advocate for the inclusion of these dimensions in municipal green bonds and related projects.

As climate finance and development finance converge under the concept of climate-resilient development (IPCC, 2023), integrating climate vulnerability dimensions is crucial. Implementing this recommendation would foster dialogue between poverty alleviation, racial justice, and gender justice agendas with urban climate finance, green bonds, climate finance, and development finance agendas. This integrated approach promotes more comprehensive and inclusive climate action policies, ensuring that all affected communities are considered and supported.

10.5 Fourth Policy Recommendation: Ensure a Just Distribution of Environmental and Financial Burdens and Benefits

Based on the findings of this dissertation and within the analytical framework of climate justice, it is recommended to establish criteria and mechanisms to identify and address the unjust distribution of environmental and financial burdens and benefits associated with municipal green bonds and the projects they finance. This requires attention not only to economic and legal aspects but also to the spatial distribution within municipalities or urban areas. Furthermore, it is crucial to consider the role of political will and socioeconomic privilege, as historically and currently, privileged and higher-income social classes tend to reside in areas with better and greater access to environmental benefits such as potable water, as illustrated in the cases of Mexico City and Cape Town (see map in figure 23).

This recommendation is supported by the observations from the three case studies. San Francisco: The southeast treatment plant project is located in a Black-majority neighborhood that has historically faced a concentration of the city's pollution sources, exemplifying environmental racism. Mexico City: The water infrastructure projects financed by the municipal green bond are situated in low-income neighborhoods with intermittent access to water and overexploited groundwater, leading to surface collapse. Cape Town: The water management devices financed by the municipal green bond were installed in low-income households, which are spatially concentrated in Black and mixed-race neighborhoods (Cape Town, 2013).

To effectively identify and address distributive injustices, it is essential to consider the spatial dynamics of cities. Legal frameworks and economic assessments alone are insufficient, as evidenced by the following: In all three cases, existing laws and public policies aim to address poverty and combat racism, yet spatial disparities persist. In Mexico City, the highly subsidized drinking water service does not alleviate the issue of intermittent access in low-income peripheral neighborhoods. In Cape Town, the state-subsidized daily water quota for low-income individuals has become a restrictive ceiling rather than a vital minimum, exacerbating access issues for predominantly racialized, historically marginalized communities. High-income households in both cities consume the most water (e.g., Morales-Novelo et al., 2018; Savelli et al., 2023).

This recommendation is directed at municipal or city governments considering the issuance of municipal green bonds. It is also relevant for organizations and social movements advocating for climate justice, environmental justice, and social justice. By extending their focus beyond legal and economic aspects to include spatial considerations, these entities can better achieve distributive justice within the climate justice framework. Implementing this recommendation can shed light on the material dynamics of unjust distribution, contributing to a more transparent and fair approach to addressing and rectifying these injustices.

10.6 Fifth Policy Recommendation: Promote a Global Subnational Dialogue Facilitating South-South and South-North Exchanges on Municipal Green Debt and its Nexus with Climate Finance, Climate Action, and Climate Justice

Based on the findings of this dissertation and within the analytical framework of climate justice, it is recommended to establish platforms for the exchange of subnational experiences related to municipal green debt and its interrelation with climate finance, climate action, and climate justice. These platforms should facilitate dialogue from both South-South and North-South perspectives, reflecting the diverse urban realities and climate challenges faced by cities globally. This recommendation is supported by evidence from case studies of municipal green bonds in both the global South and North, as detailed in chapters 6, 7, and 8, and the experiences of municipal bonds in the United States, discussed in chapter 5. It is crucial to acknowledge the heterogeneity among cities or urban settlements worldwide in terms of size, governance capacities, financial resources, and exposure to climate change impacts. Nevertheless, the distinction between the global North and South, or developed and developing regions, remains

a pertinent context for understanding local urban dynamics and the differentiated responsibilities and capabilities in addressing climate change.

South-South Exchange: Municipalities and urban settlements in the global South face similar challenges related to population concentration and climate vulnerabilities. Additionally, subnational governments often struggle with governance and financial stability. An exchange of experiences between these regions would facilitate a dialogue between contexts with analogous challenges, fostering shared solutions and strategies.

North-South Exchange: The US' extensive experience with municipal bonds, spanning over two centuries, serves as a valuable reference for both municipal debt and municipal green debt, as detailed in chapter 5. The US has also initiated steps to incorporate racial justice criteria in municipal bonds, such as the publication of the *Racial Equity Framework in Municipal Bond Markets* (Public Finance Initiative, 2023). This exchange can provide insights into best practices and potential pitfalls, enriching the knowledge base of subnational governments in the global South.

The primary audience for this recommendation includes subnational governments in both the global South and global North, as well as social organizations interested in monitoring and promoting climate finance, development finance, and municipal finance. This recommendation underscores the increasing importance of municipal or subnational levels of governance in international climate change policy, which has traditionally been dominated by national governments and multilateral organizations. Establishing exchange platforms can promote more inclusive and effective climate action by leveraging the experiences and insights of diverse governance levels.

To implement this recommendation, several key steps should be taken. First, create exchange platforms by developing formal venues for South-South and South-North exchanges, such as conferences, workshops, and online forums. These platforms will enable subnational governments and social organizations to share experiences and strategies. Second, facilitate knowledge sharing by encouraging the documentation and dissemination of case studies, best practices, and lessons learned, particularly concerning municipal green debt and climate finance. This can be achieved through collaborative research projects and publications. Third, promote collaborative initiatives that foster partnerships between subnational governments from different regions, facilitating practical exchanges and mutual learning. Finally, it is

essential to incorporate climate justice criteria into these discussions, ensuring that exchanges address how municipal green debt can either mitigate or exacerbate existing injustices.

By fostering these exchanges, municipalities can benefit from a wealth of knowledge and experience, enhancing their ability to implement effective and equitable climate finance strategies. This approach promotes a more integrated and just global response to climate change, leveraging the strengths of diverse governance structures across different contexts.

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ANNEXES

Annex 1

List of Interviews. A total of 36 interviews were conducted across three locations: San Francisco, United States; Cape Town, South Africa; and Mexico City, Mexico. The interviews were conducted in English and Spanish.

Profile	**Date**	**City, Country**
Policy expert	January 05, 2022	San Francisco, United States
Water activist	January 06, 2022	
Policy expert	January 17, 2022	
Water activist	January 18, 2022	
Policy expert	February 01, 2022	
Household member	January 20, 2022	
Water activist	March 10, 2022	
Water Activist	February 03, 2022	Mexico City, Mexico
Household member	February 22, 2022	
Academic	February 24, 2022	
Household member	February 24, 2022	
Water activist	March 02, 2022	
Water activist	March 03, 2022	
Policy expert	March 04, 2022	
Academic	March 05, 2022	
Water activist	March 11, 2022	
Household member	March 13, 2022	
Household member	March 14, 2022	
Policy expert	July 03, 2022	
Academic	September 27, 2022	Cape Town, South Africa
Water activist	October 08, 2022	
Household member	October 08, 2022	
Household member	October 12, 2022	
Household member	October 12, 2022	
Household member	October 12, 2022	
Policy expert	October 17, 2022	
Policy expert	October 17, 2022	

Water activist	November 11, 2022	
Water activist	November 11, 2022	
Household member	November 16, 2022	
Water activist	November 17, 2022	
Water activist	November 24, 2022	
Water activist	November 24, 2022	
Policy expert	November 28, 2022	
Policy expert	December 05, 2022	
Water activist	December 16, 2022	

Annex 2

Sample Interview Questions

Project identification:

Title: Green City bonds as a Space of Socio-Ecological Conflict.

BOF: DOCPRO4 - TT(ZAP)BOF

Project identifier: 41525

PhD student: Héctor Herrera

Research Project Title: Green City Bonds of Water Infrastructure: A Climate Justice Analysis

Note: This study primarily employs semi-structured interviews. Therefore, the specific questions posed will depend heavily on the unique contexts in which the interviews take place.

Sample Questions For Experts on Green Bonds (e.g., Policy Officers, Standard Setting Organizations, etc.)

1. Can you describe your areas of expertise?
2. How long have you been involved in the issuance, implementation, or monitoring of green bonds?
3. What major experiences have you had with the issuance and implementation of green bonds?
4. In your view, what are the primary benefits associated with the issuance and implementation of green bonds, particularly green city bonds for water infrastructure?
5. What are the main obstacles encountered during the issuance and monitoring of green bonds?
6. How do you foresee the future development of the green bond market?
7. In your opinion, how do green city bonds differ from other types of green bonds, such as corporate or sovereign green bonds?
8. How would you characterize the distribution of both positive and negative environmental and financial impacts associated with green city bonds?

Sample Questions for Representatives of NGOs and Social and Environmental Movements

1. Can you describe your areas of expertise?
2. How long have you been involved in your field or movement?
3. How do you define climate justice, environmental justice, and water justice?
4. How do you perceive the relevance of climate justice, environmental justice, and water justice in the context of this city/neighborhood?

5. How is your community, neighborhood, or city financing its response to climate change and related policy initiatives?
6. How familiar are you with green bonds in general and green city bonds in particular?
7. What do you identify as the primary positive and negative impacts of water infrastructure project X, which is financed through a green city bond?
8. How do you envision the future of the green city bond market?
9. How would you describe the distribution of positive and negative environmental and financial impacts associated with green city bonds?

Sample Questions for Local Residents of Neighborhoods Where Water Infrastructure Projects Funded by Green City Bonds are Located

1. Are you aware of water infrastructure project X? Do you know where the funding for this project comes from?
2. What do you consider to be the main positive and negative impacts of water infrastructure project X?
3. How would you describe the changes in your neighborhood following the implementation of water infrastructure project X?
4. In your opinion, how could the issuance and implementation of green city bonds for water infrastructure be improved?
5. How would you describe climate justice issues in your neighborhood? (Provide an accessible explanation of the concept of climate justice).
6. How do you believe climate change may affect water access in your neighborhood?

Note: The rest of the questions will be open-ended and adjusted based on the specific circumstances of the interviewees.