

100 billion dollar COP-out

A critical analysis of the illusions and realities of climate adaptation

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Abstract

Climate adaptation has emerged as a defining paradigm of North-South relations in the 21st century, positioned at the intersection of development, security, and environmental governance. This thesis examines the tension between calls for diverse ontological and epistemological approaches to adaptation and the apparent homogeneity in adaptation practice, developing a methodological approach to empirically measure discourse centralization.

Through analysis of 45 National Adaptation Plans submitted to the UNFCCC, this research applies structural topic modeling and a novel “Dominance Index” to assess the degree to which adaptation discourse reflects plurality or uniformity. The findings reveal that adaptation discourse clusters most strongly by region rather than income level or geography, suggesting regional epistemic communities may have greater influence than either global frameworks or local knowledge systems in shaping how climate vulnerability is conceptualized and addressed.

Viewed through the lens of Human Security and critical future studies, these patterns offer insights into power dynamics in climate governance. The regional clustering pattern complicates the binary opposition between the pragmatic “adaptation nexus” approach and the critical “adaptation regime” perspective, revealing a more complex landscape of knowledge production that has significant implications for the future of adaptation as a framework for addressing climate vulnerability in North-South relations.

Acknowledgements

1 Introduction

Climate adaptation is emerging as one of the defining paradigms of North-South relations in the 21st century. As climate impacts intensify across the globe, the question of how societies should adapt to these changes has moved from the periphery to the center of international governance. Yet despite the growing importance of adaptation in climate summits, funding mechanisms, and policy discussions, there remains a troubling uniformity in how adaptation is conceptualized and implemented across diverse contexts.

This homogeneity persists despite a rich body of literature arguing that truly effective responses to complex challenges require ontological and epistemological diversity—different ways of knowing and being in relation to climate futures. Scholars have argued that the dominant development paradigm systematically excludes alternative knowledges and possibilities (Escobar, 2018) and highlight the “epistemicide” that occurs when Western knowledge systems are universalized at the expense of other forms of knowing (santos2016?). These critiques suggest that effective climate adaptation would require not just technical adjustments within existing systems, but openness to fundamentally different ways of conceptualizing relationships between humans, non-humans, and future generations.

This thesis examines the tension between the theoretical call for diverse approaches to adaptation and the apparent homogeneity in adaptation governance. Rather than assuming uniformity, however, I develop a methodological approach to empirically measure discourse centralization in climate adaptation. Through analysis of National Adaptation Plans (NAPs) submitted to the UNFCCC, I investigate to what extent adaptation discourse reflects a plurality of epistemological and ontological positions or the dominance of a singular global discourse. ## Climate Adaptation

International climate change action has evolved significantly since the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. Initially focused primarily on mitigation—reducing greenhouse gas emissions—the climate governance architecture has expanded to include adaptation as a second pillar following the Cancun Agreements in 2010, and loss and damage as a third pillar with the Paris Agreement in 2015.

This evolution reflects the growing recognition that some climate impacts are now unavoidable, even with ambitious mitigation efforts. The concept of “common but differentiated responsibilities” established at the Earth Summit has shaped how these pillars are operationalized, with industrialized countries seen as bearing greater responsibility both for emissions reductions and for providing support to developing countries facing disproportionate climate impacts despite contributing least to the problem.

Climate adaptation has become increasingly central to Human Security frameworks. As defined by the UNDP (1994), Human Security broadens traditional security concepts to include threats to food security, environmental security, community security, and personal security—all domains directly affected by climate change. Climate adaptation intersects with each of these dimensions, potentially reshaping how security is conceptualized and pursued in international relations.

The funding landscape for adaptation has evolved to include mechanisms like the Green Climate Fund, the Adaptation Fund, and various bilateral and multilateral arrangements. Despite pledges like the “\$100 billion promise” and the recent \$300 billion commitment at COP29 in Baku (2024), actual disbursement patterns remain contentious, with questions about what counts as adaptation finance and who controls how it is allocated and implemented.

1.1 Homogeneity

Working within large climate policy organizations, one encounters a striking uniformity in how adaptation is conceptualized and approached. Despite operating across dramatically different geographical, cultural, and socioeconomic contexts, adaptation projects often employ remarkably similar framing, methodologies, and solutions. This homogeneity exists in tension with the diverse climate impacts experienced across regions and the heterogeneous social, economic, and cultural contexts in which adaptation must occur.

The field of climate adaptation research reveals this tension clearly. On one hand, the “adaptation nexus” approach, drawing from participatory development traditions, emphasizes technical adjustments and institution-building within existing systems. On the other hand, the “adaptation regime” critique, emerging from post-structural analysis, argues that adaptation discourse functions as a technique of power that reproduces rather than challenges existing inequalities. Between these approaches lies a fundamental disagreement about what adaptation is and ought to be.

This tension reflects a broader challenge in addressing complex global challenges: how to navigate between universal frameworks needed for coordination and the diverse knowledge systems, ontologies, and epistemologies that might offer more contextually appropriate and transformative solutions. Scholars like Raworth (2017), Mazzucato (2021), and Scott (1998) have proposed alternative frameworks for governance that could potentially accommodate greater diversity in approaches to complex challenges like climate adaptation.

But how homogeneous is adaptation discourse in practice? Rather than assuming either complete uniformity or radical diversity, this thesis develops a methodological approach to empirically measure discourse centralization in climate adaptation. This approach allows us to move beyond binary oppositions to understand the actual patterns of discourse in adaptation governance.

1.2 Research Questions

This thesis addresses three central research questions:

1. To what extent is climate adaptation discourse centralized or diverse across different contexts?
2. What do patterns of discourse centralization reveal about power dynamics in climate adaptation governance?
3. What implications do these discourse patterns have for the future of climate adaptation as a framework for North-South relations?

To address these questions, I develop a methodological approach centered around the “Dominance Index”—a measurement tool for quantifying the degree of discourse centralization across different contexts. This approach combines structural topic modeling of National Adaptation Plans with calculations of topic dominance to identify patterns in how adaptation is conceptualized in official policy documents.

While the Dominance Index itself is relatively straightforward, its application to questions of discourse centralization represents a functional bridge between critical theory and quantitative methods. This interdisciplinary approach allows for empirical assessment of theoretical claims about discourse homogeneity while maintaining sensitivity to power dynamics in climate governance.

The analysis reveals a surprising finding: adaptation discourse clusters most strongly by region rather than income level or geography. This suggests that regional epistemic communities and institutions may shape adaptation conceptualizations more significantly than either purely global frameworks or purely local knowledge systems. This finding complicates both the adaptation nexus and adaptation regime perspectives, pointing toward a more complex landscape of knowledge production in climate adaptation.

1.3 Structure

This thesis makes three primary contributions to our understanding of climate adaptation governance:

1. First, it provides a theoretical framework for understanding adaptation as a site of contested futures where epistemological and ontological assumptions shape which adaptation pathways are considered possible or impossible. By drawing connections between critical future studies and adaptation governance, the thesis illuminates how discourse centralization can function as a form of “defuturing”—actively reducing rather than expanding future possibilities.

2. Second, it develops a methodological approach for measuring discourse centralization that can be applied beyond climate adaptation to other domains of global governance. The Dominance Index offers a way to empirically assess the degree to which discourse reflects a diversity of perspectives or the dominance of particular ways of knowing and being.
3. Third, it offers empirical insights about regional patterns in adaptation discourse that challenge simplistic narratives about global-local dynamics in climate governance. These findings have implications for how we understand the role of regional institutions in mediating between global frameworks and local implementation.

The thesis is structured in three parts:

- Part 1 establishes climate adaptation as a case study. Chapter 1 traces the evolution of adaptation within international climate governance. Chapter 2 reviews competing paradigms in adaptation research, contrasting the adaptation nexus and adaptation regime approaches.
- Part 2 develops the theoretical and methodological framework. Chapter 3 presents a theoretical framework drawing from critical future studies to understand adaptation as a site of contested futures. Chapter 4 outlines the methodological approach, including the development of the Dominance Index and its application to NAPs.
- Part 3 presents the analysis and implications. Chapter 5 presents findings on discourse centralization patterns across different dimensions. Chapter 6 discusses the implications of these patterns for power dynamics in adaptation governance and the future of climate adaptation as a framework for North-South relations. Chapter 7 concludes by reflecting on the broader significance of these findings for addressing complex global challenges.

Through this structure, the thesis bridges critical theoretical perspectives with empirical analysis to offer new insights into how climate adaptation discourse is shaped and what this means for addressing one of the defining challenges of our time.

Part I

Climate adaptation

2 Context: Climate action

International climate change action is governed by the United Nations Framework Convention on Climate Change (UNFCCC) [source]. The Convention has annual Conferences of the Parties (COP) to the Convention, also known as climate summits. The first summit, known colloquially as the Earth Summit, was held in Rio de Janeiro in 1992. The Earth Summit also created two other conventions, The Convention on Biological Diversity (CBD) and The United Nations Convention to Combat Desertification (UNCCD) [source].

The Summit established the concept of *Common, but differentiated, responsibilities*, highlighting Global North countries, defined in the convention as Annex I and Annex II countries. Here, industrialized countries are seen to have a greater responsibility for environmental destruction, and thus a greater responsibility to remedy it [source]. This principle has become a cornerstone of international climate negotiations, though its interpretation has evolved over time, particularly as the economic circumstances of various countries have changed (**rajamani2000?**).

Official development assistance, an OECD measurement for foreign aid, was adapted to the Summit, known as the Rio markers, making it possible to code North-South aid as contributing towards the goals established in these conventions [source]. The Rio markers system allows donors to indicate when activities target climate mitigation, climate adaptation, biodiversity, or desertification as either a “principal” or “significant” objective. This tracking system has become increasingly important as climate finance has grown in prominence, though it has been criticized for inconsistent application across donors and for potentially inflating climate finance figures (**weikmans2017?**).

2.1 Mitigation

The Kyoto summit in 1997 established climate mitigation as the first pillar of the UNFCCC [source]. Here, the level of greenhouse gasses was to be kept at a level below what was dangerous to the biosphere. The cuts that this entailed was to be done by the already industrialized countries, as they were historically responsible for the emissions. The Kyoto Protocol set legally binding emissions reduction targets for 37 industrialized countries and economies in transition, with an average reduction of 5.2% from 1990 levels to be achieved by 2012 (**böhringer2003?**).

It also created a market for carbon, called “Flexibility mechanisms”, where emissions could be traded from developing countries to industrialized countries [source]. These mechanisms

included Emissions Trading, the Clean Development Mechanism (CDM), and Joint Implementation (JI). The CDM in particular became a significant channel for North-South cooperation, allowing developed countries to implement emission-reduction projects in developing countries and earn certified emission reduction credits (**michaelowa2007?**).

In this way, developing countries that are under no obligation to cut their emissions, could sell carbon credits [source]. This approach was designed to reduce the overall costs of meeting mitigation targets while providing sustainable development benefits to host countries. However, the geographic distribution of CDM projects has been uneven, with the majority concentrated in larger emerging economies like China, India, and Brazil, while least developed countries, particularly in Africa, have hosted relatively few projects (**corbera2009?**).

The Paris Agreement, adopted at COP21 in 2015, strengthened the commitment to mitigation, calling for a target to limit climate change to 1,5 degrees [source]. This marked a significant shift from the Kyoto approach, establishing a universal framework where all countries contribute to mitigation efforts according to their capacities and circumstances, through “nationally determined contributions” (NDCs). Unlike Kyoto’s top-down approach with specific targets for developed countries, Paris introduced a hybrid system combining bottom-up national pledges with international oversight (**falkner2016?**).

The Paris system attempted to resolve long-standing tensions in the climate regime. By allowing countries to determine their own contributions based on national circumstances, it achieved near-universal participation while maintaining the principle of common but differentiated responsibilities. However, this flexibility came at the cost of ambition, with the first round of NDCs collectively putting the world on track for approximately 3°C of warming rather than the Agreement’s 1.5-2°C goal (**unep2017?**).

2.2 Adaptation

As the targets set in the Kyoto protocol were deemed inadequate to deal with the climate crisis, and Governments faced resistance to mitigation measures from lobbyists and citizens, climate adaptation became more visible and was adapted as the second pillar at COP16 in Cancun in 2010 [source]. This emerged from growing recognition that even with ambitious mitigation efforts, some climate impacts were already occurring and others were inevitable, necessitating organized adaptation efforts (**klein2003?**).

The development of adaptation within the UNFCCC progressed gradually before its formal establishment as a pillar. Early efforts included the 2001 establishment of the Least Developed Countries Fund (LDCF) and Special Climate Change Fund (SCCF) under the Global Environment Facility, as well as the Adaptation Fund under the Kyoto Protocol. The 2004 Buenos Aires Programme of Work on Adaptation and Response Measures and the 2006 Nairobi Work Programme on Impacts, Vulnerability, and Adaptation provided frameworks for knowledge sharing and capacity building (**khan2016?**).

The Cancun Adaptation Framework established several important mechanisms, including the Adaptation Committee to promote coherent implementation of adaptation actions, the process for formulating and implementing National Adaptation Plans (NAPs), and approaches to address loss and damage. This framework represented a significant step forward in balancing adaptation and mitigation within the climate regime (**roberts2011?**).

Climate adaptation are all measures to reduce climate damages. In industrialized countries, adaptation usually means managing surface runoff and in low-lying countries, sea-level level rise and storm surges, with a mix of mechanical- and nature-based interventions. These include infrastructure modifications like sea walls, expanded drainage systems, and elevated buildings, alongside ecosystem-based approaches like wetland restoration, managed retreat from coastlines, and urban greening (**kates2012?**).

In developing countries, this process is more complex and something I will explore further below Chapter 3. Adaptation in these contexts intersects with broader development challenges, including poverty reduction, food security, water management, disaster risk reduction, and public health. The boundaries between adaptation and development are often blurred, leading to debates about “adaptation mainstreaming” versus transformative approaches to adaptation (**ayers2012?**).

The adaptation landscape includes diverse financing mechanisms, including the Adaptation Fund (established under the Kyoto Protocol), the Least Developed Countries Fund, the Special Climate Change Fund, and the Green Climate Fund. Despite these multiple channels, adaptation finance has consistently lagged behind mitigation finance, creating tensions in international negotiations (**khan2019?**). The Green Climate Fund, established in 2010 and operationalized in 2015, has a mandate to balance its funding between mitigation and adaptation, but has struggled to achieve this balance in practice (**nakhooda2015?**).

Adaptation funding is further complicated by challenges in defining and measuring adaptation outcomes, attributing climate impacts, and ensuring funds reach the most vulnerable communities (**barrett2014?**). The absence of universally agreed metrics for assessing adaptation effectiveness—unlike mitigation, where greenhouse gas emissions provide a common metric—creates challenges for prioritizing investments and demonstrating results (**bours2014?**).

Private sector engagement in adaptation has been more limited than in mitigation, where carbon markets and renewable energy investments have created clearer business opportunities. Adaptation often involves public goods like flood protection or heat warning systems that don’t generate direct financial returns, making private investment more challenging (**surminski2018?**). Insurance mechanisms represent one area of private sector engagement, with initiatives like the InsuResilience Global Partnership aiming to expand climate risk insurance coverage in vulnerable countries (**weingärtner2017?**).

The adaptation governance landscape is further complicated by its multi-level nature, with actions required at global, regional, national, and local scales. International frameworks provide guidance and resources, but adaptation is inherently context-specific, requiring localized assessment of vulnerabilities and appropriate responses (**adger2005?**). This creates challenges

for coherence across scales and for ensuring that global policies and financing mechanisms effectively support local adaptation needs.

2.3 Loss and damage

Loss and damage grew more prominent in UNFCCC negotiation as new knowledge was produced and activism from small island developing states highlighted, that some nations could disappear due to sea level rise, if climate action was not intensified [source]. The concept emerged from the recognition that there are limits to adaptation—some climate impacts simply cannot be adapted to, particularly for vulnerable nations facing existential threats (**warner2013?**).

The Alliance of Small Island States (AOSIS) first proposed an international insurance pool for loss and damage from sea-level rise in 1991, well before the UNFCCC was established. However, the concept only gained significant traction two decades later, with the establishment of the Warsaw International Mechanism for Loss and Damage in 2013, and its subsequent incorporation into Article 8 of the Paris Agreement (**boyd2017?**). This long struggle reflects persistent resistance from developed countries concerned about liability and compensation claims, with the United States in particular insisting on language in the Paris Agreement explicitly stating that Article 8 “does not involve or provide a basis for any liability or compensation” (**calliari2018?**).

This led to both a sharpening of the original target from 1997, to a new one to limit global warming to 1.5° C, and the establishment of the loss and damage pillar [source]. The 1.5°C target emerged largely from research showing the dramatically different implications of 1.5°C versus 2°C warming, particularly for vulnerable regions and ecosystems. The IPCC Special Report on Global Warming of 1.5°C, released in 2018, provided comprehensive scientific evidence for these differences, noting substantially reduced risks at 1.5°C compared to 2°C (**ipcc2018?**).

Loss and damage is meant to compensate for damages *beyond adaptation* (Janzen et al., 2021). It is mainly understood in two ways. First, as a form of legal process, within domestic courts or under the UNFCCC umbrella. In this process, damages from an event are calculated, the contribution of climate change to the event is established, the responsibility for the emissions are attributed, and the damages are compensated [source]. This approach draws on principles of international environmental law, particularly the “polluter pays” principle and the concept of state responsibility for transboundary harm (**mayer2017?**).

Climate attribution science has advanced significantly in recent years, with methodologies now able to quantify the extent to which climate change has increased the likelihood or intensity of specific extreme events (**otto2017?**). This scientific progress strengthens the potential for legal approaches to loss and damage, though significant challenges remain in establishing causation chains from emissions to specific damages and in allocating responsibility among multiple emitters over time.

Second, as a form of risk management, where risk is reduced through adaptation measures, transferred through insurance schemes and retained through resilience measures [source]. This approach includes both economic and non-economic losses, with the latter encompassing losses of culture, identity, territory, and indigenous knowledge that cannot be readily monetized (**barnett2016?**). Insurance-based approaches have gained particular traction, with initiatives like the InsuResilience Global Partnership aiming to provide climate and disaster risk finance and insurance solutions to 500 million vulnerable people (**weingärtner2019?**).

A breakthrough came at COP27 in Sharm el-Sheikh with the establishment of funding arrangements for loss and damage, followed by the operationalization of the Loss and Damage Fund at COP28 in Dubai. These developments represent significant progress, though questions remain about the fund’s size, who contributes, who can access it, and under what circumstances (**roberts2023?**). Initial pledges totaled approximately \$700 million—far below estimates of loss and damage costs, which range from \$290-580 billion annually by 2030 for developing countries alone (**markandya2018?**).

COP	Place	Date	Happening
	Rio de Janeiro	1992	The UNFCCC is established
3	Kyoto	1997	The climate mitigation pillar
10	Cancun	2010	The climate adaptation pillar
21	Paris	2015	The climate loss and damage pillar
29	Baku	2024	\$300 bn is pledged for climate resilience

: Timeline of the main climate summits {.striped .hover}

2.4 UNFCCC negotiations

The UNFCCC understands climate damages, all the negative effects of climate change, as a kind of spillover effect. Unmitigated emissions lead to damages, unadapted damages causes losses that have to be compensated. Since the UNFCCC, like most international agreements, is negotiated by countries that have to balance their need for strong policy action and future uncertainty, the process is ambiguous (Hall & Persson, 2018). This ambiguity manifests in deliberately vague language that can accommodate divergent interpretations, allowing countries with different positions to claim the agreement supports their view (**bodansky2016?**).

UNFCCC negotiations involve complex interactions between different country groupings with varying interests and capabilities. These include the G77 and China (representing over 130 developing countries), the Least Developed Countries (LDCs), the Alliance of Small Island States (AOSIS), the European Union, the Umbrella Group (including the US, Japan, Australia and others), and the Environmental Integrity Group (**betzold2012?**). These coalitions provide developing countries with greater negotiating power than they would have individually, though the diverse interests within groups like the G77 can create internal tensions (**ciplet2015?**).

The dynamics within these negotiations reflect broader power imbalances in the international system. Technical complexity, language barriers, delegation size disparities, and limited institutional capacity create challenges for many developing countries, despite formal procedural equality (**schroeder2010?**). Civil society organizations often provide technical support to vulnerable country delegations, while also using various forms of advocacy to influence the negotiation process (**allan2020?**). The private sector, particularly fossil fuel industries, also exercises significant influence, both through direct lobbying and by shaping national positions of major economies (**newell2000?**).

Many see the relationship between climate action and economic growth as opposites, resisting binding agreements and preferring unsubstantiated goals. This tension often manifests in debates over the scale and nature of economic transformation required to address climate change effectively. Economic analyses have traditionally framed climate policy as imposing costs that must be weighed against the benefits of avoided damages, with models typically showing modest optimal carbon prices that increase gradually over time (**nordhaus2019?**).

The Convention has room for multiple interpretations of most aspects of it, and there are two main ways of the relation between the pillars. The first one is that the goal is to *minimize the damage* as much as possible by mitigating as much as possible, and that adaptation and loss and damage are there as a safety precaution. This perspective, often advanced by developed countries and mainstream economic analyses, emphasizes maximizing mitigation efforts to reduce the need for adaptation and loss and damage measures (**tol2009?**).

The second is that there exists an *optimal combination of mitigation, adaptation, and loss and damage* that uses the resources more efficiently. This view, grounded in economic efficiency logic, suggests balancing investments across all three pillars based on cost-benefit analyses that consider the marginal returns to different types of climate action (**tol2018?**). It recognizes that some level of climate change is already unavoidable, making adaptation necessary regardless of mitigation efforts, and that in some cases, adaptation may be more cost-effective than extremely expensive mitigation options.

This economically-oriented framing has been criticized for several reasons. First, it tends to obscure questions of justice and equity by focusing narrowly on aggregate costs and benefits without adequate attention to their distribution (**adger2006?**). Second, it struggles to account for non-economic values, including cultural heritage, biodiversity, and human lives, that cannot be readily monetized (**fanning2020?**). Third, it typically applies high discount rates that effectively devalue future impacts, raising intergenerational equity concerns (**stern2007?**).

Beyond these economic frameworks, some scholars and activists argue for rights-based or justice-oriented approaches that prioritize the needs and perspectives of those most vulnerable to climate impacts, regardless of economic efficiency calculations (**schlosberg2014?**). These approaches emphasize historical responsibility for emissions, procedural justice in decision-making, and recognition of diverse values and knowledge systems.

Indigenous perspectives offer yet another framing that often emphasizes relationships, reciprocity, and responsibilities to future generations and non-human beings (**whyte2017?**).

These approaches typically involve more holistic understandings of climate change that situate it within broader patterns of colonialism, extraction, and disruption of Indigenous relationships with lands and waters.

These diverse perspectives on the relationship between mitigation, adaptation, and loss and damage reflect broader tensions in climate governance between technocratic approaches that seek optimal policy designs and more political approaches that emphasize power, justice, and competing values (**hulme2010?**). The integration of these three pillars continues to evolve, with ongoing debates about their proper balance, financing, and implementation. As climate impacts intensify and the window for limiting warming to 1.5°C narrows, these discussions take on increasing urgency within and beyond the UNFCCC process (**roberts2021?**).

The formal separation of these pillars within the climate regime reflects both organizational convenience and political compromises, but in practice, they are deeply interconnected. The level of mitigation determines the scale of adaptation and loss and damage needed, while effective adaptation reduces but does not eliminate loss and damage. Recognizing these interconnections, some scholars and practitioners advocate for more integrated approaches to climate governance that address all three pillars in coordinated ways (**klein2007?**).

These debates about the relationship between mitigation, adaptation, and loss and damage are not merely academic but have profound implications for the direction of climate policy and finance. They shape decisions about resource allocation, institutional arrangements, and priority-setting at international, national, and local levels. As climate impacts intensify and the limitations of conventional approaches become increasingly apparent, these fundamental questions about how to conceptualize and respond to climate change remain at the center of climate politics and governance.

3 Literature review: Nexus and regime

As mentioned above Chapter 2, this section will present the two main strands of climate adaptation research. One is sympathetic, the adaptation nexus, while the other is critical, the adaptation regime. Climate adaptation is concerned with vulnerability to climate damages, and the main disagreement is in the production of vulnerability.

The literature in this field maps onto the thinking in the field of development studies, where the study of interventions, projects that seek to change societies abroad, has a long theoretical history. These competing paradigms reveal fundamentally different understandings of what adaptation is, how vulnerability is produced, and consequently, what appropriate interventions look like.

3.1 Adaptation nexus

This approach has its roots in participatory movements in the 1990s, critiquing the then paradigm of top-down development research and practice, preoccupied with governmental institutions (Chambers, 1994; Freire, 1970). The participatory turn emerged as a response to decades of failed development interventions that imposed external solutions without understanding local contexts or incorporating local knowledge. Paulo Freire’s critical pedagogy emphasized dialogue and conscientization as alternatives to what he termed the “banking model” of education and development, where experts simply deposited knowledge into supposedly empty vessels (Freire, 1970). Robert Chambers similarly challenged development professionals to examine their biases and recognize the value of local expertise, famously advocating for “putting the last first” (Chambers, 1994).

The researcher was not to observe and report, but had the ethical responsibility to include and empower the communities they researched (Desai & Potter, 2006). This ethical reorientation reflected broader epistemological shifts in development studies, recognizing multiple ways of knowing and the value of situated knowledge. Researchers were encouraged to view themselves as facilitators rather than experts, working alongside communities to co-produce knowledge rather than extracting data for academic purposes (Desai & Potter, 2006). This represented a significant departure from conventional research methodologies that maintained clear boundaries between researcher and subject.

New methods were developed to better map communities and engage them in knowledge production, such as participatory rural appraisal [source]. These methodologies included techniques like transect walks, community mapping, seasonal calendars, and wealth ranking exercises that enabled communities to visualize and analyze their own situations. Unlike conventional survey techniques that often reinforced power differentials, these approaches were designed to be accessible to non-literate participants and to foster collective analysis. The emphasis on visual tools and group discussions helped bypass literacy barriers and created opportunities for more inclusive participation, particularly among marginalized community members (Chambers, 1994).

The data collected was used with new analytical framework centering the individual and communities. These frameworks analyzed how livelihoods were stitched together with a mix of assets, endowments, capabilities (Sen, 2000), shaped by access (Ribot & Peluso, 2003) and aspirations (Appadurai, 2004), amongst others. The Sustainable Livelihoods Framework became particularly influential, conceptualizing households as managing portfolios of five types of capital—natural, physical, financial, human, and social—in pursuit of diverse livelihood strategies (scoones1998?). This framework provided a more holistic understanding of how people navigate complex environments than previous approaches focused narrowly on income or employment.

Amartya Sen’s capabilities approach similarly shifted focus from resources or income to what people can actually do and be with those resources (Sen, 2000). By emphasizing capabilities rather than commodities, this framework highlighted how the same resources might translate into very different outcomes depending on various conversion factors, including personal characteristics, social arrangements, and environmental conditions. This approach provided a normative framework for evaluating development interventions based on their contribution to expanding substantive freedoms rather than simply increasing income or consumption.

Jesse Ribot’s theory of access complemented these frameworks by examining the mechanisms through which people gain, control, and maintain access to resources (Ribot & Peluso, 2003). This approach went beyond formal property rights to consider how access is shaped by technology, capital, markets, labor, knowledge, authority, identity, and social relations. By highlighting these multiple mechanisms, Ribot’s work helped explain why formal rights often fail to translate into actual benefits for marginalized groups and how power operates in resource governance.

This gave valuable insight into how societies functioned, and sparked new forms of interventions, with a focus on co-management and knowledge transfer. Community-based natural resource management (CBNRM) emerged as one application of these insights, based on the premise that local users with secure rights over resources would manage them more sustainably than distant state authorities (agrawal2001?). Co-management approaches similarly sought to establish partnerships between local communities and state or non-state actors in resource governance, recognizing that neither complete centralization nor complete decentralization was optimal in most contexts (ostrom2009?).

These approaches were not without criticism. Some scholars argued that participatory methods could be co-opted by powerful actors, reinforcing rather than challenging existing power structures (**cooke2001?**). Others noted that an uncritical focus on “the local” might romanticize communities and obscure internal divisions along lines of gender, class, caste, or age (**agarwal2001?**). Nevertheless, these frameworks and approaches represented an important shift in development thinking toward more contextually sensitive and participatory approaches.

This strand of research has since become a part of the mainstream development discourse, and variations on the participatory methods being implemented by the largest aid organizations like the World Bank [source]. The World Bank’s adoption of “community-driven development” approaches in the early 2000s represented a significant institutionalization of participatory methods, with billions of dollars channeled through programs emphasizing community control over planning decisions and resources (**mansuri2013?**). Similarly, the United Nations Development Programme incorporated community-based adaptation into its climate programming, emphasizing local knowledge and decision-making while providing technical and financial support.

They see climate adaptation as just one policy area amongst all the others, and is searching for some key sectors and for synergies between them [source]. This “mainstreaming” approach seeks to incorporate adaptation considerations into existing development planning and sectoral policies rather than treating adaptation as a standalone issue (**huq2004?**). Proponents argue that mainstreaming promotes efficiency, sustainability, and coherence across different policy domains. Key sectors typically identified for adaptation mainstreaming include agriculture, water management, health, disaster risk reduction, and infrastructure (**klein2007?**).

The search for synergies between adaptation and other policy objectives has been particularly prominent in discussions of “co-benefits,” where interventions simultaneously advance adaptation goals while yielding benefits in areas such as mitigation, biodiversity conservation, or poverty reduction. This emphasis on multiple benefits aligns with the efficiency logic of mainstream development institutions and responds to the reality of limited resources for addressing multiple challenges.

One example of this could be tree planting projects, that while their main purpose is carbon sequestration, the project could contribute in many ways:

- Economic security through the sale of forest carbon credits to the global north. If the tree is planted as a part of a farming system as a form agroforestry, the wood could be seen as a form of long-term investment that could be harvested in 30 years
- Food security through production of fruit
- Gender equality by giving the responsibility for managing the trees to women
- Environmental security by providing shade with leaves and reduce soil erosion with roots.

This example illustrates the nexus approach’s emphasis on finding interventions that address multiple objectives simultaneously. By framing tree planting as contributing to climate mit-

igation, adaptation, economic development, gender equality, and environmental protection, proponents can appeal to diverse stakeholders and funding sources. Similar multi-purpose framings can be found in integrated water resource management, climate-smart agriculture, and ecosystem-based adaptation (Almenar et al., 2021).

The adaptation nexus approach has gained traction partly because it aligns well with existing institutional arrangements and funding streams. By emphasizing the integration of adaptation into existing development sectors and identifying potential synergies between adaptation and other objectives, this approach minimizes disruption to established organizational structures and processes. This alignment makes the approach attractive to large development institutions and bilateral donors that prefer working through existing channels and frameworks (Schipper, 2020).

The nexus approach is also compatible with the rise of resilience thinking in development and adaptation. Resilience frameworks emphasize building the capacity of systems (whether households, communities, or ecosystems) to absorb shocks, self-organize, and adapt or transform in response to change (folke2006?). This emphasis on building adaptive capacity aligns well with the nexus approach’s focus on enhancing assets, capabilities, and institutional arrangements across multiple sectors.

The nexus understanding sees vulnerability as an individual’s *lack* of certain skill, capability, or access to a resource. When the right resource is given, it is expected to start an upwards spiral, where outcomes will improve in all other fields as well. This conceptualization of vulnerability focuses on characteristics of individuals or communities that make them susceptible to harm, such as limited assets, poor infrastructure, or weak institutions (kelly2000?). It tends to frame vulnerability as a condition rather than a process, emphasizing what people lack rather than examining how and why they came to lack these resources or capabilities.

This framing aligns with asset-based approaches to development that focus on building the capitals that households and communities can draw upon to respond to stresses and shocks. By enhancing these assets and capabilities, the logic goes, individuals and communities will be better able to navigate not only climate challenges but a range of other stresses they might face. This logic underpins many mainstream adaptation interventions, from livelihood diversification programs to improved infrastructure to early warning systems (lemons2007?).

However, this framing has been criticized for its tendency to depoliticize vulnerability by focusing on technical solutions without addressing the structural factors that create vulnerability in the first place. Critics argue that by framing vulnerability as primarily a problem of individual or community capacity, the nexus approach may inadvertently place responsibility for adaptation on those with the least resources and power to transform the systems that produce vulnerability (taylor2015?).

Moreover, the emphasis on synergies and win-win solutions may obscure difficult trade-offs and competing interests that are inherent in adaptation decision-making. Not all stakeholders will benefit equally from particular adaptation interventions, and some may even be harmed. The

nexus approach's tendency to emphasize positive synergies may inadequately prepare practitioners for navigating these difficult trade-offs and power dynamics (Eriksen et al., 2021).

Despite these critiques, the adaptation nexus approach remains highly influential in both research and practice, particularly among major development institutions and funding agencies. Its practical orientation, compatibility with existing institutional structures, and promise of addressing multiple objectives simultaneously contribute to its continued dominance in mainstream adaptation discourse.

3.2 Adaptation regime

The adaptation regime has its roots in the deconstructionist anthropology of development (Lewis & Mosse, 2006). It is heavily influenced by the work of Michael Foucault, and critiques of the *discourse of development*. The discourse, as “a system of knowledge practices, technologies, and power relationships” that orders the relationships between people and institutions. (Lewis & Mosse, 2006, p. 4). This approach draws from post-structural theory, particularly Foucault's concepts of discourse, governmentality, and biopolitics, to analyze how power operates through knowledge production and institutional practices (Lewis & Mosse, 2006).

Central to this perspective is the understanding of discourse not simply as language but as a system that structures what can be thought, said, and done in a particular domain. Discourses establish “regimes of truth” that determine what counts as valid knowledge and who is authorized to speak it (foucault1980?). From this perspective, development discourse constructs its objects (underdevelopment, poverty, vulnerability) in ways that simultaneously create the need for intervention and position certain actors (experts, development institutions) as uniquely qualified to intervene (Escobar, 1995).

The discourses that order the relationships between rich and poor countries change over time, and development had replaced civilization, just as civilization had replaced God before it (Ferguson, 1994).¹ The seminal pieces here are Escobar (1995)'s deconstruction of the development discourse in Latin-America and the start of a post-development field of study and Ferguson (1994)'s deconstruction of development projects, and finding that the projects fail in predictable ways.

Ferguson's ethnographic study of development in Lesotho demonstrated how development interventions, even when failing to achieve their stated objectives, successfully expand bureaucratic state power and depoliticize poverty by rendering it a technical problem rather than a political one (Ferguson, 1994). His concept of the “anti-politics machine” highlights how development discourse systematically represents poverty and underdevelopment as technical problems requiring technical solutions, effectively sidelining questions of politics, power, and structural inequality. By framing complex political-economic realities as technical challenges amenable to expert intervention, development discourse limits the space for radical alternatives and reinforces existing power relations.

Escobar similarly traced how development discourse constructed the “Third World” as an object of knowledge and intervention, establishing relationships of power between experts and those to be “developed” (Escobar, 1995). He documented how development institutions, from the World Bank to bilateral aid agencies to NGOs, produce and disseminate knowledge about developing countries that reinforces certain ways of seeing and intervening while marginalizing others. This knowledge production constitutes a form of power that shapes what interventions are considered legitimate, what outcomes are valued, and whose expertise counts.

These critiques laid the groundwork for the post-development school, which questioned whether development should be reformed or rejected altogether. Rather than seeking better development, post-development scholars called for alternatives to development—approaches that break with the epistemological and institutional frameworks of conventional development and create space for diverse ways of knowing and being (rahnama1997?). This perspective emphasized the importance of local, indigenous, and non-Western knowledge systems and practices that had been marginalized by dominant development discourse.

As nature and climate discourses grew to prominence, Agrawal (2005) argued that the new relationships should be understood as a form of *environmentality*. Adapting Foucault’s concept of governmentality to environmental contexts, Agrawal examined how environmental governance regimes produce new kinds of environmental subjects who come to care about and act toward the environment in new ways (Agrawal, 2005). His ethnographic study of forest councils in Kumaon, India, demonstrated how participation in new regulatory regimes transformed local residents’ subjectivities and relationships to forest resources over time.

This concept of environmentality provided a theoretical bridge between Foucauldian analyses of development and emerging critiques of environmental governance. It highlighted how environmental interventions, like development projects, operate not simply through coercion but through reshaping how people understand themselves and their relationships to the natural world. This perspective is particularly relevant for understanding climate adaptation, which often involves similar processes of knowledge production, subject formation, and governance at multiple scales.

Paprocki (2018) describes it as an *Adaptation regime* based on her field work in Bangladesh. She argues that some countries are constructed as climate vulnerable and therefore in need of climate adaptation and that this imaginary is closely related to other historical processes of colonialism. Through careful ethnographic work in coastal Bangladesh, Paprocki documents how a diverse set of actors, including government officials, NGO workers, scientists, and donor agency representatives, collectively produce knowledge about climate vulnerability that justifies particular kinds of interventions while foreclosing others (Paprocki, 2018).

This production of Bangladesh as the “ground zero” of climate change operates through what Paprocki terms “anticipatory ruination”—the rendering of certain places as already lost, which justifies radical interventions that might otherwise face resistance. This discursive production of climate vulnerability is not politically neutral but aligned with particular development

visions that privilege urbanization, export-oriented growth, and market-based solutions over rural livelihoods and communities (Paprocki, 2018).

All societal issues are reduced to be climate related, and unavoidable. This dystopian imaginary builds the groundwork for extensive experimentation, since the dystopian outlook eliminates the possible downsides. This “climate reductionism” transforms complex social, economic, and political challenges into technical problems of climate vulnerability, effectively depoliticizing issues like poverty, inequality, and land rights (**taylor2015?**). By framing climate impacts as inevitable and beyond human control, the adaptation regime eliminates the space for questioning whether particular interventions are necessary or desirable, or whose interests they serve.

This, she argues, leads to dispossession as land is taken for shrimp aquaculture and migration to the cities is promoted. The poor and vulnerable that were supposed to be helped, simply are not (Paprocki, 2018). Paprocki documents how adaptation interventions in coastal Bangladesh have facilitated a transition from rice farming to export-oriented shrimp aquaculture, displacing smallholder farmers and agricultural laborers. This dispossession is justified in the name of climate adaptation, with shrimp farming presented as more viable in a climate-changed future despite its negative social and environmental impacts (Paprocki, 2018).

Similarly, rural-to-urban migration is framed as an adaptive response to climate change rather than a consequence of policies that undermine rural livelihoods. This framing naturalizes displacement as inevitable rather than acknowledging how particular development choices create conditions that make rural livelihoods increasingly precarious. The adaptation regime thus serves to legitimize and accelerate existing processes of agrarian transition and urbanization while obscuring the political choices and power relations that shape these processes (Paprocki, 2018).

Dewan (2022) further develops this, highlighting the building of dams and polders as flood protection. She argues the polders built as a climate adaptation measure, are the same as the old for flood protection, and are successful at acquiring funding. Climate adaptation was *the spice* that made their applications for funding work. The only issue was that the polders did not work. By blocking the seasonal flooding and draining, the rivers became silted and needed dredging, furthering the risk of floods (Dewan, 2022).

Dewan’s analysis illustrates how the adaptation regime recycles old development interventions under new climate adaptation labels. Polders (embankments designed to protect low-lying land from flooding) had been constructed in Bangladesh since the 1960s, with mixed results. Yet rather than learning from these experiences, similar interventions were repackaged as climate adaptation to access new funding streams. This “adaptation as spice” phenomenon reveals how the climate adaptation label is used to legitimize and secure funding for interventions that might otherwise face scrutiny or resistance (Dewan, 2022).

Moreover, Dewan shows how these interventions often fail on their own terms, creating new vulnerabilities rather than reducing existing ones. By disrupting natural hydrological processes, the polders contributed to river siltation, waterlogging, and increased flood risk—precisely the

problems they were supposed to address. This pattern of maladaptation highlights the limits of technical approaches that fail to engage with complex social-ecological systems and the knowledge of those who inhabit them (Dewan, 2022).

The adaptation regime critique extends beyond Bangladesh to other contexts where similar dynamics operate. In the Pacific Islands, scholars have documented how the construction of small island states as inevitably disappearing due to sea level rise has justified interventions focused on migration rather than supporting communities' desires to remain and adapt in place (**farbotko2010?**). This "drowning islands" discourse constructs Pacific Islanders primarily as future climate refugees, obscuring their agency, resilience, and ongoing adaptation efforts. It also shifts attention from the responsibilities of high-emitting countries to reduce emissions to the supposed inevitability of displacement (**barnett2016?**).

In sub-Saharan Africa, critical analyses have shown how adaptation programs often prioritize commercial agriculture and market integration over strengthening existing livelihood strategies and local knowledge systems (**taylor2013?**). Climate adaptation has become a vehicle for promoting particular agricultural models, such as climate-smart agriculture, that align with the interests of global agribusiness and carbon markets rather than the needs and priorities of smallholder farmers. These interventions often emphasize technological solutions and market mechanisms while marginalizing social, cultural, and political dimensions of vulnerability (**eriksen2015?**).

In the context of urban adaptation, scholars have documented how adaptation planning in cities like New York, Rotterdam, and Mumbai privileges the protection of valuable real estate and economic assets over addressing the needs of marginalized communities (**anguelovski2016?**). These interventions often reproduce existing patterns of socio-spatial inequality, with adaptation benefits accruing disproportionately to already privileged groups while adaptation burdens fall more heavily on the poor and marginalized (**shi2016?**).

Across these diverse contexts, similar patterns emerge of vulnerability being constructed in ways that align with existing development paradigms rather than challenging them. Adaptation interventions reproduce rather than transform the political-economic relations that generate vulnerability in the first place. The adaptation regime operates not through simple imposition but through the production of knowledge, subjects, and governance arrangements that make particular approaches seem natural, necessary, and inevitable (**eriksen2015?**).

Critics have also examined the role of visualization technologies and media representations in producing the adaptation regime's dystopian imaginaries. Climate models, vulnerability maps, and disaster photography together constitute what Donna Haraway calls "God tricks"—seemingly objective perspectives that mask their partial and situated nature (**haraway1988?**). These visual technologies produce certain places and populations as exceptionally vulnerable, justifying interventions by external experts while often marginalizing local understandings of environmental change and appropriate responses (**mahony2016?**).

The adaptation regime critique does not deny the reality of climate impacts or the need for adaptation. Rather, it questions who defines what adaptation means, whose knowledge counts

in designing interventions, and who benefits from adaptation funding. It calls attention to how adaptation discourses and practices can reproduce rather than challenge existing power relations, and how they may foreclose alternative futures that do not align with dominant development paradigms (Scoville-Simonds et al., 2020).

This critical perspective has begun to influence adaptation practice, with growing attention to questions of justice, transformation, and alternative knowledge systems. Some scholars and practitioners are exploring how adaptation might be reimagined as a site of contestation and possibility rather than technical management—a space where communities can articulate and pursue their own visions of climate-just futures (**nightingale2015?**). These approaches emphasize the political nature of adaptation decisions and seek to democratize adaptation governance in ways that center the agency and knowledge of those most affected by climate impacts.

Perhaps most fundamentally, the adaptation regime critique challenges us to rethink what counts as adaptation and who gets to decide. It suggests that true adaptation may require transforming the social, economic, and political systems that produce vulnerability in the first place, rather than simply adjusting to their outcomes. This may involve reimagining and reconfiguring relationships between humans and non-humans, between present and future generations, and between different ways of knowing and being in the world (Ireland & McKinnon, 2013).

Part II

Research design

4 Theory: Development Ontology and Epistemological Diversity

Climate adaptation discourse operates at the intersection of multiple knowledge systems and worldviews, each with distinct assumptions about what constitutes valid knowledge, how we understand vulnerability, and what futures are possible or desirable. This chapter develops a theoretical framework for analyzing discourse centralization in climate adaptation through the lens of development ontology and epistemological diversity.

The central theoretical tension I explore is between homogenizing global discourses and diverse epistemological traditions. Climate adaptation represents a particularly revealing site for examining this tension because it necessarily involves negotiating between standardized global frameworks and diverse local realities. As international institutions, national governments, and local communities engage with adaptation challenges, they draw upon different knowledge systems, temporal frameworks, and understandings of human-environment relationships that may align or conflict with one another (schipper2006?).

This theoretical framework is informed by several interdisciplinary fields, including development studies, future studies, science and technology studies, and political ecology. By bringing these perspectives together, I aim to develop an analytical lens that can help us understand the power dynamics at play in how adaptation is conceptualized and implemented across different contexts. This framework will guide my empirical analysis of discourse centralization in National Adaptation Plans, providing theoretical grounding for interpreting patterns of homogeneity or diversity in adaptation discourse.

The chapter proceeds as follows: First, I discuss the concept of epistemological diversity through the lens of Epistemologies of the South, exploring how Northern knowledge systems have often marginalized alternative ways of knowing that might offer valuable insights for adaptation. Second, I examine different ontological perspectives that shape adaptation approaches, particularly focusing on tensions between technocratic and relational ontologies. Third, I analyze how “the local” and “the global” are constructed and related in adaptation discourse, with particular attention to how scale operates as a political technology. Fourth, I explore how adaptation discourse shapes future possibilities through processes of both future-making and defuturing. Finally, I develop the concept of discourse centralization as a theoretical framework for my empirical analysis.

4.1 Epistemologies of the South

A critical starting point for understanding epistemological diversity in climate adaptation is Boaventura de Sousa Santos' concept of "Epistemologies of the South." Santos argues that modern Western knowledge production has systematically rendered alternative knowledge systems invisible through what he terms "epistemicide" – the elimination or marginalization of knowledge systems that do not conform to dominant scientific paradigms (santos2014?). This cognitive injustice parallels the material injustices of climate change itself, where those least responsible for emissions often face the greatest impacts while having the least voice in shaping response strategies.

Santos identifies two key problems in dominant knowledge systems: the "epistemological problem" concerning what counts as knowledge and who can produce it, and the "ontological problem" concerning what exists and how we relate to it (santos2014?). Both problems are evident in climate adaptation discourse, where certain forms of expert knowledge (particularly climate science, economics, and engineering) are typically privileged over indigenous, local, and experiential knowledge. This privileging occurs despite growing recognition that addressing complex challenges like climate adaptation requires diverse knowledge systems working in complementarity rather than hierarchy (nightingale2016?).

The concept of cognitive justice, central to Santos' framework, suggests that there can be no social justice without recognizing the validity and value of diverse ways of knowing (santos2014?). In the context of climate adaptation, cognitive justice would require creating space for multiple knowledge systems to inform how vulnerability is understood and addressed. This does not mean uncritically accepting all knowledge claims as equally valid but rather recognizing that different knowledge systems have different strengths, limitations, and domains of applicability (watson-verran1993?).

Santos proposes an "ecology of knowledges" as an alternative to epistemological monocultures. Rather than positioning Western scientific knowledge as inherently superior to other forms of knowledge, an ecology of knowledges recognizes the partial and situated nature of all knowledge systems and seeks productive dialogue between them (santos2014?). This approach aligns with calls from scholars and practitioners for more pluralistic and inclusive approaches to climate adaptation that draw on diverse knowledge systems (naess2005?).

In practice, creating an ecology of knowledges in climate adaptation faces significant challenges. Institutional structures, funding mechanisms, and professional incentives often reinforce the dominance of particular knowledge systems and marginalize others (Escobar, 2020). Language barriers, power differentials, and different ontological assumptions can make meaningful dialogue across knowledge systems difficult. Moreover, the urgency of climate impacts can be used to justify bypassing deliberative processes in favor of rapid expert-driven interventions (eriksen2015?).

Despite these challenges, there are growing examples of efforts to create more epistemologically diverse approaches to adaptation. These include community-based adaptation initiatives that

center local knowledge and priorities, indigenous-led adaptation planning that draws on traditional ecological knowledge, and transdisciplinary research approaches that bring together diverse forms of expertise (Ireland & McKinnon, 2013). These examples suggest alternatives to the dominant adaptation paradigm that might better address the complex challenges posed by climate change.

4.2 Development Ontologies

Ontological assumptions—fundamental beliefs about the nature of reality, causality, and change—shape how vulnerability and adaptation are conceptualized and addressed. Different development ontologies produce radically different understandings of what adaptation is and how it should be pursued. These ontological differences often remain implicit in adaptation discourse but significantly influence which approaches are considered legitimate or feasible (Goode & Godhe, 2017).

A technocratic ontology frames vulnerability as primarily a technical problem requiring expert solutions. This perspective emphasizes quantification, prediction, and control, viewing adaptation as a process of adjusting systems to accommodate projected climate impacts. Technologies and management techniques are positioned as primary solutions, with effectiveness measured through standardized indicators and metrics (**nightingale2016?**). This ontological perspective aligns with what Inayatullah terms the “predictive-empirical” approach to futures, which focuses on forecasting trends and designing responses based on these predictions (Inayatullah, 1998).

The technocratic ontology is evident in many mainstream adaptation approaches, from climate-resilient infrastructure projects to early warning systems to precision agriculture. While these approaches can deliver important benefits, they may also reinforce existing power structures by positioning adaptation as requiring specialized expertise that is primarily available from Northern institutions and experts (Eriksen et al., 2021). This ontological perspective often treats biophysical climate impacts as primary while treating social, political, and economic factors as secondary context, despite evidence that these factors fundamentally shape vulnerability and adaptive capacity (**o?’brien2007**).

In contrast, a relational ontology understands vulnerability as embedded in dynamic social-ecological relationships and power dynamics. This perspective emphasizes connectivity, emergence, and transformation, viewing adaptation as a process of reconfiguring relationships between humans and non-humans, present and future generations, and different forms of knowledge (**nightingale2015?**). Rather than seeing systems as collections of discrete entities that can be independently manipulated, a relational ontology sees them as constituted through ongoing relationships that cannot be reduced to their component parts (**ingold2011?**).

The relational ontology is evident in approaches to adaptation that emphasize social learning, ecosystem-based adaptation, and community-led transformations. These approaches tend to

be more process-oriented than outcome-oriented, focusing on building capacity for ongoing adaptation rather than implementing fixed solutions (**elling2011?**). They may draw on indigenous and traditional knowledge systems that often embody relational understandings of human-environment interactions (**whyte2017?**).

Another significant ontological distinction is between market-based and commons-based approaches to adaptation. A market-based ontology prioritizes economic efficiency and private sector solutions, viewing adaptation primarily through the lens of managing climate risks to investments and assets. This perspective often emphasizes property rights, insurance mechanisms, and market incentives as key tools for adaptation (**surminski2018?**). It aligns with neoliberal approaches to development that favor market-based solutions to social and environmental challenges.

In contrast, a commons-based ontology centers collective governance and shared resources, viewing adaptation as a process of sustaining and enhancing commons that support community resilience (**bollier2014?**). This perspective emphasizes cooperative institutions, collective action, and non-market forms of value. It aligns with alternative development approaches that recognize the limits of market mechanisms for addressing public goods and intergenerational justice (**ostrom2009?**).

These ontological differences are not merely abstract philosophical disagreements but shape concrete adaptation practices and outcomes. They influence which adaptation approaches receive funding and institutional support, whose expertise is valued in designing interventions, what success looks like, and who benefits or loses from particular interventions. As Escobar argues, ontological differences are inherently political, involving struggles over “the kinds of worlds that will be created and the kinds of worlds that will be destroyed” (Escobar, 2018).

4.3 Local vs. Global

Scale is a central organizing principle in climate adaptation discourse, with “the local” and “the global” frequently positioned as distinct domains requiring different forms of knowledge and governance. However, critical geographers have long argued that scale is not a pre-given hierarchy but a social construction with significant political implications (**marston2000?**). How scale is constructed in adaptation discourse shapes who has authority to speak about adaptation needs, what kinds of knowledge are considered relevant, and how resources are allocated.

The global scale is constructed through international institutions like the UNFCCC, scientific bodies like the IPCC, and financial mechanisms like the Green Climate Fund. These institutions produce standardized categories, metrics, and approaches that enable comparison and coordination across diverse contexts (**mahony2015?**). The global framing of climate change emphasizes its planetary nature, positioning it as a challenge that transcends national boundaries and requires coordinated international action. This framing has been crucial for

building political momentum for climate action but can also abstract from the differentiated responsibilities and impacts that characterize climate change (**beck2014?**).

The local scale, in contrast, is constructed as the site of concrete impacts and interventions. Local knowledge, institutions, and practices are increasingly recognized as essential for effective adaptation, leading to the rise of approaches like community-based adaptation (**huq2018?**). The local framing emphasizes context-specific vulnerabilities, capacities, and priorities that may not be visible from global perspectives. However, “the local” is not a neutral category but is often constructed in ways that align with particular political agendas, whether romanticizing local communities as inherently sustainable or representing them as lacking capacity and requiring external assistance (Mac Ginty, 2015).

Between these poles lie various intermediate scales, including the national, regional, and sectoral. National governments play a crucial role in adaptation governance, mediating between international frameworks and local implementation through policies, institutions, and resource allocation (**biesbroek2018?**). Regional bodies can facilitate knowledge sharing and cooperation across countries facing similar adaptation challenges. Sectoral approaches focus on particular domains like agriculture, water, or health, often crossing jurisdictional boundaries while maintaining distinct communities of practice (**klein2007?**).

My analysis focuses particularly on the regional scale as a potential mediating force between global frameworks and local realities. Regional knowledge systems, institutions, and networks may create spaces for more context-sensitive approaches to adaptation while still enabling coordination across diverse local contexts. The regional scale may thus offer possibilities for balancing the standardization needed for global action with the diversity needed for local relevance (**murtinho2016?**).

The politics of scale in adaptation governance involve ongoing negotiations about where different kinds of decisions should be made and by whom. These negotiations are not merely technical questions of efficiency or subsidiarity but fundamentally political questions about authority, legitimacy, and accountability (**swyngedouw2004?**). When adaptation is framed as primarily a global challenge requiring expert-driven solutions, local communities may be positioned as passive recipients rather than active agents in adaptation processes. Conversely, when adaptation is framed as primarily a local responsibility, broader structural causes of vulnerability may be obscured, and communities may be left to address challenges that exceed their capacities without adequate support (Eriksen et al., 2021).

The concept of “glocalization” helps us understand how global and local processes interact in adaptation governance. Rather than seeing the global and local as separate domains, glocalization highlights how they mutually constitute each other through complex interactions (**robertson1995?**). Global frameworks like the Paris Agreement influence local adaptation practices, while local innovations and experiences shape the evolution of global frameworks. These interactions are not politically neutral but reflect and reproduce power differentials between actors operating at different scales (**peck2002?**).

4.4 Future-making

Climate adaptation is fundamentally oriented toward the future, concerned with anticipating and responding to projected climate impacts. How futures are imagined and constructed through adaptation discourse shapes what interventions are considered necessary, desirable, or even possible. Different approaches to future-making in adaptation reflect different epistemological and ontological assumptions, with significant implications for whose futures are prioritized and how agency is distributed (Nalau & Cobb, 2022).

Sohail Inayatullah's typology of predictive, cultural, and critical epistemologies of the future provides a useful framework for understanding different approaches to future-making in adaptation (Inayatullah, 1990). The predictive approach, dominant in mainstream adaptation discourse, relies on scientific forecasting, scenario planning, and risk assessment to anticipate future climate impacts and design appropriate responses. This approach privileges certain forms of expertise, particularly climate science, economics, and engineering, and tends to frame the future primarily in terms of biophysical changes and their direct consequences (O'Brien 2011).

While valuable for identifying potential risks and intervention points, the predictive approach often inadequately addresses the social, cultural, and political dimensions of climate futures. It may present particular development pathways as inevitable rather than as choices shaped by values and power relations. Moreover, by positioning experts as the primary authorities on the future, predictive approaches may marginalize the future visions and aspirations of communities most affected by climate impacts (Goode & Godhe, 2017).

The cultural approach to futures emphasizes how different cultural contexts produce different understandings of time, change, and desirable futures. This approach recognizes that how communities imagine and relate to the future is shaped by cultural values, traditions, and worldviews that may differ significantly from dominant Western frameworks (Inayatullah, 1990). In adaptation, a cultural approach might attend to how communities understand their relationships with past and future generations, how they conceptualize human-environment relationships over time, and what constitutes a good or flourishing life in their cultural context (Adger 2013).

The critical approach to futures focuses on examining and challenging the assumptions, power relations, and interests embedded in dominant future visions. This approach seeks to "denaturalize" seemingly inevitable futures by revealing how they are constructed through particular discourses and practices (Inayatullah, 1990). In adaptation, a critical approach might interrogate whose interests are served by particular adaptation pathways, how vulnerability is constructed through adaptation discourse, and what alternative futures are rendered invisible or implausible by dominant approaches (Swyngedouw 2010).

These different approaches to future-making are not mutually exclusive but can complement each other in more comprehensive adaptation planning. Combining predictive tools with cultural sensitivity and critical reflection may enable more robust and equitable approaches

to anticipating and shaping climate futures (**vervoort2015?**). However, in practice, the predictive approach often dominates, with cultural and critical perspectives relegated to the margins of adaptation discourse and practice.

The concept of “defuturing” developed by Tony Fry helps us understand how dominant adaptation discourses can actively reduce rather than expand future possibilities (Fry, 2019). Defuturing occurs when particular ways of framing climate challenges and solutions foreclose alternative development pathways that might better address the intertwined challenges of climate change, inequality, and unsustainability. When adaptation is framed narrowly as adjusting to climate impacts within existing systems rather than transforming the systems that produce vulnerability, it limits the imagination of alternative futures (Eriksen et al., 2021).

For example, when coastal urban adaptation focuses primarily on protecting valuable real estate and infrastructure through seawalls and flood barriers, it may foreclose alternative approaches involving managed retreat, ecosystem restoration, or more fundamental reconsideration of urban-coastal relationships (**koslov2016?**). Similarly, when agricultural adaptation emphasizes technological packages like drought-resistant crops and precision irrigation, it may foreclose alternative pathways involving agroecology, food sovereignty, or different land tenure arrangements (**taylor2018?**).

Adaptation discourse thus plays a crucial role in what Goode and Godhe term “anticipatory regime formation”—the processes through which particular ways of knowing and governing the future become institutionalized (Goode & Godhe, 2017). Through policies, plans, funding mechanisms, and expert networks, certain approaches to adaptation become normalized while others are marginalized or rendered implausible. These anticipatory regimes shape not just how we respond to climate impacts but how we imagine and enact possible futures (**anderson2010?**).

4.5 Discourse Centralization

Drawing on the theoretical perspectives discussed above, I develop the concept of discourse centralization as a framework for analyzing epistemological diversity in climate adaptation. Discourse centralization refers to the degree to which adaptation discourse reflects a single dominant perspective or accommodates multiple ways of knowing and being. High centralization indicates a homogeneous discourse dominated by particular epistemological and ontological assumptions, while low centralization indicates a more heterogeneous discourse that encompasses diverse perspectives (Inayatullah, 1990).

Discourse centralization operates through several interrelated mechanisms. First, knowledge authorization determines what counts as valid knowledge and who is recognized as a legitimate knowledge producer (**foucault1980?**). In adaptation discourse, certain forms of expertise (particularly climate science, economics, and technical planning) are typically authorized as more credible and relevant than others (such as local, indigenous, or experiential knowledge). Second,

problem framing shapes how adaptation challenges are understood and what solutions seem appropriate (**bacchi2009?**). When adaptation is framed primarily as a technical problem, for example, it suggests technical solutions rather than political or social transformations.

Third, linguistic practices such as specialized terminology, standardized categories, and particular narrative structures can reinforce certain ways of knowing while excluding others (**fairclough2013?**). The language of climate models, vulnerability indices, and cost-benefit analysis, for example, may be inaccessible to many stakeholders and privilege certain kinds of knowledge over others. Fourth, institutional arrangements including funding mechanisms, governance structures, and professional incentives can systematically favor particular approaches to adaptation while marginalizing alternatives (Escobar, 1995).

These mechanisms of discourse centralization have significant implications for climate justice. When adaptation discourse is highly centralized around Northern epistemologies and ontologies, it may reproduce colonial power relations and marginalize the perspectives of those most vulnerable to climate impacts (Ireland & McKinnon, 2013). Conversely, more decentralized discourse that creates space for epistemological diversity may enable more just and effective approaches to adaptation that draw on multiple knowledge systems and center the needs and aspirations of affected communities (**santos2014?**).

The concept of discourse centralization provides a theoretical foundation for empirically analyzing patterns of homogeneity or diversity in adaptation discourse. Rather than assuming either complete homogeneity or radical diversity, this approach enables nuanced assessment of the degree to which adaptation discourse reflects epistemological plurality or monoculture across different contexts (Petersen et al., 2015). It also helps us identify factors that may promote or inhibit epistemological diversity in adaptation governance, such as institutional structures, power relations, and historical legacies.

5 Methods: Dominance index

To analyze discourse centralization in climate adaptation, I develop a methodological approach centered around the “Dominance Index”—a measurement tool for quantifying the degree to which adaptation discourse is concentrated around particular topics or perspectives. This approach combines structural topic modeling of National Adaptation Plans with calculations of topic dominance to identify patterns in how adaptation is conceptualized across different contexts.

The methodology bridges critical theoretical perspectives with quantitative text analysis, creating an interdisciplinary approach that can systematically analyze discourse patterns across a substantial corpus of documents. Rather than assuming either complete homogeneity or radical diversity in adaptation discourse, this approach enables empirical assessment of the degree to which discourse reflects epistemological plurality or monoculture across different contexts.

This methodological approach can measure the distribution of topics across documents and document groups, identifying patterns of concentration or dispersion. However, it cannot directly measure epistemological diversity—topic distribution serves as a proxy that requires careful interpretation. The approach does not capture discourse elements that may not be reflected in word co-occurrence patterns, such as rhetorical structures, implicit assumptions, or visual elements of the documents.

The primary corpus consists of National Adaptation Plans (NAPs) submitted to the UNFCCC—official policy documents that outline countries’ approaches to climate adaptation. These documents represent a particularly revealing window into adaptation discourse because they are produced through standardized international frameworks while addressing context-specific national priorities. The NAPs are prepared by national governments in consultation with various stakeholders and experts, and they outline adaptation priorities, strategies, and planned actions.

This corpus provides several advantages for comparative analysis. First, NAPs follow a relatively standardized format defined by UNFCCC guidelines, creating a consistent basis for comparison across countries. Second, they represent official national positions rather than individual perspectives, making them relevant for understanding national-level discourse patterns. Third, they cover a diverse range of countries across different regions, income levels, and vulnerability profiles, enabling meaningful comparative analysis.

However, the focus on NAPs also has important limitations. As official government documents, NAPs represent formal institutional discourse rather than the full range of adaptation perspectives within a country. They may exclude or marginalize viewpoints from civil society, local communities, or groups with limited access to formal planning processes. Moreover, NAPs are produced within the constraints of UNFCCC frameworks and often with support from international consultants, potentially introducing homogenizing influences from the outset.

This methodological approach involves four main steps:

1. **Corpus collection and preparation:** Gathering NAP documents and processing them for analysis, including tokenization, stop word removal, lemmatization, and creation of a document-term matrix.
2. **Structural topic modeling:** Applying computational techniques to identify latent topics in the corpus and examine how these topics vary across different document characteristics.
3. **Dominance Index calculation:** Developing a quantitative measure of discourse centralization based on the concentration of top topics in different document groups.
4. **Visualization and interpretation:** Creating visual representations of discourse patterns and interpreting these patterns through the theoretical framework developed in the previous chapter.

Each of these steps involves specific methodological choices and techniques that shape the analysis, which I elaborate in the following sections.

[visualization placeholder - methodology flowchart]

The approach outlined here draws on both computational text analysis methods, particularly topic modeling (Roberts et al., 2019), and critical discourse analysis traditions that examine how discourse reflects and reproduces power relations (fairclough2013?). By combining these approaches, I aim to leverage the systematic analytical capabilities of computational methods while maintaining critical awareness of the political and epistemological dimensions of adaptation discourse.

5.1 Corpus collection and preparation

The corpus consists of 45 English-language National Adaptation Plans (NAPs) submitted to the UNFCCC as of March 2025. These documents represent a diverse range of countries across different regions, income levels, and vulnerability profiles. The documents were collected directly from the UNFCCC NAP Central website (napcentral.org), which serves as the official repository for submitted NAPs.

The focus on English-language documents is a significant methodological constraint. It excludes NAPs submitted in other languages (particularly French and Spanish), potentially skewing the analysis toward Anglophone countries or those with stronger ties to international institutions where English is dominant. This limitation means the analysis cannot claim to represent the full global landscape of adaptation discourse but rather offers insights into patterns within the English-language subset of NAPs.

Despite this limitation, the corpus includes substantial representation from diverse global contexts:

- 18 documents from Africa (40% of the corpus)
- 14 documents from Asia-Pacific (31% of the corpus)
- 11 documents from Latin America and Caribbean (24% of the corpus)
- 2 documents from Europe (4% of the corpus)

In terms of income classification:

- 13 from Low-Income Countries (29% of the corpus)
- 19 from Lower-Middle Income Countries (42% of the corpus)
- 11 from Upper-Middle Income Countries (24% of the corpus)
- 2 from High-Income Countries (4% of the corpus)

The corpus also includes 15 Least Developed Countries (LDCs), 8 Small Island Developing States (SIDS), and 7 Landlocked Developing Countries (LLDCs), with some countries belonging to multiple special status categories.

Each document is tagged with relevant metadata drawn from World Bank classifications and UNFCCC designations. This metadata includes:

- Geographic region (Africa, Asia-Pacific, Latin America and Caribbean, Europe)
- Income level (Low, Lower-middle, Upper-middle, High)
- Special status (SIDS, LDC, LLDC, non-special)
- Submission date
- Document length

The collection of this metadata enables systematic comparison of discourse patterns across different country groupings to identify potential factors influencing how adaptation is conceptualized. The metadata is stored separately from the document text to prevent it from influencing the topic modeling process itself.

Document preparation involves multiple stages of processing to convert the raw NAP documents into a format suitable for computational analysis. This begins with extracting the text content from PDF documents, which presents technical challenges including handling of complex formatting, tables, figures, and inconsistent document structures. I use PDF extraction tools combined with manual verification to ensure accurate text extraction.

Once extracted, the text undergoes several preprocessing steps:

1. **Tokenization:** Breaking the text into individual words or tokens, which represent the basic units of analysis. This process includes removing punctuation, standardizing capitalization, and handling hyphenation.
2. **Stop word removal:** Eliminating common words (e.g., “the,” “is,” “and”) that carry little semantic meaning but appear frequently in the text. I remove both standard English stop words and domain-specific terms that appear across all documents but provide limited analytical value due to their ubiquity. These domain-specific stop words include terms like “adaptation,” “climate,” “plan,” “national,” “country,” and “UN-FCCC,” which are so common in the corpus that they do not help differentiate between different conceptualizations of adaptation.
3. **Lemmatization:** Reducing words to their base or dictionary form to treat variations of the same word as a single unit. For example, “adapting,” “adapts,” and “adapted” all become “adapt.” This process helps reduce dimensionality and improve the signal-to-noise ratio in the data.
4. **Creation of document-term matrix:** Organizing the processed text into a matrix that represents the frequency of each term in each document. This matrix serves as the primary input for the subsequent topic modeling.

These preprocessing steps enable computational analysis but also involve certain trade-offs. Tokenization breaks text into individual words, losing information about phrasal meanings and sentence structures. Stop word removal eliminates words that, while common, might carry important functional meanings in certain contexts. Lemmatization may obscure subtle distinctions in how terms are used (e.g., converting both “developed” and “developing” to “develop,” potentially blurring an important distinction in climate discourse).

To address some of these limitations, I retain the original text alongside the processed version, allowing for contextual verification when interpreting model outputs. I also conduct sensitivity analyses with different preprocessing choices to ensure that key findings are not artifacts of particular preprocessing decisions.

The final processed corpus contains approximately 3.5 million words across the 45 documents, with an average of 78,000 words per document. Document length varies considerably, from around 20,000 words for the shortest NAP to over 150,000 words for the longest, reflecting differences in both detail and scope across different national contexts. The preprocessing reduces this to approximately 1.2 million tokens representing about 25,000 unique terms, which form the basis for the subsequent topic modeling.

5.2 Structural topic modeling

To identify patterns in how adaptation is conceptualized across different NAPs, I employ structural topic modeling (STM), a computational technique that identifies latent topics in a

corpus and allows for the incorporation of document metadata as predictors of topic prevalence (Roberts et al., 2019). Unlike simpler forms of topic modeling, STM enables examination of how topic prevalence varies with document characteristics like region or income level, making it particularly suitable for comparative analysis of adaptation discourse.

Topic models are unsupervised machine learning methods that discover abstract “topics” that occur in a collection of documents. The fundamental assumption of topic modeling is that documents are mixtures of topics, where a topic is a probability distribution over words. Each document can be described as a mixture of topics, with certain topics more prevalent than others in each document.

The STM algorithm processes the document-term matrix to identify clusters of words that frequently co-occur, representing coherent topics within the corpus. Mathematically, STM represents each document as a mixture of k topics, with each topic defined as a distribution over the vocabulary. The model simultaneously estimates topic content (the words associated with each topic) and topic prevalence (the proportion of each document devoted to each topic) using a variational expectation-maximization algorithm (Roberts et al., 2019).

What distinguishes STM from other topic modeling approaches is its ability to incorporate document metadata as covariates that can affect either topic content or topic prevalence. This allows us to examine, for example, how topic prevalence varies across different regions or income levels, or how the content of similar topics might differ across these categories. In this analysis, I focus primarily on topic prevalence covariates, examining how the distribution of topics varies across different document characteristics.

A key methodological decision in topic modeling is determining the appropriate number of topics (k). Too few topics may obscure important distinctions in the corpus, while too many may result in incoherent or redundant topics that are difficult to interpret. I employ a data-driven approach to identify the optimal number of topics, using several metrics:

- **Semantic coherence:** Measures the degree to which high-probability words for a topic tend to co-occur in documents. Higher semantic coherence suggests more coherent, interpretable topics.
- **Exclusivity:** Measures the degree to which words are exclusive to particular topics rather than appearing across many topics. Higher exclusivity suggests more distinctive topics.
- **Held-out likelihood:** Measures the model’s ability to predict held-out text not used in training, providing an indication of how well the model generalizes.

In addition to these standard metrics, I incorporate a complexity factor that penalizes models with higher numbers of topics. This complexity penalty acknowledges that additional topics introduce greater interpretive challenges without necessarily improving model performance in a meaningful way. The penalty is calculated as a linear function of k , with the specific coefficient determined through experimentation.

After testing models with k ranging from 20 to 80, I select a model with 40 topics based on the balance of semantic coherence, exclusivity, and the complexity penalty. This represents a middle ground that captures meaningful variation in the corpus while maintaining interpretability. The final model is trained using the spectral initialization method, which provides more consistent results than random initialization, and with 100 iterations of the variational expectation-maximization algorithm to ensure convergence.

It's important to recognize what topic models can and cannot tell us. Topics identified through this process are statistical constructs representing patterns of word co-occurrence. They do not inherently align with human-intuitive conceptual categories, nor do they capture all aspects of discourse such as narrative structure, rhetorical devices, or implicit assumptions. The topics are also specific to this corpus—they represent patterns within the NAPs rather than universal categories of adaptation discourse.

For the top topics identified in the model, I provide tentative interpretations based on:

1. The highest probability words for each topic
2. The most distinctive words for each topic (using FREX: FRequency and EXclusivity)
3. Representative documents with high proportions of the topic
4. Examination of the original context in which topic-associated words appear

[visualization placeholder - topic word cloud]

These interpretations should be understood as plausible readings rather than definitive meanings. They aim to translate statistical patterns into conceptually meaningful categories to facilitate interpretation of discourse patterns, while acknowledging the interpretive judgment involved in this translation.

The resulting topic model provides several outputs for analysis:

1. **Topic-word distributions:** The probability of each word being generated by each topic, which helps interpret what each topic represents.
2. **Document-topic proportions:** The estimated proportion of each document devoted to each topic, which forms the basis for the Dominance Index.
3. **Metadata correlations:** How document characteristics like region or income level correlate with topic prevalence, which helps identify patterns across different contexts.
4. **Topic correlation matrix:** How different topics relate to each other, which can reveal broader thematic clusters within the discourse.

These outputs enable systematic analysis of patterns in adaptation discourse across different contexts. Rather than imposing predetermined categories or frameworks, this approach allows patterns to emerge inductively from the text while still enabling structured comparison through metadata. The topic model thus serves as a bridge between the unstructured text of the NAPs and the more structured analysis of discourse centralization through the Dominance Index.

5.3 Dominance Index calculation

To quantify the degree of discourse centralization, I develop a Dominance Index that measures how concentrated or dispersed topic distributions are across different groups of documents. The index provides a single metric that can be compared across different contexts to identify variations in discourse centralization. A high Dominance Index indicates that a few topics dominate the discourse, suggesting a more homogeneous conceptualization of adaptation. A low Dominance Index indicates a more even distribution of topics, suggesting greater diversity in how adaptation is conceptualized.

The Dominance Index focuses specifically on the concentration of the top n topics in a given group of documents. This approach directly addresses the core question of whether adaptation discourse is dominated by a small number of topics or distributed across many different topics. After testing different values, I select n=5 as capturing a significant portion of the discourse while maintaining meaningful distinctions between different contexts.

The calculation of the Dominance Index follows these steps:

1. **Group documents:** Aggregate documents according to relevant characteristics (e.g., all documents from a particular region or income level).
2. **Calculate topic proportions:** For each topic, calculate the average proportion across all documents in the group. This gives us the average prevalence of each topic within that group.
3. **Rank topics:** Sort topics by their average proportion in descending order to identify the most prevalent topics in the group.
4. **Calculate top-n proportion:** Sum the proportions of the top 5 topics to determine what fraction of the discourse they represent collectively.
5. **Normalize the index:** Scale the result to a 0-1 range, where 0 represents a perfectly even distribution across all topics and 1 represents complete concentration in a single topic.

The mathematical formula for the Dominance Index (DI) can be expressed as:

$$DI = (\text{sum of proportions for top 5 topics} - \text{minimum possible sum}) / (\text{maximum possible sum} - \text{minimum possible sum})$$

Where:

- The minimum possible sum would be $5 * (1/k)$ in a perfectly even distribution across all k topics
- The maximum possible sum would be 1 (if all discourse were concentrated in a single topic)

This normalization ensures that the Dominance Index is comparable across different values of k and n , though in this analysis both are fixed ($k=40$, $n=5$).

The Dominance Index approach differs from entropy-based measures that are sometimes used to quantify diversity in topic distributions. While entropy measures capture the overall evenness of a distribution, the Dominance Index focuses specifically on the concentration of the most prevalent topics, which more directly addresses the question of discourse centralization. The top- n approach also offers greater interpretability, as it can be directly related to specific topics that dominate the discourse.

To address potential biases from uneven document lengths or sample sizes, I implement several controls:

1. **Document length normalization:** Topic proportions are calculated as fractions of each document, controlling for differences in document length.
2. **Jackknife resampling:** For groups with more than five documents, I use jackknife resampling (leave-one-out) to assess the stability of the Dominance Index and calculate confidence intervals.
3. **Sample size thresholds:** For very small groups (fewer than three documents), I flag the results as potentially less reliable and interpret them with greater caution.

These controls help ensure that the Dominance Index reflects genuine patterns of discourse centralization rather than artifacts of the corpus composition. However, they cannot entirely eliminate the influence of sample size disparities, particularly for the smallest groups.

The Dominance Index enables systematic comparison of discourse centralization across different groupings:

- Regional groups (Africa, Asia-Pacific, Latin America and Caribbean, Europe)
- Income levels (Low, Lower-middle, Upper-middle, High)
- Special status designations (SIDS, LDCs, LLDCs, non-special)
- The corpus as a whole (providing a baseline for comparison)

[visualization placeholder - dominance index comparison chart]

This comparative approach helps identify factors that might influence the degree of epistemological diversity in adaptation discourse. For example, if the Dominance Index varies significantly across regions but not across income levels, this might suggest that regional knowledge systems or institutional frameworks play a more important role in shaping adaptation discourse than economic circumstances.

However, it's important to specify what the Dominance Index can and cannot tell us. The index measures the concentration of topics in a document group, which serves as a proxy for discourse centralization. A higher concentration (higher Dominance Index) suggests a more centralized discourse, while a lower concentration suggests a more diverse discourse. But this metric does

not directly measure epistemological diversity or the substantive content of the discourse. Topic diversity is not necessarily equivalent to epistemological diversity—a discourse might include many different topics while still operating within a single epistemological framework.

Moreover, the Dominance Index doesn’t tell us whether a particular pattern of centralization is “good” or “bad” from a normative perspective. A highly centralized discourse might reflect genuine consensus around effective approaches, while a highly diverse discourse might reflect fragmentation or lack of coherence. Interpreting the normative implications of different Dominance Index values requires connecting the quantitative results to the substantive content of the topics and the broader theoretical framework.

5.4 Visualization and interpretation

To make patterns of discourse centralization more accessible and interpretable, I develop visualization techniques that complement the quantitative analysis. These visualizations serve both analytical and communicative purposes, helping to identify patterns in the data and effectively convey these patterns to readers who may not be familiar with the technical details of topic modeling or the Dominance Index.

The primary visualization approach is a “bullseye” representation of discourse dominance. This visualization places topics as points on a target diagram, with distance from the center determined by the topic’s prevalence. In highly centralized discourse (high Dominance Index), points cluster near the center, indicating that a few topics dominate. In more decentralized discourse (low Dominance Index), points are more evenly distributed throughout the target, indicating greater diversity of topics.

The bullseye visualization is constructed as follows:

1. The diagram is divided into concentric rings, with the innermost ring representing the highest topic prevalence and the outermost ring representing the lowest.
2. Topics are positioned based on their average proportion within the document group, with more prevalent topics placed closer to the center.
3. Each topic is represented by a point, with optional labeling for the most prevalent topics to aid interpretation.
4. Color coding can be used to distinguish different types of topics (e.g., based on thematic categories) or to indicate topic correlations.

[visualization placeholder - bullseye diagram]

This visual representation provides an intuitive way to compare discourse patterns across different contexts. By placing bullseye visualizations for different regions or income groups side by side, we can readily observe differences in discourse centralization that might be less

apparent in numerical comparisons alone. The bullseye approach is particularly effective for communicating the concept of discourse centralization to non-specialist audiences.

The bullseye visualization can show the degree of centralization but doesn't directly indicate which topics are prevalent. To address this, I complement the bullseye diagrams with more detailed visualizations that show the specific topics that dominate in different contexts:

- **Bar charts:** Comparing Dominance Index values across different groupings to identify variations in overall centralization.
- **Heatmaps:** Showing the prevalence of specific topics across different contexts to identify which topics dominate in which contexts.
- **Network visualizations:** Illustrating relationships between topics and document characteristics to reveal patterns of association.

[visualization placeholder - topic prevalence heatmap]

These visualizations help bridge the gap between the abstract metric of the Dominance Index and the substantive content of the discourse. They enable identification of both patterns of centralization (how concentrated the discourse is) and patterns of content (which specific topics dominate in which contexts).

The interpretation of these patterns draws on the theoretical framework developed in the previous chapter. I analyze how discourse centralization relates to epistemological diversity, examining whether differences in Dominance Index values across contexts reflect meaningful variations in how adaptation is conceptualized. This interpretation involves several layers of analysis:

1. **Pattern identification:** Identifying variations in the Dominance Index across different groupings and assessing their statistical significance.
2. **Content analysis:** Examining which specific topics dominate in different contexts and how these topics relate to different epistemological and ontological perspectives.
3. **Contextual interpretation:** Considering how patterns of discourse centralization might relate to broader factors such as regional knowledge systems, institutional frameworks, or historical legacies.
4. **Theoretical connection:** Relating the empirical findings to theoretical concepts such as epistemological diversity, ontological assumptions, and the politics of scale.

This interpretive process aims to move beyond simple description of discourse patterns to deeper analysis of their implications for climate adaptation governance. It seeks to connect the “what” (patterns of discourse centralization) to the “why” (factors that might explain these patterns) and the “so what” (implications for just and effective adaptation).

The interpretation explicitly considers alternative explanations for observed patterns. For example, if regional groups show different Dominance Index values, this could reflect:

- Genuinely different epistemological traditions across regions
- Institutional factors such as regional development banks or policy frameworks
- Historical patterns of knowledge exchange and policy diffusion
- Artifacts of the corpus composition or analytical method

By considering these alternatives, I aim to develop more robust interpretations that acknowledge the complexity of factors shaping adaptation discourse.

Throughout this interpretive process, I maintain awareness of what this methodological approach can and cannot tell us. The analysis can identify patterns of topic distribution across different contexts and suggest possible factors influencing these patterns. It cannot definitively establish causal relationships or directly measure epistemological diversity. The findings should be understood as evidence-based insights that can inform further research and policy discussions, rather than as final conclusions about the nature of adaptation discourse.

Despite these limitations, this methodological approach offers valuable insights into patterns of discourse centralization that would be difficult to discern through manual analysis alone. By combining computational methods with critical theoretical perspectives, it contributes to our understanding of how adaptation is conceptualized across different contexts and what factors might influence these conceptualizations. These insights have implications for both academic understandings of adaptation discourse and practical efforts to promote more just and effective adaptation governance.

Part III

Analysis

6 Findings

7 Discussion

8 Conclusion

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R-packages

```
grateful::cite_packages( pkgs = pkgs, cite.tidyverse = TRUE, output = "paragraph" )
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