URBAN SUSTAINABLE DEVELOPMENT

GOVERNANCE, FINANCE AND POLITICS

Edited by
Pedro Vormittag
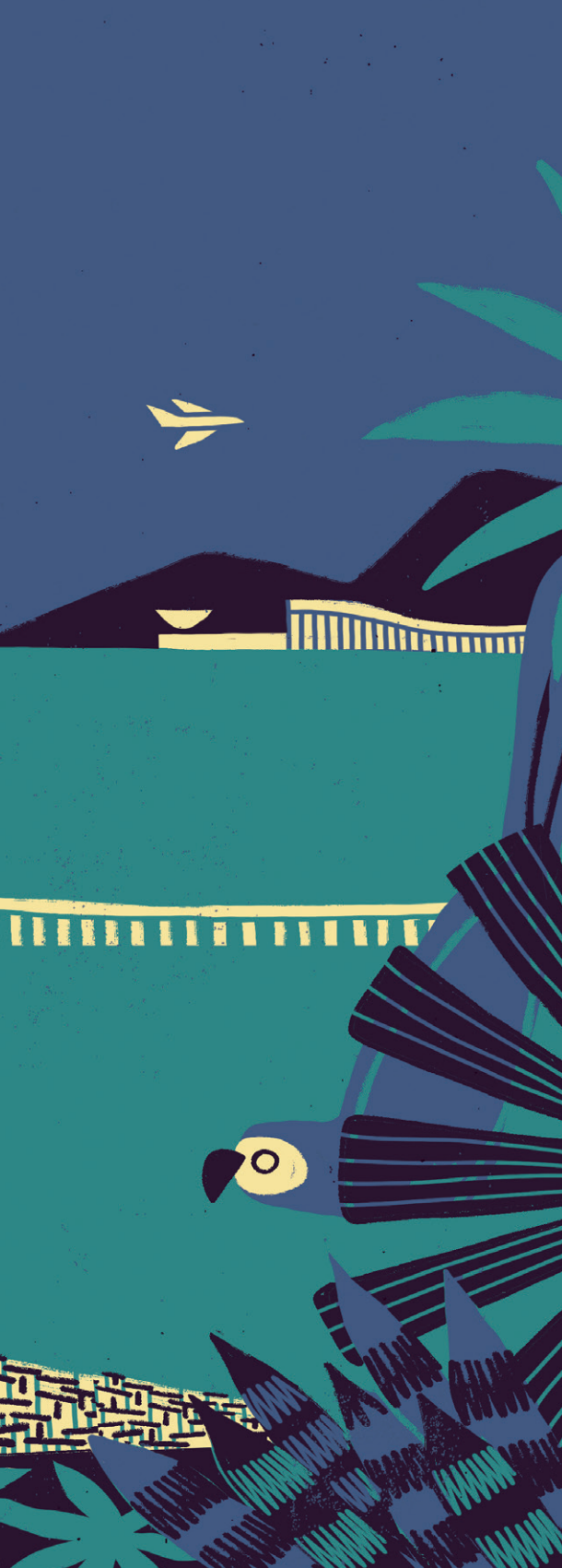**Marianna Albuquerque**
Eugénie L. Birch

CEBRI
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Rio PREFEITURA

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Knowledge Partner Institutions

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Putting the "Urban" in Sustainable Development

Pedro Vormittag and Marianna Albuquerque
Editors

This book is born from a shared understanding of the crucial role cities, like Rio de Janeiro, played during Brasil's G20 presidency[1] and the need to enhance the global conversation on sustainable development by focusing more on its urban and local dimensions.

In the context of an escalating climate crisis, urban sustainable development is emerging as a critical issue. As cities grow at unprecedented rates, the demand for innovative approaches to environmental sustainability, social justice, regulatory frameworks, and economic vitality becomes even more pressing. In response, *Urban Sustainable Development: Governance, Finance and Politics* seeks to shape the agenda for sustainable urban futures. This volume brings together leading scholars, government officials, practitioners, and experts from across the world to discuss the governance, financial structures, and political dynamics driving urban sustainability.

While the role of cities in sustainable development is increasingly

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1. Following the official branding of the G20 Brasil, we have adopted the spelling "Brasil" throughout this book.

recognized, it remains underexplored. To address this, the book is divided into two sections, each providing unique insights into the complexities of urban sustainable development.

The first section offers a conceptual debate, laying the theoretical foundation to understand the intersections between taxation, regulation, mitigation, and adaptation policies. Here, the authors explore the crucial roles of local governments, the importance of multilevel governance, and the financial mechanisms that can either support or hinder green initiatives. It also examines the political tensions between urban development and environmental conservation, particularly in regions where these goals are often seen as incompatible. This theoretical lens equips readers with the tools to critically assess current sustainability frameworks and imagine future pathways for resilient cities.

Professor Candice Howarth begins the discussion by outlining the key ideas shaping both urban sustainability and the broader environmental sustainability agenda. Dr. Arkebe Oqubay follows with an experience-driven analysis, drawing on his tenure as Mayor of Addis Ababa to discuss the concept of productive cities. Professor Adela Gondek explores the often-overlooked ethical dimensions of sustainability in urban spaces.

The G20's Urban 20 (U20) engagement group, central to this book's development, provides a framework for Professor Fernando Straface's contribution, which traces the origins and evolution of U20 since its launch during Argentina's 2019 G20 presidency. Together with Mariana Cammisa, he reflects on lessons in city diplomacy at the highest level. João Cochlar tackles the legal question of how city networks can play a role in climate litigation, a pressing issue for advancing the international urban sustainability agenda.

The second section transitions from theory to practice, presenting case studies illustrating how cities worldwide address urban sustainability in diverse contexts. From large metropolises to regional centers, these case studies analyze governance models, financing instruments, and political strategies that are making an impact. Topics include innovative public-private partnerships, community-based urban planning, gender, digitalization, and best knowledge-sharing practices among cities.

Professor Eugénie Birch offers a historical reflection on Rio de Janeiro's recent trajectory as a global city. H.E. Fahd Abdulmohsan Al-Rasheed shares lessons from Riyadh's transformation, one of the most significant urban projects in the world. Mauricio Rodas, former Mayor of Quito, introduces the Green Cities Guarantee fund, a recent step toward financing sustainable urban transformations. Dr. Yoon Jae Ro and colleagues Sungho Lee and Munsu Kang address the particular challenges Global South cities face. Practitioners Hazem Galal, Rajat Chowdhary, Mounir Kabbara, and Cristina Reyes push the discussion of smart cities forward by introducing the concept of cognitive cities.

Dr. Riatu Mariatul Qibthiyyah explores the financial bottlenecks hindering the development of sustainable cities, while Dr. Rebecca Bill Chavez addresses the intersection of gender, urban spaces, and the digital divide. Paul Gallay and co-authors Amelia Ding, Hellas Lee, Victoria Sanders, and Bernadette Baird-Zars emphasize the need to rethink public engagement with community leaders on flood management, a debate that resonated in Brasil in 2023. Dr. Jeffrey Schlegelmilch and colleague Amy Campbell examine how cities can manage increasingly unpredictable risks associated with the climate crisis.

Urban mobility, a critical aspect of sustainability, is tackled by Dr. Jacqueline Klopp, who addresses the policy gaps in Global South cities, while Dr. Clarisse Cunha Linke maps the path toward decarbonizing Brasil's transport matrix. Dr. Mohamed Abdelraouf highlights successful examples of sustainability in Gulf Cooperation Council cities. Dr. Xin Dong and Li Zhuang delve into China's urban transformation since its 1978 reforms, considering the challenges ahead for greening Chinese cities. Dr. Arkebe Oqubay returns to offer insights from African leadership, while Dr. Andrew J. Kruczkiewicz, Camila Pontual, Jessica Weinberg, Isabella Pereira, and Walter Baethgen use Rio de Janeiro's case to discuss preparing cities for increasingly severe weather events. Mr. Frederic de Mariz, drawing on both academic and financial expertise, outlines how to mobilize finance in response to climate disasters like those that impacted Rio Grande do Sul in 2024.

The strength of this book lies in the diversity of its contributors. It brings together voices from academia, government, civil society, international organizations, and the private sector, representing countries such as Argentina, Brasil, China, Ecuador, Ethiopia, India, Indonesia, Morocco, Saudi Arabia, South Korea, the United Kingdom, and the United States. Academics provide theoretical insights, government leaders share practical policy experiences, and finance and sustainable development experts offer critical economic and political feasibility analyses.

This project owes much to its authors but also benefited from the invaluable support of many individuals and institutions. Professor Eugénie Birch, from the University of Pennsylvania, offered unwavering support and intellectual leadership since the project's initial and often confusing steps. Bruno Zilli's editorial guidance and

project management skills proved indispensable for the successful completion of a book with so many authors, a mission for which he counted on the steadfast assistance of Iuri Rosario, Marcelo Gribel, and Barbara Pires.

At the Brazilian Center for International Relations (CEBRI), Feliciano de Sá Guimarães's support and Luciana Gama Muniz's enthusiasm for the project kept us moving forward, while Julia Dias Leite's leadership proved yet again indispensable for the daring and necessary endeavors of thinking about Brasil's place in the world. José Pio Borges's bold intellectual vision for CEBRI allowed it to be the home of such an ambitious book.

At the Rio de Janeiro City Hall—a government body that proved essential not only for this book but for the whole G20 presidency of Brasil in 2024—, this book owes to Secretary Lucas Padilha's belief in its relevance and Vice-Mayor Eduardo Cavaliere's unwavering political support in putting out a book that helps Rio continue to lead the world in sustainable development. Both have counted on the support of Mayor Eduardo Paes, a veteran of the international conversation on cities and sustainable development, at all times.

Way beyond the borders of Guanabara Bay in Rio, this book could not have been born with such quality without the support of its Knowledge Partner Institutions, which helped gather and select authors and craft the book's direction. Chief among them, Morocco's Policy Center for the New South ensured our project would have international reach and representation. We are thankful to the leadership of Dr. Karim El Aynaoui, the intellectual rigor of Arkebe Oqubay, and the enthusiastic help and support of Akram Zaoui. The University of Pennsylvania's Institute for Urban Research, through Professor Eugénie Birch mobilizing, ensured this book would

have scholarly pertinence. From Columbia University, dozens of friends and inspiring experts coalesced under the leadership of its Global Center in Rio, to which we are thankful to Thomas Trebat and Camila Pontual. The Inter-American Dialogue, through the energetic backing of Rebecca Bill Chavez on the relevance of the urban debate for world affairs, has offered this book and research agenda a path forward, a direction shared by the Atlantic Council, whose pioneering work in climate resilience and adaptation is a compass for this book's mission.

In a time of increasingly extreme challenges for cities and the world, we hope this book helps set the agenda for cities as solutions for the Sustainable Development Goals. The following pages are meant for both consultation and inspiration.

The Rio de Janeiro view from Favela do Vidigal inspired this book's cover.

Photo by Raquel Camargo Araujo, Rio G20 Committee.

Section 1

Conceptual Foundations

1.

Integrating Climate Mitigation and Adaptation Strategies in Cities

Candice Howarth

The Need to Integrate Climate Mitigation and Adaptation in Cities

Efforts to manage and prepare for the climate crisis have historically been driven by climate mitigation (i.e. action to reduce man-made greenhouse gas emissions) primarily through renewable energy, energy efficiency, sustainable transportation, and land-use planning. Climate adaptation on the other hand (i.e. action aimed at preparing for and adapting to the impacts of climate change) involves adjusting systems, structures, and policies to cope with the impacts of climate change, such as rising sea levels, heatwaves, and floods. However, mitigation and adaptation strategies have generally been, and continue to be, developed and implemented separately, often in isolation (Reckien et al. 2018). This is problematic considering that mitigation targets are being missed (IPCC 2022) and global temperatures continue to increase as a result (Lindsay and Dallman 2024). This is especially true in cities, where mitigation has been prioritized over adaptation

(Grafakos et al. 2021). This is not cost-effective, does not reflect the multidimensionality and complexity of adaptation and mitigation, and can lead to a range of challenges, maladaptation, and unintended consequences (Howarth and Robinson 2024).

The climate is already changing, and integration of adaptation and mitigation in policy and practice is now urgently needed. Whilst the nature of adaptation and mitigation approaches is complex, explaining *why* these are often designed and implemented separately could provide opportunities for integrated approaches to climate action that address both simultaneously and maximize co-benefits (Jennings et al. 2020). For example, not adopting integrated approaches could contribute to a range of inefficiencies occurring alongside a lack of policy coherence such as rapid investment in solar or onshore wind, which could result in habitat disruption and reduce ecosystem resilience (Howarth and Robinson 2024). Addressing the two sides of the climate action "coin" simultaneously could help bridge knowledge gaps, limit inefficient, siloed work, enhance co-benefits of climate action, minimize unintended consequences, and ultimately enable climate-resilient economic growth.

Urban areas, which house over half of the world's population, are important components in global climate action particularly as they are responsible for 67–72% of global CO_2 emissions (Lwasa et al. 2022), primarily due to transportation, buildings, industry, and energy use. They are also highly vulnerable to the impacts of climate change, with many located in coastal areas, floodplains, or regions prone to weather extremes. Integrating both climate mitigation and adaptation strategies within cities is a necessity and an opportunity for cities to become more liveable, sustainable, and resilient in the climate crisis.

Key Challenges in Integrating Adaptation and Mitigation

While climate mitigation and adaptation are usually treated and implemented separately, they are deeply interrelated and complementary. Nevertheless, a series of challenges affect the ability to design, implement, and monitor their integration within cities.

Institutional Silos

A range of institutional silos underpin the framing, conceptualization, design, and implementation of adaptation and mitigation approaches. For example, nationally, regionally, and within cities, distinct departments or teams often work on these issues separately, frequently, and with limited interaction, leading to fragmented efforts (Kissinger et al. 2021). Mitigation is regularly handled by energy and transportation departments while adaptation often falls under disaster risk reduction, environment, or planning departments, or in some cases is not incorporated into climate strategic plans. In the United Kingdom (UK), for example, following a wave of Climate Emergency Declarations in 2019–2020, it was found that only 11% of these declarations mentioned the term "climate adaptation" (Howarth et al. 2021). Their main focus was on mitigation with resulting Climate Action Plans rarely referencing the need to adapt to the impacts of climate change. This separation can result in missed opportunities for synergies and lead to conflicting policies (Dyson and Harvey-Scholes 2022). For example, efforts to promote urban densification (e.g. through initiatives such as 15-minute cities) as a mitigation strategy could increase vulnerability to climate hazards such as heat waves or flooding if adaptation measures are not incorporated into the planning process (Abdelfattah et al. 2022). In addition, institutional memory is recurrently short, with policy

officials remaining in post for short periods of time and taking their knowledge and insights on potential integration with other policy areas with them (Bremer et al. 2021).

Competing Priorities and Funding

Cities face a number of competing priorities, from housing, transportation, economic development, local pollution, and public health priorities, all while managing stretched resources and competing for limited funding (Betsill and Bulkeley 2007). Both climate mitigation and adaptation thus often struggle to compete with more immediate concerns particularly in areas of economic deprivation and where competition for funding is resource-intensive, highly competitive, and conducive to the prioritization of isolated single agendas. Where climate action plans may exist and where there are dedicated funds for climate mitigation (e.g. grants for renewable energy projects) or climate adaptation (e.g. flood defense systems, tree planting), these are rarely joined up or explicitly designed to facilitate integrated approaches (Grafakos et al. 2021). This can hinder and slow the design and implementation of solutions that address mitigation and adaptation simultaneously and can at times lead to unintended consequences, maladaptation, or mal-mitigation.

Conflicting Timescales

There have been and still are conflicting timescales in the implementation of climate action. Historically, mitigation has been prioritized over adaptation at the international level, where the United Nations Framework Convention on Climate Change

(UNFCCC) had a strong focus on mitigation when it was established (Hall and Persson 2018), as the need to adapt to the impacts of climate change was not as prominent. Currently, short-term planning versus long-term impacts can further exacerbate challenges to integrating adaptation and mitigation as city priorities often span different pressing agendas, typically operate on short-term timelines, driven by electoral cycles and immediate needs, whereas climate change is a long-term challenge, usually perceived as distant in time and geography. Mitigation and adaptation efforts must both account for decades of future impacts and societal behaviors and shifts, but cities generally lack the long-term vision and political will to commit to strategies that do not lead to immediate benefits. Furthermore, while the science of climate change is accepted and fairly well understood, the actual and perceived uncertainties surrounding the precise impacts of climate change can make it difficult to incorporate adaptation plans, especially in cities with limited resources and technical capacity (Schneider and Kuntz-Duriseti 2002).

Opportunities for Integrating Climate Adaptation and Mitigation

Co-Benefits of Integrating Climate Adaptation and Mitigation

Integrating climate adaptation and mitigation in cities can offer co-benefits that enhance urban resilience, environmental sustainability, and social equity (Jennings et al. 2020). Climate adaptation measures, such as green infrastructure, permeable surfaces, and flood management systems, reduce the risks posed by extreme weather such as flooding, drought, and heat waves, which

are likely to affect cities under a changing climate (Hoegh-Guldberg et al. 2018). Simultaneously, these measures contribute to climate mitigation by sequestering carbon, reducing urban heat islands, and improving energy efficiency. In the context of heat preparedness and adaptation, for example, green roofs and urban forests can absorb carbon dioxide whilst also cooling buildings, thus reducing energy demand for air conditioning (Howarth et al. 2024).

There are also multiple health benefits of integrating adaptation and mitigation (Spencer et al. 2017). Energy-efficient buildings, sustainable transport, and renewable energy sources are central to mitigation, lowering pollution, improving air quality, and creating more comfortable living environments. The adoption of active transportation, such as cycling and walking, reduces greenhouse gas emissions while improving public health and lowering the risk of heat-related illnesses. These integrated strategies also bring wider economic benefits by creating more jobs in green industries alongside supporting reduced energy use and healthcare costs (Klein et al. 2005).

Supporting Green Growth and the Just Transition

A city that integrates mitigation and adaptation action can facilitate a shift towards a low-carbon, climate-resilient economy that is socially inclusive and equitable and does not leave any vulnerable workers, communities, and industries behind that are dependent on fossil fuels (McCaulley and Heffron 2018). Climate mitigation and the transition to cleaner energy sources provide significant potential for widespread job creation in renewable energy, green construction, and sustainable agriculture. However, this shift can only be successful if it avoids job losses that can disproportionately

affect certain workers and communities, such as those reliant on fossil fuel-related jobs. Similarly, climate adaptation is essential for social equity and protecting vulnerable communities, which are often the hardest hit by climate impacts but the least responsible for emissions that are causing the climate crisis. Incorporating climate resilience into urban planning, infrastructure design, and economic systems enables continued growth and development helping to ensure that cities can adapt to and prepare for the impacts of climate change. Additionally, a focus on improving social equity by prioritizing vulnerable communities in adaptation planning ensures that disadvantaged populations benefit from improved infrastructure and are better protected against climate-related risks.

Supporting Cities to Prepare for Climate Hazards

The integration of climate mitigation and adaptation strategies is vital for preparing cities and communities for the increased frequency and severity of climate hazards such as heatwaves, flooding, and droughts that the world will face under a changing climate (IPCC 2022). These events require coordinated action that not only reduces greenhouse gas emissions but also builds resilience against its unavoidable impacts. Heatwaves are becoming more frequent and intense due to climate change, posing significant risks to public health, infrastructure, and the economy (Howarth et al. 2024). They have been known as an "invisible risk" making their severity challenging to convey and often leading to countless avoidable heat-related deaths (Howarth et al. 2023). The integration of mitigation and adaptation is crucial in addressing this threat particularly as some of the micro-scale solutions (e.g. increased use of air conditioning) to keep people cool can lead to rising greenhouse

gas emissions and local ambient temperatures. By transitioning to low-carbon economies, embracing energy efficiency, promoting renewable energy, and decreasing reliance on fossil fuels cities the likelihood of future heat waves becoming more extreme and the Urban Heat Island effect can be reduced. Heat adaptation strategies in cities can focus more on behavioral and nature-based solutions by investing in green infrastructure, such as parks, green roofs, and urban forests, to reduce the urban heat island effect, absorb heat, and provide shade. Retrofitting buildings with better insulation and ventilation, alongside the promotion of passive cooling techniques, can further help reduce indoor temperatures without over-reliance on air conditioning.

Preparing for and managing flooding events, also made worse by climate change, is similarly problematic for cities, particularly those exposed to this hazard. Whether from rising sea levels, heavier rainfall, or more frequent storms, coastal and inland flooding are predicted to increase. Integrating mitigation and adaptation efforts can help cities manage these risks more effectively, while they can reduce their share of greenhouse gas emissions by implementing greener transportation and energy systems. Green infrastructure, including permeable pavements and rain gardens, avoiding paved over driveways simultaneously helps manage stormwater and facilitates carbon sequestration. The low-lying city of Rotterdam in the Netherlands, for example, faces significant risks from rising sea levels and flooding. To address this challenge, the city has implemented the Rotterdam Climate Initiative, which integrates flood protection with sustainable urban development and energy efficiency measures, through its "water plazas" that act as public spaces during dry periods and temporary water storage during heavy rainfall, helping to mitigate flood risks.

Reflections on How to Integrate Climate Adaptation and Mitigation in Cities

Integrating at Different Scales

City action on climate change sits within an ecosystem of climate action at and across different scales: international, national, regional, and local. Each level of governance plays a unique role in ensuring synergies and alignment between climate adaptation and climate mitigation efforts, but coordination across all scales is similarly crucial for addressing both the causes and impacts of climate change efficiently (Landauer et al. 2019).

Internationally, frameworks such as the Paris Agreement provide important platforms and mechanisms for countries to demonstrate their commitment to reducing greenhouse gas emissions while enhancing resilience and preparedness for climate impacts and promoting sustainable and equitable transitions. Exploring this at the national level, governments develop climate policies that, if well-constructed, focus on achieving national mitigation and adaptation targets. Nationally Determined Contributions (NDCs) under the Paris Agreement require countries to outline actions that reduce emissions and build resilience, and this often translates to national plans. Of the NDCs recorded by September 2023, 94% of parties provided quantified mitigation targets and 81% provided an adaptation component (an increase compared to the previous reporting period) (UNFCCC 2023). Few targets and plans explicitly look at adaptation and mitigation simultaneously. The UK, for example, has a national Net Zero Strategy with the aim to reach net zero by 2050 and its 2023 Net Zero Growth Plan sets out existing strategies, focusing on the scale-up and deployment of technologies

for decarbonizing homes, power, industry, and transport. The UK also has a distinct Climate Change Risk Assessment, produced every five years, with a government response in the form of a National Adaptation Programme. However, these policies and programmes are developed independently of each other with little consideration for identifying synergies between adaptation and mitigation targets.

Regionally, at the European Union level, countries can implement mitigation and adaptation by coordinating resource management and infrastructure planning across municipalities. Climate change and the impacts of climate change do not discriminate geographically, and emissions from all countries contribute to the climate crisis with the impacts felt across geographies, timescales, and spatial scales, regardless of where emissions originated. Regions within and across countries often manage shared resources like rivers or forests, making them key players in managing climate risks. Cross-border collaborations, such as those across European Union—e.g. the EU's 2030 climate target to reduce net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels, the EU's 2040 climate targets aiming to reduce the EU's net greenhouse gas emissions by 90% by 2040 relative to 1990, the EU's 2050 long-term climate strategy to be climate-neutral by 2050 with net-zero greenhouse gas emissions, and the EU Adaptation Strategy which outlines how the EU can adapt to the impacts of climate change and become climate resilient by 2050—ensure that regions align their mitigation and adaptation efforts to achieve larger sustainability goals.

Locally, cities and communities are seen to have the most tangible integration of mitigation and adaptation. It is also where there is a fuller understanding of how such efforts can be implemented to align with the needs and resources of the local context (Russell

and Christie 2021). Local governments design policies for energy-efficient buildings, sustainable transportation, and green infrastructure that sequester carbon (mitigation) while reducing urban heat and flood risks (adaptation). Engaging communities in these processes ensures that climate action is tailored to local needs and challenges, and this has been particularly evident and successful through the use of citizen assemblies and juries to engage with citizens as well as via climate commissions which play an important convening role in designing and supporting local climate action (Howarth et al. 2021; 2023).

Role of Governance, Finance and Politics

The successful integration of climate mitigation and adaptation strategies is critically dependent on governance, finance, and politics within cities (Bulkeley et al. 2011). These three factors shape decision-making, assign and allocate resources, and implement policy needed to address climate change effectively within the boundaries of the urban environment. Generally speaking, governance structures provide the frameworks to support and deliver coordinated action, finance enables the necessary investments and flows of money to support this action, and political will drives the ambition required to design, implement, and ramp up meaningful change. Together, these factors can determine the success of climate strategies at a macro level and their alignment and integration within and across adaptation and mitigation agendas, ensuring that cities can reduce their emissions while adapting and building resilience to the inevitable impacts of climate change.

Cities do not operate in isolation. Climate action relies on multilevel governance, as discussed above, where national and local authorities

work together to align policies. National governments create broad frameworks such as emission targets, while local governments implement practical solutions such as green infrastructure and flood defenses, this is then further enforced within cities, at times independent of (often slow) progress beyond city boundaries. Cross-sectoral coordination ensures collaboration across key sectors such as energy, transportation, and health, addressing both climate mitigation (e.g., reducing emissions through electric vehicles) and adaptation (e.g., heat-resilient infrastructure), but this generally occurs in isolation with missed opportunities to join up these cross-sectoral collaborations and make the most of co-benefits of climate action. Within this process, stakeholder engagement is crucial, involving communities, businesses, and civil society to ensure that climate policies are inclusive, equitable, and widely supported, particularly for vulnerable groups, enhancing the effectiveness of climate initiatives (Sprengel and Busch. 2011). This has been particularly successful through the model of climate commissions, established in the UK and initially launched in the cities of Leeds, Belfast, and Edinburgh, often occurring at a city level, and whose aim is to translate national climate targets to the local level through such a collaborative process (Howarth et al. 2023).

Finance plays a key role in integrating climate mitigation and adaptation efforts by ensuring adequate resources and flows of finance for climate action, especially in developing countries (Dikau and Volz 2021). International mechanisms such as the Green Climate Fund (GCF) support projects that promote renewable energy, energy efficiency, and climate-resilient infrastructure. Blended finance, combining public and private investments, helps to scale up climate efforts by de-risking private ventures into green technologies. Additionally, budgeting for climate resilience is vital,

as governments must plan for both mitigation and adaptation by allocating resources for low-carbon infrastructure and disaster risk reduction, ensuring long-term sustainability and reducing vulnerability to climate impacts.

Leadership, public opinion, and international diplomacy are important components of politics and significantly impact the integration of climate mitigation and adaptation in urban areas. For example, strong political will is crucial for setting ambitious climate targets and embedding climate resilience into long-term plans, as seen in cities like Copenhagen and New York. Public opinion pressures governments to prioritize climate action, especially when it aligns with voter interests and social justice. International cooperation, through agreements like the Paris Agreement, fosters collaboration, technology sharing, and financial support, particularly for developing countries. Political dynamics, therefore, shape the success and scope of global climate efforts.

Role of the IPCC and UNFCCC in Integrating Climate Adaptation and Mitigation in Cities

The Intergovernmental Panel on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC) play crucial roles in integrating climate adaptation and mitigation in cities (Wamsler et al. 2020). The IPCC synthesizes the most up-to-date scientific evidence on climate change and can thus highlight the importance of combining adaptation and mitigation (Hermansen et al. 2023). Indeed, the IPCC's three working groups have been known to work together producing IPCC outputs to ensure that integration happens. The IPCC's assessments guide cities in adopting science-based solutions,

helping local governments understand how adaptation measures, like green infrastructure, can reduce emissions while protecting against climate impacts. IPCC reports offer valuable insights for urban policymakers, emphasizing the co-benefits of integrated strategies, such as improving air quality, enhancing public health, and fostering urban resilience.

The UNFCCC, on the other hand, focuses on the international governance of climate action. Frameworks like the Paris Agreement promote global cooperation, encouraging cities to develop adaptation and mitigation plans aligned with national climate commitments. The UNFCCC facilitates climate finance through mechanisms such as the GCF, enabling cities to access resources for implementing sustainable urban projects. The two organizations underscore the need for cities to simultaneously tackle climate risks and reduce emissions, fostering a unified global approach. Together, the IPCC's science-based guidance and the UNFCCC's policy frameworks create the foundation for cities to integrate climate adaptation and mitigation, promoting long-term sustainability and resilience.

Conclusion

Integrating climate mitigation and adaptation strategies is crucial for the future of cities, but it is not without its challenges. Efforts to manage climate change in cities often focus on mitigation efforts to reduce greenhouse gas emissions separately from efforts seeking to adapt to the impacts of climate change, which can lead to inefficiencies. Yet, integrating both approaches can create co-benefits and reduce emissions while enhancing resilience to climate impacts. Cities that embrace and align mitigation and adaptation

agendas could reduce their emissions by raising their resilience to climate hazards and improving the quality of life of their residents, thus, strengthening a range of co-benefits across society. Mitigation efforts tackle the root causes of climate change, aiming to reduce the future severity of these hazards, while adaptation ensures that communities are equipped to handle the impacts that are already occurring. As the impacts of climate change become more pronounced, the need for integrated urban climate strategies will continue to grow. By developing green infrastructure, promoting energy-efficient technologies, designing climate-resilient urban areas, and learning from across sectors, cities can simultaneously reduce emissions and enhance their ability to cope with the increasingly harsh effects of climate change.

However, it is not a straightforward process. There are several challenges to integrating climate mitigation and adaptation in cities, including institutional silos—where different departments handle mitigation and adaptation separately, missing opportunities for synergies—and competing priorities (e.g. housing, economic development, and limited funding) that makes it difficult to implement integrated strategies. Moreover, cities often operate on short-term political cycles and deal with a lack of coordinated funding or policy frameworks, while climate challenges require long-term planning. Overcoming these barriers is crucial for making cities more sustainable and climate-resilient, ensuring they can address both mitigation and adaptation needs effectively.

While these and other challenges exist, the benefits of an integrated approach are clear. Integrating climate adaptation and mitigation in cities brings numerous co-benefits, enhancing resilience, environmental sustainability, and social equity. By fostering

synergies between adaptation and mitigation strategies, cities can appropriately address the multidimensional impacts of climate change while optimizing resource allocation and efficiency. This holistic approach not only promotes long-term urban sustainability but also ensures that vulnerable communities are better protected from the adverse effects of a changing climate.

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2.

Sustainable and Productive Cities and Urban Sustainable Development: A Developing Countries Perspective

Arkebe Oqubay

The article discusses the role of sustainable and productive cities as drivers of global transformation. Cities, as the heart of human civilizations, not only propel economic development and serve as technological and innovation hubs but also inspire hope and optimism for the future. They contribute over 80 percent of the global economy and nearly 100 percent to all scientific and technological breakthroughs. Rapid urbanization has been a primary force in the demographic shift that impacts global transformation. With their unparalleled resilience and innovation ability, cities are also at the forefront of significant global challenges, such as the COVID-19 pandemic and climate change, finding sustainable solutions. Cities are not just essential to the 2030 Agenda for Sustainable Development and the Paris Climate Agreement, endorsed by all United Nations member countries, but are the subject and primary actors in implementing

it. By recognizing the importance of making "cities and human settlements inclusive, safe, resilient and sustainable" (Goal 11), the 2030 Agenda underscores the importance and impact of cities in shaping the future.

However, in shaping global transformation, cities face significant challenges in releasing their full potential, including financial, governance, and political constraints. A G20 Summit in Rio de Janeiro led by Brasil could be instrumental in promoting city transformation and urban sustainable development as essential components of the development agenda, empowering cities to take charge of their transformation. The objectives of the paper are: (1) to present urbanization and urban transformation as a framework; (2) to explain why and how cities should strive to be not only *productive* but also *sustainable* to promote their national development strategies, to achieve Sustainable Development Goals (SDGs) and the net zero agenda; (3) to further discuss the dynamics of city transformation with a focus on Addis Ababa's transformation as a case study; and (4) to learn from city leadership experiences. The article will explore critical questions: What specific strategies can cities implement to become productive and sustainable cities? What examples of successful city transformation and leadership experiences can be learned from? Given the urbanization wave, population growth, and the lagging structural transformation, these questions have significant implications for cities in emerging and developing economies or the Global South.

This article is enriched by the author's over three decades of experience in development policymaking and transformation, including serving as the former mayor of Addis Ababa and former minister of urban development. This unique perspective,

combined with extensive scholarly and research work drawing from development economics, urban development, and international political economy, provides a comprehensive understanding of the issues at hand. The paper is structured into four sections covering the above mentioned themes, supplemented by an introduction and conclusion. The author's unique perspective is a critical element that makes this paper a valuable resource for understanding urban transformation.

Urbanization Pattern and Urban Transformation

Economic history tells us that demographic shifts and technological advances are the two drivers of economic development. Technological advances have accelerated since the first industrial revolution in England (1850s–1950s), followed by the second and third industrial revolutions (1850s–1950s) and the ongoing fourth industrial revolution, which is characterized by green and digital transformation (which was activated after the 1950s).[1] The acceleration of technological advancement and innovation was propelled by population pressure. This section highlights that cities are engines of economic growth and innovation; accelerated urbanization in the twenty-first century is expected to shape developing and emerging economies; the demographic shift—shifts in population growth and median age in developing countries accompanied by aging and population decline in advanced economies. Cities have the primary role in sustainable structuring transformation.

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1. Fossil fuels powered the first, second, and third industrial revolutions. The fourth industrial revolution is transitioning from fossil fuels, driven by digital and green technology breakthroughs.

Demographic Shifts

Between 1900 and 2000, the world population increased from 1.6 billion to over 6 billion, a nearly four-fold increase in the 20th century. In this century, it is projected to hit almost 10 billion by 2050, peaking by the end of the century. Asia and Africa are the main drivers of population growth in the twentieth and twenty-first centuries. By 2000, Asia accounted for 60 percent of the world population, while Africa is expected to be the primary driver in the 21st century. Various factors, including fertility rate, public health and life expectancy, migration, and global scale events, influence the demographic shift. In addition, shifts in the age structure accompanied demographic shifts, although uneven across various regions.

Advanced economies faced an aging population while developing countries enjoyed the increase in younger populations, with Africa enjoying 20 years in contrast to Asia's 34 years and advanced economies 45 years. Asia garnered a demographic dividend in the second half of the twentieth century, when the working-age population grew faster than the dependent population, leading to increased economic productivity (UN DESA 2024). Africa will pass through this process in the twenty-first century. Africa's population will increase from 1.4 billion in 2025 to 2.5 billion by 2050, with significant implications for economic development—an increase from 1.4 billion to 2.5 billion in 2050, with a projected additional 800 million people joining the workforce with a considerable impact on job creation, the potential to emerge as hubs of productive capacity, and contributing to market growth (Best 2001; UNCTAD 2019).
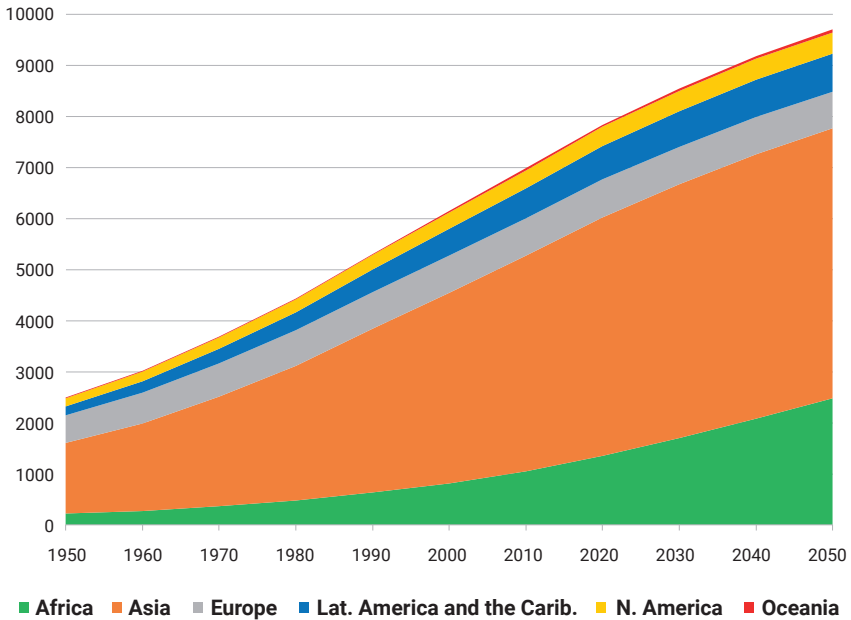
Figure 1. World population by regions (1950–2050, millions).
Source: Greening of African Economic Development from UN DESA data.

Rapid Urbanization

However, from a demographic and technological development perspective, rapid urbanization and the accompanying urban transformation are fundamental drivers of global change. In 1900, the urbanization level was below 15 percent, doubling to 30 percent by 1950 and reaching nearly 58 percent in 2025. It is projected that roughly 70 percent will live in urban areas by 2050, peaking at 90 percent by 2100, witnessing a fundamental shift in human history. The pace of economic development and industrialization, population growth and age structure, technological advances, and rural-to-urban migration have influenced the rate of urbanization.

However, the level of urbanization characterizes significant unevenness among different regions. For instance, over four-fifths of people in the Americas and Europe will live in cities by 2025, while it will only reach 55 percent in Asia. Africa will be the least urbanized, reaching 45 percent. Various factors account for the variations in urbanization levels that reflect the accompanying economic growth and transformation.

Since 1960, African cities have transformed in size, urban structure, and economic contributions. In 1960, cities in the newly independent African countries accounted for 20 percent of the Gross Domestic Product (GDP), and 15 percent lived in cities. By 2000, cities' contribution to the national economy had increased to nearly 60 percent. By 2050, African cities' contribution is projected to grow to 85 percent of Africa's GDP. In 1960, only three cities had a population between 1 and 5 million; by 2020, the number had increased to 68. In the same period, the total number of cities with a population over 300,000 increased from 19 to 235 and is projected to grow to 366 in 2035, of which five are mega-cities over 10 million and 19 are metropolitan cities with 5–10 million population.
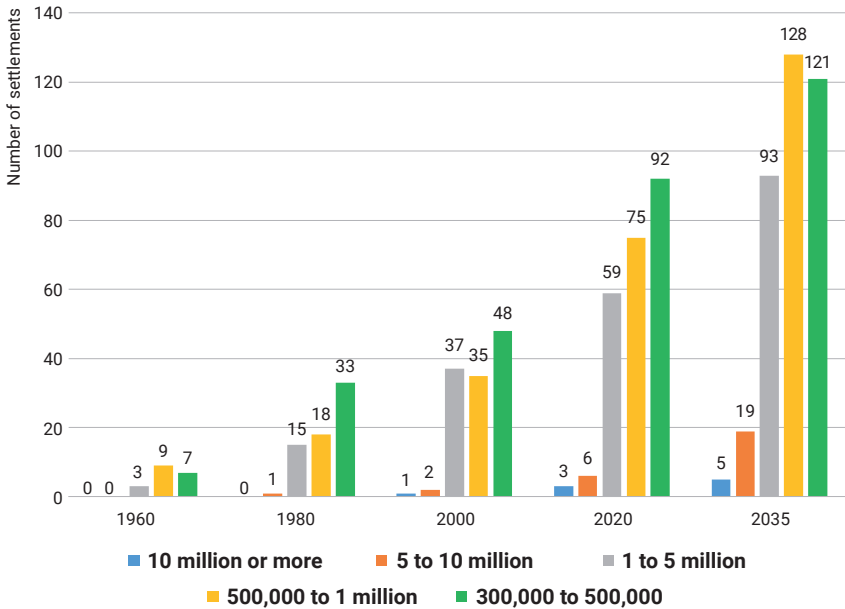
Figure 2. Urban settlements in Africa (1960, 1980, 2000, 2020, 2035).
Source: Greening of African Economic Development from UN DESA data.

Agglomeration Economies and Innovation Spillovers

The historical perspective of the role of cities in economic growth captured by Paul Bairoch (1988) in *Cities and Economic Development: From the Down of History to the Present* highlights cities as catalysts of economic development; the Industrial Revolution as the turning point emphasizing the interconnectedness between industrialization, urbanization and role of cities; and the diverse nature of cities and the economic disparity of cities as a permanent feature.[2] Jane Jacob's pioneering works, *The Economy of Cities* (1969) and *Cities and the Wealth of*

2. See more: Von Thünen (1863); Hoover (1948); Le Corbusier (1929), Lefebvre (1996); Mumford (1972); Castells (1991); Henderson (1974, 2003); Glaeser (2011).

Nations (1984), emphasize cities where the new is created and the notion of a "productive city" and innovation hub as premier drivers of economic development, "cities are settlements where much new is added to older work and this new work multiplies and diversifies a city's division of labor; that cities develop because of this process, not because of events outside of themselves; that cities invent and reinvent rural economic life; that developing new work is different from merely repeating and expanding efficiently the production of already existing goods and services" (1969, 122). Moreover, Jacobs underscores the interconnection and synergy between industrialization and urbanization and puts cities at the heart of structural transformation. Jacobs adds: "A country's basic wealth is its *productive capacity*, created by the practical opportunities people have to *add new work*" (1969, 77, author's emphasis).

Agglomeration economies are a key feature that enables cities to play a central role as they foster positive externalities and spillover, namely, *localization economies*, associated with external economies of scale generated by the concentration of firms in the same industries in the same vicinity (Marshall 1920). This process functions through the advantages brought by the pool of skilled labor, the availability of intermediate inputs and services, and the knowledge and technological spillovers, referred to as the Marshallian Trinity. Moreover, Ohlin's *urbanization economies* generate external economies of scale across various industries and sectors in relatively large cities and urban centres (Ohlin 1933). Multiple channels of agglomeration are revealed through a combination of an organic process and policy-driven through multiple typologies of industrial hubs—industrial parks, special economic zones, and technology hubs, among the many variations influenced by the nature of sectors and national context as

comprehensively presented in Oqubay and Lin (2020) *The Oxford Handbook of Industrial Hubs and Economic Development.*[3]

From a development economics perspective, industrialization and exports are vital for sustained structural transformation because of the *special properties* of manufacturing, the strategic benefits of exports, and the increasing role of technological innovations. Exports play a strategic role as a source of international learning, relaxing constraints on balance-of-payments and maximizing increasing return to scale (Passineti 1982, 1993; Thirlwall 2013). Manufacturing is an engine of growth and structural change because of: (a) strong causal relations between the growth of manufacturing output and the growth of GDP; (b) between the growth of manufacturing output and the growth of productivity; and (c) between the rates at which manufacturing expands and the growth of productivity outside the manufacturing sector (Thirlwall 2013; Kaldor 1967). From a Schumpeterian evolutionary perspective, technological change is the driver of industrial capitalism that emphasizes the vital role of innovation and production capability and the activation of "creative destruction" that pulls the rise of new industries and new economies (Schumpeter 1934). Historical evidence suggests that industrial policy and productive transformation are vital in economic catch-up and structural transformation.[4] However, the landscape of industrial policies is evolving with time, involving the increasing importance of environmental sustainability, the blurred boundaries among sectors, the rise of the high-value services sector, and the industrialization of agriculture.[5]

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3. See also Krugman (1993); Porter (1998); Saxenian (1996).

4. See more: Oqubay (2015); Cramer, Sender, and Oqubay (2020); Oqubay, Cramer, Chang, and Kozul-Wright (2020).

5. See more: Lee (2019); Kuznets (1966); Ocampo, Rada, Taylor (2009); Mazzucato (2013); UNCTAD (2016); Oqubay and Ohno (2019).

Climate Change and Green Transition

As homes to the majority of humanity and the associated production and consumption, and as engines of economic development, cities are responsible for about 70–75 percent of global urban greenhouse emissions, powered by the dominant fossil fuel energy sources. Out of the 25–30 billion metric tons of CO_2 generated annually, industrial activities in cities account for 20–25 percent, transport, buildings, and built-up areas for about 35–40 percent, mobility for about 20-25 percent, and waste management for the remaining 3–5 percent. From the perspective of environmental sustainability and sustaining economic growth, the appropriate response should *not* be to degrowth, as some prominent advocates advocate, but to find a sustainable approach to growth and economic development. This is because economic development is the only pathway to ending poverty and improving people's living standards in the developing world. The foundation of this perspective is that green growth or green transformation should be based on building industrial capacities and developing green technologies to create a carbon-neutral economy and make progress to net zero emissions.[6]

The significant drivers of green growth and transformation are the increasing pressure for national security—energy security and resource scarcity and the brake on economic catch-up; increasing pollution in urban centres and its impact on public health and public pressure; and the recognition that the world is in the mid of Green Industrial Revolution powered by digital transformation and green technologies. The evidence suggests that carbon emissions, energy use, and accelerated growth can be decoupled. The global green transformation landscape is being championed by developing

6. See more: Mathews (2014); Mathews and Oqubay (2024); Thurbon, Kim, Tan, Mathews (2023).

countries, particularly in renewable energy, electric vehicles, and battery storage, notably by China, which has allowed drastic cost reduction benefiting from the learning and experience curves. Figure 4 shows the global rise of renewable energy, EV manufacturing, and electric-powered high-speed and metro transport, significantly contributing to urban sustainable development.
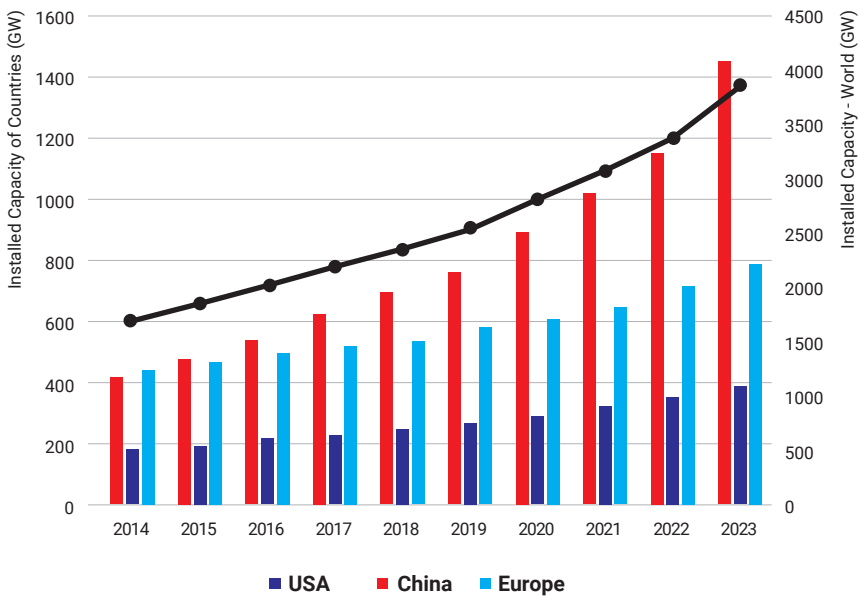
Figure 3. Renewable energy (2014–2023).
Source: Compiled by Greening of African Economic Development from the IRENA database.
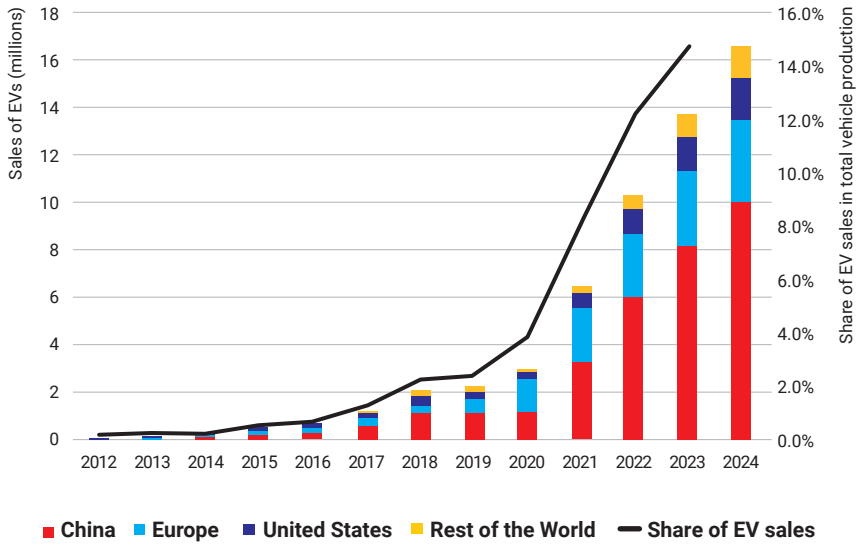
Figure 4. Sales of EVs (2012–2024).
Source: Compiled by Greening of African Economic Development from data of IEA, IRENA, and Organisation of Motor Vehicles Manufacturers.
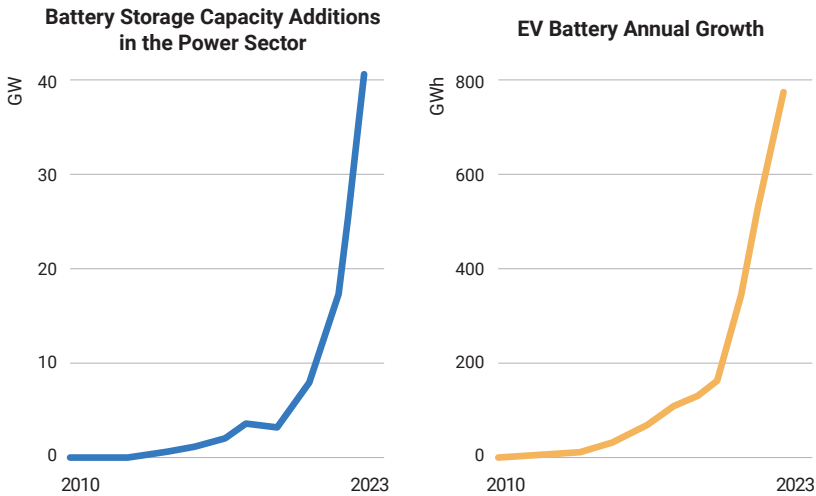
Figure 5. Growth of battery storage technology. The energy sector is propelling huge growth in the global battery market. Today, batteries are the fastest growing clean technology.
Source: International Energy Agency.

On the political economy side, the incumbent fossil fuel industry receives significant subsidies amounting to over a trillion dollars in direct subsidies annually and over five trillion dollars in indirect support, undermining the global carbon-neutral path. In contrast, green growth and green technology attracted insufficient subsidies. In addition to this perspective, just transition is an essential principle, Common But Differentiated Responsibility (CBDR), a solid commitment to establishing loss and damage fund for vulnerable countries, and the polluter pays principle is a guiding principle.

In conclusion, this section reviews the global urban dynamics, which significantly affect policymaking and international collaboration. First, it highlights that developing and emerging economies would play a significant role in global transformation as nearly 80 percent reside in these countries. A considerable wave of urban growth will be concentrated in Asia and Africa, given that the next urbanization shift will occur in these regions. National, sub-national, and local governments can use strategies and policies essential for transformation. Second, all world cities—mega cities, metropolitan, and cities—must focus on economic growth and creating employment opportunities, expanding exports, building productive capacity, and attracting productive investment to steer the economy. For instance, Asia is now emerging as an engine of global economic growth, primarily concentrated in Asian cities. Third, cities have the choice to promote environmental sustainability and green transformation as an essential feature of high-quality economic development and as they have the potential to shape the future. Finally, national urban policies, city plans, and city governance can be crucial in achieving broad goals (Nayyar 2019).

Urban Sustainable Development and City Transformation

Global Compact on the SDG Goals

The United Nations adopted Agenda 2030 with 17 SDGs and their main policy application in urban structures, illustrating cities' centrality. These goals call for *productive cities*, as goals 1, 2, 4, 8, and 9 illustrate; *sustainable cities*, as goals 11, 12, 13, 14, and 15 show; and *inclusive cities*, as goals 2, 3, 5, and 10 highlight. The SDG goals' success depends on the policies, leadership and *urban governance*, as goals 16 and 17 show (see figure 4). Given the trend that an increasing proportion of the world population will live in urban centres, then, by default, all the SDGs will directly impact cities since the outcome of the goals is to improve the livelihood of people wherever they live.

	SDG Goal	Main policy application in cities and urban settings
1	No poverty	Implement policies that support affordable housing, social protection, and access to essential services to reduce urban poverty.
2	Zero hunger	Promote urban agriculture, improve food distribution systems, and ensure access to nutritious food in urban areas.
3	Good health and well-being	Address urban health challenges such as pollution, lifestyle diseases, and access to healthcare; promote healthy living environments.
4	Quality education	Enhance access to quality education for all urban residents, particularly marginalized communities; ensure equitable education opportunities.
5	Gender equality	Promote gender equality in urban areas by ensuring equal access to services, employment, and participation in decision-making processes.

	SDG Goal	Main policy application in cities and urban settings
6	Clean water and sanitation	Ensure sustainable water management, improve urban sanitation services, and reduce water-related environmental impacts.
7	Affordable and clean energy	Increase energy efficiency, promote the use of renewable energy, and ensure affordable energy access for all urban dwellers.
8	Decent work and economic growth	Foster inclusive economic growth, create job opportunities, and promote decent work in urban economies.
9	Industry, innovation, and infrastructure	Develop resilient urban infrastructure, enhance public transportation, and foster innovation to support sustainable urban growth.
10	Reduced inequality	Reduce income disparities, ensure equal access to services, and promote social inclusion in urban settings.
11	Sustainable cities and communities	Focus on urban planning, affordable housing, public transportation, green spaces, and reducing cities' environmental impact.
12	Responsible consumption and production	Promote sustainable urban consumption and production practices, including waste reduction, recycling, and resource-efficient processes.
13	Climate action	Implement climate mitigation and adaptation strategies in cities, reduce greenhouse gas emissions, and enhance resilience to climate-related impacts.
14	Life below water	Manage urban waste and pollution to prevent harm to marine and freshwater ecosystems and protect waterways that run through urban areas.
15	Life on Land	Protect and restore urban green spaces, promote biodiversity, and manage urban forests sustainably.
16	Peace, justice, and strong institutions	Strengthen urban governance, promote inclusive institutions, ensure access to justice, and reduce violence in cities.
17	Partnerships for the goals	To achieve sustainable urban development, foster collaboration between local governments, businesses, and civil society and share knowledge and resources for effective implementation.

Table 1. SDG goals and main policy application in urban areas and cities.

The Paris Climate Agreement

The Paris Climate Agreement (signed by 196 countries in 2015) aims to achieve climate neutrality by 2050, net zero emissions, and maximize efforts to limit the temperature increase to 1.5°C.

	Paris Agreement Goals	Policy application in cities and urban structures
1	Limit global warming	Implementing policies to reduce carbon emissions from buildings, transportation, and energy use, and promoting the use of renewable energy sources to contribute to the net zero goals.
2	Adaptation	Enhancing infrastructure resilience, improving urban planning to withstand extreme weather events, incorporating climate adaptation strategies in city development plans, and expanding forest areas.
3	Develop clean technologies	Speeding up technological innovation to bring breakthroughs and enhance international technology transfer.
4	Finance flow	Attracting and directing investments towards sustainable urban projects, promoting green finance, and ensuring that city budgets align with climate resilience and low emission.
5	Climate change funding	Establishing the climate loss and damage fund to support vulnerable regions and rich countries to provide a minimum of $100 billion for climate change adaptation.

Table 2. Paris Climate Agreement goals.

The Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report (AR6) Synthesis Report provides the most updated scientific synthesis on climate science, impacts, risks, and potential solutions. The following summary highlights the main policy implications for cities and urban areas.

	Theme	Implication for Cities and Urban Sustainable Development
1	Global warming	Cities significantly contribute to global warming due to their high energy consumption and emissions. Cities must design strategies to reduce carbon footprint, transition to renewable energy, and improve energy efficiency.
2	Climate impacts	Cities are highly vulnerable to extreme weather events, including heat waves, flooding, and storms. Therefore, they must build resilient urban infrastructure and services. Long-term urban plans must incorporate projections of climate change impacts to ensure future sustainability.
3	Mitigation and adaptation	Cities must prioritize sustainable urban planning, such as green building practices, sustainable public transportation, and green spaces. They should also implement adaptation measures such as flood protection, stormwater management, and upgrade urban infrastructure.
4	Climate finance	Urban areas require considerable investments to pursue low-carbon transitions and build climate resilience. Cities should prioritize budgets for climate goals and mobilize green financing for urban sustainable development.
5	Equity and social justice	Climate impacts disproportionately affect low-income and marginalized communities in cities, and urban policies must enhance equitable access to resources, protect from climate risks, and engage communities in decision-making.

Table 3. IPCC's Synthesis Report VI (2022).

Nonetheless, the Paris Agreement fails to address the intellectual property rights (IPR) issue under the TRIPS, which continues to be a significant obstacle, as was observed during the COVID-19 crisis, regarding the waiver of IPR for developing countries. Regarding financial resource mobilization, legal instruments for enforcing the decision were not agreed upon, leading to the sidelining of the critical resolution of the Paris Climate Agreement.[7]

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7. See more: IPCC (2023); UN (2015); UNEP (2024).

City Transformation and Urban Sustainable Development

Cities across continents and regions have demonstrated that city governments can play a leading role through exemplary initiatives. This section presents prominent examples in advanced and developing countries and the case of transforming an African city through the case of Addis Ababa, where the author led as a mayor, internationally recognized transformation, for which he received recognition as Best Mayor Addis Ababa and finalist World Mayor, 2006.

Transforming an African City: The Case of Addis Ababa

The metropolitan city witnessed the first significant transformation during the author's Mayorship between 2002 and 2006. This paper presents three major flagship priorities among the many initiatives and plans. The first was an award-winning Integrated Housing Development Program, a pioneering initiative in which the United Nations Human Settlements Programme (UN-HABITAT) conducted extensive studies to extract the best lessons. It aimed to address the 700,000 housing units and shelters deficit and integrate with various multiple aims. The creation of employment opportunities through the booming construction industry aimed to create tens of thousands of jobs and the establishment of hundreds of medium-sized construction companies and sub-contracts, which included extensive capacity-building programs. The program was designed to boost technical and vocational education and training (TVET) to build synergy with skills development. The program aimed primarily at wealth creation to motivate city residents to engage in savings and allow ownership. Housing distribution was based on a computer-based lottery basis to ensure transparency. Women got priority, allowing them to benefit from 55–60 percent of completed

condominium houses, combined with the city government's subsidy providing free land lease costs and infrastructure costs and targeted subsidies to low and medium-income like studio and one-bedroom dwellings. Low mortgage interest rates were integrated into the program, allowing for use for building houses and with a 10–20 percent equity requirement, and mortgage paid back in 15–25 years. The program was integrated with slum upgrading to build neighborhoods partly in the city's old and periphery, maintaining residents' social fabric and neighborhoods that combine community services and commercial quarters (all ground floors), and designing modular and cost-effective buildings. The typical nature of this program combined the productive city, focusing on boosting the city's economic vitality, ensuring environmental sustainability, and executing inclusiveness.[8]

The City Government of Addis Ababa initiated an extensive education program to end the shift system in schools, which hosted 700,000 students in primary and high schools and employed over 12,000 teachers. The primary aim was not only to improve the quality of education but also to ensure that mothers have the opportunity to work full day by ensuring that students attend school for a full day. The city built 5,000 school rooms accommodating nearly 300,000 students, which was necessary for ending multiple shifts and allowing double the teaching contact hours. The program upgraded existing schools with toilet facilities, title deeds, and protected compounds. The program created massive jobs that contributed to developing the construction sector and manufacturers. New modular five-floor building designs were introduced for economic land use, reducing construction costs and allowing massive

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8. See more: City Government of Addis Ababa (2004), UN-HABITAT (2011).

construction to be completed in 12–18 months. All classrooms were equipped with the required furniture and facilities. The project was primarily implemented at the school level in 100 sub-cities and engaged the Teacher-Parent Committees. Additional reforms included reassigning school directors, introducing new recruitment methods, and improving teachers' salaries. Again, the program was designed to build a productive, sustainable, and inclusive city.

A vital component of the city transformation was the changes introduced in the city plan based on the principle of a compact city, the mixed settlements of various income groups (a unique feature of Addis Ababa), mixed residential and commercial buildings, allocating special zones for industrial use, and expanding production and market clusters for small and medium enterprises. The city plan concept shifted from a rigid city planning approach to a structural plan that allows flexibility to adapt to the growth realities, supported by targeted local economic development contributing to the specialization of various parts of the city. A new initiative, Green and Clean Addis Ababa, was launched to mobilize grassroots communities and partner with the private sector and belief organizations. A new institution, the Beautification and Cleaning Agency and Code Enforcement Agency, contributed to sustaining the initiative. Urban mobility is central to improving the city's productivity and economic growth, affecting the quality of living. The city government allocated a significant budget for expanding major arteries, and priority shifted to giving adequate pedestrian pavements. A new approach to completing road projects in the shortest time reduced the disruption during the construction period and improved city performance.

Piloting and phased approaches were introduced in these projects

to test the idea and incorporate best practices and learning, leading to speedy learning and benefitting from the scaling up while managing risks. In addition, the program engaged city residents with inputs to the design of the project, discussion on the draft plans, and reviews during implementation. The city's structure was restructured to make it lean, reduce waste, and improve execution quality. The city hall's restructuring involved over 40,000 employees and was implemented with no layoffs but reassignment to new productive activities. The city hierarchy was reduced from five to three levels—city hall, ten sub-cities, and 100 local administrative offices with service delivery responsibilities. The city government also introduced how the city political appointees are organized, municipal services are under the city manager, and critical municipal services are organized under city public enterprises.

The factors that led to the success of the city transformation were: first, the federal government's commitment to grant Addis Ababa Charter City status with broad mandates allowing the city to play a prominent role, improve its revenue sources, and transform into a thriving city. The national urban development policy, city plans, and industrial development strategies focused on promoting a productive city based on the principle of sustainability (FDRE 2003, 2003, 2005, 2008). The city leadership focused on solutions outside the conventional thinking, coming up with unique approaches to the challenges rooted for decades. It maximized the advantage of learning from targeted learning-by-doing and lessons from international best practices. As a federal capital and the diplomatic and political capital, the seat of the African Union and UNECA, close coordination with the federal government and continental organizations was essential. An essential factor in this process was the focus on engaging the civil society, private sectors, and other

stakeholders, which facilitated the speedy implementation of the transformation plan and inspired the city residents.

In summary, all the reforms undertaken led to the emergence of a sustainable and productive city. The city transformation movement's lasting impact was that the city witnessed a high standard on the city government, and the experiment and outcomes of this pioneering experience became the standard to measure successive mayors. Moreover, the city transformation's most significant impact was that city residents felt empowered and proud of their city.

Global Experiences in Building Urban Sustainable Development

Productive cities focus on employment creation and attracting productive investment and talents to build international competitiveness in exports and industrial and innovation hubs. Experiences in South Korea, Singapore, and China show that industrial clusters and platforms facilitate the development of productive capabilities. Cities such as Shenzhen, Taipei, and Silicon Valley (San Jose and San Francisco belt) are leading global innovation hubs. Shenzhen, a small fishing village of 3,000 people, has grown into an innovation hub generating nearly half a trillion dollars and is home to global technology companies and world-class R&D hubs in four decades. Silicon Valley accounts for over $400 billion in GDP and is the home of international tech companies such as Apple, Google, Meta, and others. Taipei accounts for 25-30 percent of Taiwan's GDP. From Africa, Tanger City in Northern Morocco emerged as the primary industrial and productive city and major exporter of automotive and aeronautics industry and international logistics and port services within two decades. The Shanghai New Area development became a primary hub that

attracted high-tech firms and Fortune 500 companies in advanced technologies, including Tesla.

Regional development strategies and inter-city corridors can exploit advantages in massive agglomeration economies, leading to increased economies of scale and higher mobility. The Rotterdam-Amsterdam Corridor incorporating cities such as the port city of Rotterdam, the Hague, Amsterdam, and other cities, and the corridor incorporating transportation, logistics, and economic specialization, is an example that emerged into a major economic hub. The corridor contributes 20–25 percent of the Netherlands's GDP.

Shanghai New Area Pudong Development, developed in the last three decades, is one of China's most significant urban and economic developments. It accounts for 40 percent of Shanghai's total GDP and incorporates a global financial centre, a high-tech park, a free trade zone, and transport hubs. The widely implemented high-speed railway system revolutionized economic integration, ensuring sustainable transport and accelerating urbanization and agglomeration in a vast region.

Developing sustainable cities has increasingly become popular with city residents, and various innovative initiatives have been taken. Singapore has introduced sophisticated city plans and green thinking, making Singapore one of the best places to live and work. Despite its small land (approximately 700 square km, including reclaimed land), extensive green belts and green space have been expanded. Sustainable mobility incorporates restricting and encouraging non-motorized transport, including pedestrian and cycling. The unique approach of the Singaporean housing development strategy is considered among the most advanced approaches. Singapore has built over one million public houses and

high-rises integrated with neighborhood facilities, contributing to economic land use and making it livable. These approaches are part of Singapore's compact city planning model.

Kigali, the capital of Rwanda, has emerged as Africa's cleanest city with green initiatives in the last decade. Like Singapore's green belt, the metropolitan city of London sustained exemplary green parks across the city, improving the city's livability and contributing to reducing carbon emissions. Similarly, Copenhagen and Amsterdam are the best examples of approaches to non-motorized transport, particularly cycling. A significant solution to sustainable mobility is using sustainable public transport, typically involving a metro or underground system. A pioneer and one of the most successful examples is the underground tube in London, built in 1863, constantly upgraded and supplemented by a fleet of over 8000 red buses, making 10 million passenger journeys daily, managed by the city's TfL. It is estimated to cut over 2 million tons of carbon emissions. Vienna has also developed an accessible metro system. Among the latest successful examples is the Delhi metro system, which is nearly 400 km long, transporting over two million passengers daily. The system was developed in 2002 at an investment of $20 billion, and it is transformative in reducing carbon emissions and improving the city's productivity.

Challenges of Urban Sustainable Development and Conclusions

Urban Sustainable Development

Cities and urban sustainable development are not pivotal in the current state of the global agenda and collaboration, and the G20

could play a critical role in addressing a crucial challenge. The opportunity for achieving SDG goals is narrowing, and it appears unlikely that the goals will be met in the coming five years, as initially planned when the 2030 Agenda for Sustainable Development and Sustainable Development Goals were agreed upon and launched by the UN General Secretary in 2015. A significant challenge has been the inability to align the global financial architecture with sustainable development goals. Achim Steiner of the United Nations Development Programme (UNDP) highlights "There is a pressing need for a new international financial architecture. It must align capital with sustainable development and efforts to address the climate emergency, our global community's greatest challenge since the Second World War" (Focus 2030 2023). A recent review of the urban context of the Nationally Determined Contributions (NDCs) Paris Climate Agreement points out that the progress has been inadequate in many countries. According to *Urban Content of NDCs: Local Climate Action Explored Through In-Depth Country Analyses, 2024 Report* (UNDP and UN-HABITAT 2024), only 27 percent (53 NDCs) had a high urban content, while 39 percent (76 NDCs) showed moderate urban content, and 34 percent (65 NDCs) lacked urban content.

According to IRENA, the progress made in the clean energy transition (SDG 7) has been inadequate. It is primarily constrained by financing and resources, although technological breakthroughs and innovations have made significant progress in terms of renewable energy, production of EVS, and battery storage. The aim to triple renewable power and double energy efficiency has not been achieved because of lagging public and private financing and access to low-cost financing in the developing world. The investment requirement is over $1.5 billion annually until 2030, and so far, the

finance has reached $0.5 trillion in 2022. Importantly, developing countries have received unequally low, typically seen in Africa, which received below 2 percent of the total. IRENA's report shows that the disparities in investment per capita shot up between 2015 and 2021 between Sub-Saharan Africa and developed economies- it remained the same in Africa while it rose from 22 times to 41 times in Europe and from 23 times to 57 times in 2021. African cities face a binding constraint of mobilizing resources for urban sustainable development and smooth running of the cities, and this should be seen not only as a challenge for developing countries such as African policymakers but also as a global challenge. The SDG goals and the Paris Agreement are unlikely to be achieved with the current state of commitment. This has to be linked to the $1 trillion average annual super-profits earned in the last 50 years, over $1 trillion in subsidies to the fossil fuel industry, and inadequate subsidies for energy transition. Hence, the obstacle is political constraints rather than the adequacy of financial resources. There has been little progress in raising the loss and damage fund, showing the depth of the problem and pushing cities in the Global South to more profound vulnerability.[9]

Indicators	2023 (in $ billions)	2024−2030 (in $ billions)	On/off track
Investment in renewable power generation (yearly)	570	1,550	Off track
Investment needs for power grids and flexibility (yearly)	368	720	Off track
Total (yearly)	938	2,270	Off track

Table 4. Finance and investment requirement of renewable energy (2023–2030) (based on 1.5oC Scenario).

9. See more: IPCC (2023); IEA (2024); IRENA (2024).

Governance

Political constraints from government structures include the inadequate powers exercised by local governments, conflicting priorities, blurred mandates among cities, and subnational governments—states, regions, and provinces are significant obstacles that weaken cities' role and contribution. Across countries, significant diversity is influenced by history, culture, and politics. In recent years, political constraints have been added to the reality of election results, where the ruling party may not have an outright majority, and the coalition has to function jointly while managing the tensions. In some other cases, the difficulties are compounded by a paralysis of governance and long-term investment in public utilities is neglected. The case of metropolitan Johannesburg is a good example where the coalition could not function harmoniously. The ruling parties may also change every election cycle after 4 to 5 years, which may disincentivize long-term investment programs or lead to the sidelining of significant infrastructure programs that must continue beyond the election cycle.

In addition, cities' mandates could be limited to municipal services in many cases. In contrast, cities are not responsible for leading the education system, fiscal centralization limiting the cities' mandate to raise revenue, or are not mandated to develop and manage infrastructure. Many positive experiences are available on how cities could be empowered with broad mandates and how city, sub-national, and national governments coordinate optimally and build synergy. There is no standard prescription for addressing the political and governance challenges effectively. However, a good beginning could be a political commitment to ensure cities play prominent roles in achieving national goals and effectively

responding to citizens' demands. Targeted learning on such experiences could contribute to better practices.

Cities should improve their empowerment of citizens—not only the key constituencies but also the minorities—to ensure all critical decisions are consulted and maximize the direct participation of all communities. Representative democratic practices limited to participating in periodic elections are inadequate.

City Leadership and Urban Sustainable Development

Several insights and conclusions emerge from the paper. First, resilience, adapting, and learning have become vital. We live in a changed environment where volatility and uncertainty are the order of the day, and we live in an interconnected world. In the last 15 years, the world has faced three global crises: the 2008 Global Financial Crisis, the COVID global pandemic, and the global economic recession in 2020–2024. Leadership based on conventional wisdom no longer works, and management and leadership thinking are being redefined. Resilience is increasingly becoming a response to a world of poly-crisis with implications of the role of cities, the nature of intergovernmental coordination and how we live, work, and learn. Long-term and strategic perspectives are essential to adapting to the evolving external environment, which demands rapid learning and openness.

Second, building on linkage effects in development thinking and policy approaches should be a cornerstone of planning and execution. This approach is based on the principle that all activities do not necessarily have the same leverage and linkage effects. Every program and plan should be designed to maximize the promotion

of linkage effects that forcefully lead to other productive activities. Resources are always limited and demands exceed the resource scope of cities and national governments. The approach should be strategic and pragmatic, targeting resources on activities that generate maximum synergy. In addition, city leadership should look at hidden and scattered resources to put in force. Hirschman (1958) highlights that "Development depends not so much on finding optimal combinations for given resources and factors of production as on calling forth and enlisting for development purposes *resources and abilities that are hidden, scattered, or badly utilized.*" This development perspective is connected to Amsden's (1989), diversity notwithstanding, all late industrializers have in common industrialization, "emphasizing a developing thinking that builds on learning and an unconventional approach to fundamental development challenges.

Third, cities should be able to capitalize and exploit the "advantage" of local governments, leveraging the closeness to city residents, which puts significant pressure for better performance, to tap on ideas and resources of city residents, and the network opportunities within the city, horizontally among cities, and other potential partners and stakeholders. Building on little successes and a phased approach will build momentum and capabilities, building on speed and scale economies. Exerted efforts should be put into developing leadership capabilities through experience sharing, leadership dialogue, and centres of excellence, combined with relevant research—new knowledge and policy research—and building strong partnerships with scientific communities, including research universities and think tanks.

Conclusions

The paper delves into the themes of urban sustainable development within the context of productive and sustainable cities. It highlights the importance of cities in achieving the goals of Agenda 2030, the Sustainable Development Goals (SDGs), and the Paris Climate Agreement. The paper outlines the key global trends that impact cities and urban transformation, including demographic and urbanization patterns, agglomeration economies, climate change, and the digital and green technologies of the twenty-first Industrial Revolution. It also discusses the concept of productive and sustainable cities and the current status of global compacts and collaboration.

The paper emphasizes several vital insights. Firstly, it underscores the historical influence of cities on civilizations, economic development, and innovation. Secondly, it points out that rapid urbanization in the Global South, particularly in Asia and Africa, presents opportunities for government policies to harness this positive force. Importantly, the paper stresses the need for a comprehensive vision and strategy at national, sub-national, and local levels to develop productive and sustainable cities. It provides practical guidance and examples from the evolution of such cities.

The paper evaluates the focus of the SDGs and the Paris Climate Agreement on cities and urban transformation, acknowledging the challenges, such as financial and political constraints. It also underscores the increasingly significant role of the Global South in driving global economic growth and green transformation, with China at the forefront of this global shift. This recognition of the Global South's importance to relate it to global collaboration that will bring collective and mutual benefits. The evolving global changes have redefined city leadership, making it crucial and urgent

to focus on building productive, sustainable, and inclusive cities.

Moreover, the paper suggests that the G-20 Summit in Rio has the potential to invigorate urban sustainable development significantly. With Brasil advocating for the voice of developing and emerging economies and promoting global collaboration, this summit could be a pivotal moment in pursuing sustainable cities.

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3.

The City Meets Practical Ethics

Adela J. Gondek

Cities and the SDGs

The Agenda

In the fall of 2015, the United Nations (UN) General Assembly unanimously adopted a resolution titled *Transforming Our World*, the 2030 Agenda for Sustainable Development. Widely and familiarly known, the agenda consists of the 17 Sustainable Development Goals (SDGs), among them one, the 11th, on sustainable cities and communities, uniquely tagged with the term, sustainable, among all the goals. Yet, the objectives of the other 16 goals, if realized each in their own complex ways, would uplift cities and communities, enhancing them accordingly with purchase capacity (no poverty, the 1st); food security (no hunger, the 2nd); medical care (good health, the 3rd); necessary knowledge (quality education, the 4th); human enrichment (gender equality, the 5th); watershed management (clean water, the 6th); electrical power (clean energy, the 7th); equitable labor (decent work, the 8th); functional

buildings (critical infrastructure, the 9th); consensual participation (inequality resolution, the 10th); adequate supply (responsible production, the 12th); effective transportation (climate action, the 13th); teeming waterways (aquatic life, the 14th); bountiful terrain (land life, the 15th); appropriate governance (peaceful institutions, the 16th); and collaborative organization (partnered enterprise, the 17th). In such an abundance of uplifting, cities and their affiliated towns and villages would experience all the boons of urban sustainable development.

A Polity

While progress toward any one of the SDGs can be seen as variously directly or indirectly useful to the progress of any other, a city seems to be dependent on much that is beyond its immediate perimeters. Considering this, the ancient Greeks viewed a city as a city-state, which they called a polity. This included a city and all the surrounding territorial land and coastal water. Unless it was an errant philosopher (perhaps one like Socrates), the observers of that ancient time would undoubtedly be unworried about such concerns as are iterated in the SDGs—other than the 2nd, food security, and the 9th, critical infrastructure, which might be called infrastructure security, as so much is devoted to defense. Not far away, across the Ionian Sea, beyond the perimeters of the city of Rome, roads and aqueducts extended in so many directions that the name of the city was simultaneously the name of the empire. The well-known saying, "all roads lead to Rome," came into use, accordingly. Indeed, the objective of the 16th SDG, peace, can be seen as integral to Rome's building program (312 BCE to 226 CE). Much of its far-reaching critical infrastructure was built during the time of the Pax

Romana (the so-called Peace of Rome), which lasted for about 200 years (27 BCE to 180 CE)—and inevitably facilitated conquest and dominion in practically all directions. Astoundingly, the Roman inscription of the earth with considerably indelible roads provided an infrastructural map of what became, hundreds of years later, the European Union, one of the two regional unions in the Group of 20 (G20); and a component of North Atlantic Treaty Organization (NATO). Incidentally, the Roman roads reached Turkey, which has become a member of NATO, and subsequently reached Iraq, which has gained partner status with NATO. Interestingly, the critical infrastructure of ancient Rome reached the Crimean Peninsula— but not Russia.

Connectivity

This startling connectivity to distant regions and entities demonstrates that a city—or a group of them—may be more potent than presumed. This pertains to the many modes of connectivity of the Think Tank 20 (T20), C40 Cities, Urban 20 (U20), and G20. Cities, megacities, and local governments (grouped and launched as the C40 in 2005) engage then with an array of think tanks and academic institutions (grouped and launched as the T20 in 2012). Projecting what might become their critical infrastructure, the cities (grouped and launched as the U20 in 2017), serve as platforms for discourse on urban development, in connectivity with the group or bloc of major economies worldwide (the G20, or "Group of Twenty", construed in 1999, and convened in 2008) (Rio Capital 2023). In the United States (U.S.), complex connectivity (of "polities") can be seen in areas of comparatively dense socio-economic population flows. Such areas are officially designated Metropolitan

and Micropolitan Statistical Areas by the National Office of Management and Budget for the purpose of tracking population data (Executive Office 2023). Otherwise, cities are unofficially called metropolitan areas for actualizing livelihood and lifestyle, whether economically or socially. While people are likely to be unaware of the Metropolitan or Micropolitan Statistical Areas in which they live, they are apt to be aware of the metropolitan area to or within which they regularly commute or frequently travel. One of the most populous metropolitan areas in the world (and the largest by urban landmass) is New York City, which is the largest in the U.S.—and, as a Metropolitan Statistical Area, includes many of the major cities in New Jersey and Connecticut. This metropolis commands a vast water system, which extends over 100 miles (or 160 kilometers) in various directions and includes natural watersheds, engineered reservoirs, and built aqueducts—rather like Rome.

Summits

To bring to the attention of the U.S. President and Congress issues of urban development, New York City relies on a nonprofit, nonpartisan "group", named the United States Conference of Mayors. Established during the Depression in 1932, the Conference holds two major meetings and two leadership meetings annually, intending to press their city-level concerns to the national level of government (U.S. Conference of Mayors 2023, About). The organization is composed of all mayors or other chief elected officials of cities with a population of 30,000 or more. Since there are over 1,400 such cities in the U.S., and any of the members can attend the major meetings, these cities might be designated as a macro "C1400". Even earlier, a predecessor, the National League of Cities, was established in the U.S. in 1924

to represent all cities, towns, and villages, regardless of population size. Currently, this organization has over 2,725 member cities, which represent a total of approximately 19,500 cities, towns, and villages (National League of Cities 2024)—potentially a "C19500". Both organizations are based in Washington, DC, to ensure that their voices are readily heard—but not only at the national level of government. The Conference of Mayors has recently undertaken an international survey, mapping the "Global Footprint" of U.S. cities (U.S. Conference of Mayors 2023, Mapping); and the League of Cities has undertaken a subnational expedition titled, "Centennial Roadshow: 100 Years, 100 Cities" (National League of Cities 2024). Coincidentally, the current year is the 100th anniversary of the National League of Cities, which will be commemorated with a "City Summit"—subtitled, "One Hundred Years of Strengthening Cities"—from November 13 to 16, in Florida, just before the U20 becomes engaged with the G20 from November 18 to 19, in Rio de Janeiro. Both these urban entities will express, in their urban voices, an array of localized concerns, imparting to higher officialdom what people think about homes closer to ground level, including homelessness and belongingness.

On Care

Given the expansive interconnectivity among cities around the world today, and hundreds of years after the apex of the Graeco-Roman world, a book written in the form of an encyclical letter titled On Care of Our Common Home (in Latin, Laudato Si'), was published in spring, 2015, in another city: the Vatican City, located at the center of a Rome that changed long ago, sociologically. The current Pope, the first to take the name Francis, wrote the encyclical letter, doing so

in honor and remembrance of Saint Francis of Assisi (1181–1226), for his care of animals and all nature. Coincidentally, Pope Francis, the first pope from Latin America (born in the city of Buenos Aires, Argentina), was elected to be Pope on March 13, 2013—and one day later, the United Nations General Assembly Open Working Group on Sustainable Development Goals held its first meeting to discuss ideas from around the world (IISD 2023). These would eventually become the SDGs. The encyclical letter focuses on two critical interrelated ailments of the world: the common good—our common home, the earth—is suffering, as are the poor, both from depredation. The earth is plundered, and many people are impoverished (Francis 2015, sections 9–12). By invitation of the United Nations Secretary-General António Guterres (from Portugal), the Pope delivered a message (Epatko 2015) to the General Assembly on September 25, 2015, after which it unanimously voted in favor of the resolution on the SDGs. Both the letter and the message emphasize that in "Our Common Home," whether that of cities, towns, villages, or any other communities, much is amiss. Can one say that "Our Common Home" is replete with ethics?

Ethics today

Balance

There are many different approaches to ethics in both discourse and practice, and among them some are more straightforward than others, particularly in the use of both words and deeds. Terms such as teleological and deontological might require extensive disentangling or be repelled altogether as offensively colonialist;

while actions such as the imposition of law might appear as lawlessness, or be repudiated as essentially tyrannic or, to use the word heard frequently today, as fascistic. The concept of balance, together with its application, seems to be a common baseline in ethics. In his book, the Nicomachean Ethics, the classical Greek philosopher Aristotle (384 BCE–322 BCE), develops the idea that in matters of ethics, there can be too much and too little of something (e.g., some anger becomes wrath to the point of undue violence, while other anger becomes frustration to the point of doing nothing). Somewhere between these extremes, there is a mean or middle point where anger becomes perseverance and achieves a positive outcome. He calls the mean, virtue, which is less a definitive than a flexible quality (Aristotle 2021, II.5). The idea of balancing excess and deficiency to find a mean between them interconnects Aristotle's primary book on ethics with his book titled *Politics – A Treatise on Government.* The governor (who he calls the "legislator") is a "good" man but also knows how to find necessary balances in governing the city-state. The most fundamental balance is between the size, needs, and capabilities of the population and the size, resources, and capacities of the territory (Aristotle 2004, VII. 4–5). The overall message is that sufficiency should exist between people and land, but sufficiency may differ from one to another city.

In making such observations about many cities, indicating numerous imbalances throughout and beyond the Greek world, Aristotle stands somewhat as a one-man think tank observing many legislators or governors. Centuries later, in 1972, a book commissioned by a group named the Club of Rome, was published with the title *The Limits to Growth.* Founded in 1968, the club had grown to include business leaders, scientific researchers, and government officials, who presented the researchers' findings at

international gatherings in Moscow and Rio de Janeiro in 1971 (Meadows et al. 1972, 186). From that time, 30 million copies have been sold in 30 languages, more than any other environmentalist book (Nørgård et al. 2010, 59). Astonishingly, from a contemporary perspective, neither climate nor climate change is mentioned in the text. Instead, at that earlier stage of the environmental movement, the central "problematic" (a term the Club used to signify a meta-problem or a meta-systems-problem) was one of imbalance: human population growth was so rapid that it would soon ruinously out-grow both economic and natural resources (Meadows et al. 1971, 191), or in Aristotle's terms, the people and the land would be in a serious imbalance. The idea of balance hovers in ethics, most pointedly when some form of imbalance looms. Whether in discourse or practice, standpoints such as "extremist belief" and "disproportionate force" are typically viewed as dangerous. Likewise, the "globalization" of human affairs can be viewed as excessive, leaving deficits in the SDGs in localities and their municipalities. One can hear a call rising from them for a counterbalance in the form of the "localization" of human affairs.

Documents

While the ethical concept and practice of balance have had a long descent to modernity, even if acclaimed but not achieved, documents have a critical place in our common ethics today. Documents can be confounding inasmuch as they require some form of literacy on the part of the writer, reader, listener, interpreter, editor, amender, publisher, archiver, and all others who work with them. They appear increasingly everywhere, typically in association with organization—and bureaucracy. Some, whether simple or

complex forms to be completed any number of times, are apt to be called "paperwork" or more onerously "red tape." Others are unique textual writings intended to announce, detail, teach and assert new critical ideas, in the form of guidelines for human affairs. Both kinds of documents, though the former may be tiresomely routine and the latter awakeningly breakthrough, can be described as imbued with ethicality considering they manifest agreement, evidence, fidelity, duty, truth, trust, and other such qualities. Inevitably, there are those who prefer to "give their word" verbally. In the U.S., some argue in favor of verification of citizenship for registration to vote, saying that documental proof demonstrates honesty; while others argue against any such verification (by providing, for example, a birth certificate), saying their spoken word should be believed. However, insofar as new critical ideas are intended to be conveyed efficiently to many people and even generations of them, the practice of utilizing the written word is likely to be implemented. Perhaps surprisingly, especially when the social context is significantly secular, such documents can acquire a hallowed aura. In the U.S., the so-called Charters of Freedom—the original Declaration of Independence (1776), Constitution (1787), and Joint Resolution of Congress to amend the Constitution with the Bill of Rights (1789)—can be seen in Washington, DC, at the National Archives Rotunda. Unsurprisingly, the Rotunda was built to appear as a shrine (National Archives 2016).

What could be called "great" documents typically have one or more of three participative features that imbue them with ethics—perhaps even "great" ethics. One is the groundswell of many individuals, communities, groups, leaders, and others involved positively or negatively in a specific subject of ethical concern, possibly for a lengthy period of time. Another is the appointment by a recognized,

respected authority, whether formal or informal, of a committee or commission to initiate a process of research and study that results in the document. The third is the gathering of signatories who vote how they will. In 2000, fifteen years before the UN resolution to undertake the SDGs, the three participative features indicated—impetus, work, and approval—all functioned to yield a great participative document: the Earth Charter. Previously, in 1983, the UN General Assembly established the World Commission on Environment and Development to address growing concerns such as global warming. By 1987, the Commission (chaired by former Prime Minister Brundtland of Norway) presented its report titled *Our Common Future.* The report called for a "new charter" and "new norms" that could guide the transition to sustainable development (Earth Charter n.d.). An increasingly participative discourse led to the Earth Summit in Rio de Janeiro and the Rio Declaration in 1992. By 1997, an independent Earth Charter Commission was initiated by Maurice Strong, who had been the Secretary-General of the Rio Summit, and Mikhail Gorbachev, the last leader (1985–1991) of the Soviet Union. Drawing on hundreds of international documents, consultations, and dialogues, and writing numerous drafts, the Earth Charter was completed in 2000. It was endorsed by over 2000 organizations and thousands of individuals (Earth Charter 2023). The Preamble of the Charter indicates that "we are one human family and one Earth community with a common destiny" (Earth Charter Initiative 2001). The statement, like the document in its entirety, is imbued with ethics.

Platforms

One could say that documents and their derivations, such as

conferences, schools, classrooms, films, media, civil and corporate organizations, governmental agencies, religious premises, and any other space from which words spoken or written can be formulated and projected, are platforms. The documents themselves, whether long treatises or shortlists, can be viewed as platforms and, consequently, be replete with ethics. Political parties are said to have platforms, understood to be spoken or written statements indicating what the partisans stand "for" or "on", in the forms of principles, policies, and practices. To the ancient Greek philosopher, Socrates (470 BCE–399 BCE), it appears that all of Athens, or its most vibrant space, the agora, was his platform, but so were his dialogues with his students. Unsurprisingly, a counter-platform, that of the jury at his trial for questioning the meaning of justice, sentenced him to death, even though the city of Athens evidently had an open-minded democratic regime. The Athenian leader, Pericles (499 BCE–429 BCE), considered to be a model ruler, praised the Athenians when the famed war with Sparta began, saying from his "elevated platform" that "we open our city to the world" with "liberality" to all learning, and consequently, "as a city we are the school of Hellas [Greece]"— standing not as imitators but as innovators (Thucydides 2021, II. VI). From the perspective of ethics, the platform is a critical source of advocacy, or voice, which may be that of a collaborative, an activist, or any other engaged party. Unfortunately, a platform may be replete with propaganda, censorship, and falsehood. Yet, open-minded liberality in learning may be a potent antidote, one that operates from another platform. John Locke (1632–1704), the British philosopher who wrote the book, the Second Treatise of Government, clearly knew that a book could be a revolutionary— and subversive—platform. Asserting that sovereignty belongs to

the people, to each of whom "the law of nature" gives a right to rebel against a harmful government (Locke 1690, II. 8), he kept the book anonymous. One might conclude that the ultimate platform, beyond even a great city, is nature itself.

With the continuing awareness and development of environmentally—ecologically—, or nature-based sustainability, platforms replete with corresponding ethics have proliferated. The term social responsibility first appeared publicly in a book titled *Social Responsibilities of the Businessman* written by an economist (Bowen 1953, 151). From the 1960s, the term, corporate social responsibility, together with mission, vision, and values statements came into common usage. Civil society organizations adopted and adapted this terminology in the same period of time. An organization named the Ethos Institute, founded in the 1990s in Brasil, was itself a civil society organization but aimed to guide businesses toward corporate social responsibility (Schlefer 2009, 1). In the U.S., governmental agencies also publicize statements of social responsibility. By the early years of the new millennium, this type of organizational platform appeared on what has become an immeasurable platform, the internet. Coincidently, the term sustainability has joined the term responsibility in the new toolkit of ethical terms for organizations. They can be heard frequently, as many organizations include them in periodic and sequential reports, such as those of the Global Reporting Initiative (GRI). Ironically, the "commonality" of ethics is suggested by the similarity of words in sustainability platforms. Words echo across organizations. The Sierra Club claims to protect the wild places of the earth (Sierra Club 2024), and simultaneously, ExxonMobil claims to care for land and biodiversity on the earth (ExxonMobil 2023, 4). Interpreting what is meant can be difficult.

Practice

Stating, listing, reiterating, highlighting, and even averring ethics, whether individually or institutionally, is not enough to realize sufficient change that new (or old) words and terms will come to life in society, whatever its conditions may be. There is always the possibility that anyone will sit on any particular platform without engaging in ethics or applying them in any specific situation. This may be the result of normalization, ineptitude, incompetence, prioritization and even fear, like that of any intended whistleblower concerned about a livelihood. These negativities lead to what has long been called the gap between words and deeds and is now called the gap between values and actions. Unfortunately, values statements or other codes of ethics might be viewed as dishonest—written and signed with a hypocritical hidden agenda or, as commonly said within the environmentalist movement, fraught with "greenwashing". In response to such gaps, a critical emphasis has been placed on practice in ethics today. The term, practice, can signify repeated endeavor, as in any professional or other form of activity, with the goal of becoming expert or even excellent at whatever is being practiced. Practice can also signify doing some selective activity on a regular basis precisely because one has become learned, efficient, and efficacious in doing it. Aristotle observed that a youth can excel in geometry because it is abstract, but not in ethics because he has no immersive practice in the activities pertinent to human life (Aristotle 2021, I. 1, VI. 8). Yet at least three ways can be identified in which "practice" can be hastened in ethics today. The first is basic engagement with society whether by way of partnerships, internships, networking, voluntarism, and so on. The second is the research, particularly of the many academic and trade books and journals that have been founded on practical ethics,

such as business ethics, medical ethics, bioethics, environmental ethics, and sustainability ethics, many of them launched since the 1960s. The third, and perhaps most critical, is to rely on the inputs of many participants in seeking to resolve issues ethically, as the T20 presently plans to do with the G20, in an effort to reinvent and recreate cities and other localities.

Practical ethics have often been thought of as applied ethics, and it is indubitable that practical ethics typically involve applications, such as urban sustainable development. Yet, practical ethics today differ from those of earlier times. One might say that before, significant weight was put on a "wiseman" or a leader with insight, whereas today, significant weight is put on participative teams or on what might be called "common pool" shareholders. In the former case, a decisive resolution is sought; while in the latter, an experiential resolution is sought. Beyond these observations, there are views on practical ethics that emphasize disputations in everyday life, such as inequality, vegetarianism, poverty, abortion, terrorism, and so on (Singer 2011); and other views that emphasize disputations in public life, especially that of whose responsibility pertains in any situation (Thompson 1987). Yet, one can also understand practical ethics today to be concerned not simply with private or public issues, but especially with how they work or function in reaching a conclusion. In this regard, one can identify three major dimensions of modern practical ethics (Gondek 2024). The first dimension is their global outreach, insofar as practically any issue reverberates throughout the world and stands as a precedent everywhere. The UN and many other organizations report cases from around the world, publishing them for all to review and consider. The second dimension of practical ethics is their scientific outreach since practically every issue involves disciplines of both the natural and

social sciences. These might awaken people to what will become an issue, what impacts it may have, and how to manage them, if possible. The third dimension is their pragmatic outreach, considering issues typically require constant adjustment due to constant changes in human and natural phenomena. To discern the ethics themselves can be difficult where flexibility meets variability. In their three modes of outreach, modern practical ethics navigate a myriad of circumstances. Otherwise, they might be viewed as impractical ethics.

Participation

At the same time, largely in the 1960s, when modern practical ethics emerged, the concept and practice of public, civic, or democratic participation also became more fully articulated. The two fit together well, as widespread participation provides information from many directions, perspectives, and standpoints, serving as a corrective or enhancement of any dominant or recessive pending decision. Critical platforms are increasingly imbued with inclusion, broadening participation, while practical ethics are increasingly impelled by action, often overdue. In 1948, the Universal Declaration of Human Rights was adopted with an astounding change of historic words: the phrase, "All men are born free and equal" was changed to "All human beings are born free and equal" (United Nations n.d.). Similarly, in 1964, the landmark U.S. Civil Rights Act was signed into law, with the reparative words: "No person in the United States shall…be excluded from participation in…any program or activity receiving Federal financial assistance" (U.S. Department of Labor n.d.). More recently, in 2007, the UN Declaration on the Rights of Indigenous Peoples was adopted with the solemn words: "Indigenous

peoples and individuals are free and equal to all other peoples and individuals" (UN Working Group on Indigenous Peoples 2007, 8). As inclusive participation became embedded in practical ethics, these could more readily and effectively close the values-actions gap by proceeding with actions in alignment with their values and informed by the attendant participants. In this sociological milieu, the concept and practice of environmental ethics emerged, and in 1979, the first scholarly journal dedicated to the topic was launched with the title, "Environmental Ethics." Considerably earlier, four thinkers, writers, and activists had become iconic in the newly developing environmental movement and, consequently, critical to this branch of modern practical ethics: Henry David Thoreau (1817–1865), John Muir (1838–1914), Aldo Leopold (1887–1948), and Rachel Carson (1907–1964). Thoreau lived in simplicity in the woods (Thoreau 1854); Muir gazed upon nature as a temple (Muir 1912); Leopold sought a "land ethic" (Leopold 1949); and Carson beheld the death of songbirds (Carson 1962). Following upon those visions but keeping in step with practical ethics, the U.S. Environmental Protection Agency, established in 1970, published a *Public Participation Guide* in 1981. This "provides tools for public participation and public outreach in environmental decision-making" and has been augmented with additional information on "public participation ethics, values and principles" (U.S. EPA n.d.). The English language version is 96 pages long.

While practical ethics became significantly participative, rather than distributive, the branch named environmental ethics was developing into a second generation: sustainability ethics (Gondek 2024). Terms such as "biocentric" and "ecocentric" circumvented a recurring debate between the "non-anthropocentric" and "anthropocentric" leanings of scholars and activists. With the newer

terms in place, the reality that humans are at fault and risk also tended to refocus consciousness and discourse to problem-solving, or at least management, of a complex version of that original "world problematic." The term sustainability is now common, as befits the adoption of the SDGs. Ready to apply, sustainability ethics can be understood to have three major components: earth justice, on the biosphere as a whole; environmental justice, pertaining to marginalized human populations; and sectoral justice, about socio-economic sectors, where earth justice and environmental justice intersect in numerous ways (Gondek 2024). A potent trio of critical ethics, it also has many subtypes of sustainability ethics that beckon from within ongoing cases in a host of socio-economic sectors. Many of these ethics can be affiliated with the SDGs. Among them, in the order of the SDGs, are opportunity, food, health, education, gender, water, energy, economic, infrastructure, equal, urban, consumer, climate, ocean, land, institutional, and organizational justice. All these appear in scholarly and civic arenas, and hence, can be found readily explained across the internet. Beyond them are others, some exceedingly fraught, such as racial and transition justice; while any of them can be combined with or converted to equity, which boosts possibilities that were lost or diminished due to previous injustices. Sustainability has proven to be a fountain of ethics, and these belong to us all, in common. The question remains: will they be applied?

Closing

Clearly, it is easier to enunciate an ethic or set of ethics than to put it to work. Much depends on human motivation, which is difficult to anticipate or understand, as everyone knows. Consequently,

practically all that is discussed above has its nemesis. Balance is an integral component of ethics, yet narcissistic privilege and other conditions may be impediments. Documents can be replete with ethics, yet their content may be too change-making to undertake. Platforms in a broad sense, including entire organizations, can iterate statements of ethics, yet hypocrisy can defeat an endeavor. Practice is essential to ethics, yet it can be abandoned for an acquisitive and even corrupt life. Participation can be a critical element of ethics, yet the marginalization of others may leave them with inaccessibility. As suggested earlier, in launching the project of reinventing the City of Rio, or the larger project of "enhancing the role of cities as global economic and political leaders" (CEBRI 2024, 3–4), one might ask the question, who is speaking for whom, and the ancillary question, whose ideas are we seeking? Will the voices of the people be heard, and if so, how?

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4.

Urban 20: Six Editions of City Diplomacy at the Highest Level

Fernando Straface & Mariana Cammisa

Urban 20: A Milestone in City Diplomacy to Advocate for Global Challenges in the Multilateral Dialogue

I n recent years, the internationalization of cities has become essential for their development. Urbanization, the need for new skills, the growth of a globalized economy, and the urban focus of contemporary global agendas have all turned cities into hubs of economic and political influence, making their internationalization a key priority.

The international arena has traditionally been linked to the actions of national states or governments, which makes sense given that they have dominated the structure of international order, global agenda discussions, and economic participation for centuries. However, since the late 20th century, new players, including cities, have emerged in this space.

According to the well-known theory of complex interdependence

by Keohane and Nye (1988), central governments are no longer the sole actors on the global stage. This challenges the realist perspective that focuses on the state as a singular entity, highlighting the importance of non-governmental organizations, social movements, associations, and various transgovernmental bodies.

Here, cities play a substantial role: they are major actors with popular legitimacy that can influence the quality of life of their residents by playing on the global stage. Michele Acuto (2021, 25), Professor in Urban Politics at the Melbourne Centre for Cities at the University of Melbourne, stated it clearly: cities are "centers of political power, gateways for trade (with seaports, airports, railroads, trade routes, etc.), focal points for the collection and dissemination of information and culture (with important academic institutions, museums, [...]), primary sites of religious organizations, and hubs for global mobility and/or tourism."

In this context of growing relevance, it is unsurprising that the global development agenda is increasingly linked to what happens in cities. Cities are important actors to make achieving international pledges possible. They also enrich the international agenda by providing innovative ideas and experiences accumulated through the resolution of problems that impact the well-being of their residents.

Although, in recent years cities' global leadership has grown in the multilateral fora, this was not always the case, and the launch of Urban 20 (U20), in 2018, was a milestone in city diplomacy. From the starting point that global cities should not remain outside of the discussion about development-related issues, Buenos Aires and Paris proposed the creation of Urban 20, an initiative in which cities would share their experiences in a way that enriches the debate on

major global issues. It aimed to coordinate a series of goals and actions between the mayors of major G20 cities and other global cities that could be used to inform and enrich the agenda developed by national leaders at the G20 Summit.

The conception of U20 was possible because of the leadership role of cities and city networks over the years. Several successful initiatives have served as inspiration. A noteworthy influence is the United Nations Human Settlements Programme (UN-Habitat), which at its bi-decennial conference in 2016 produced a document laying out a New Urban Agenda, a series of principles for how cities should be planned and managed to promote sustainable and inclusive urbanization best.

Likewise, C40, a network of megacities that have been united to address climate change and drive urban actions to reduce greenhouse gas emissions, was also a key inspiration. More than a decade after its creation, the network continues to generate concrete initiatives within its member cities and other key international actors in its fight against climate change. In September 2016, C40 mayors from G20 countries signed an open letter to national leaders to ensure collaboration between different levels of government in working toward the shared objectives of the Paris Agreement. This pioneering effort to make the voice of city governments heard at the G20 has shaped the objectives that U20 sought to fulfill.

Previous initiatives linking global cities demonstrate a growing recognition of the need to coordinate joint actions to address urban issues, and the G20 has been receptive to receiving input from a broad array of stakeholders. Thus, in December 2017, Horacio Rodríguez Larreta, Mayor of Buenos Aires, and Anne Hidalgo, Mayor of Paris, launched U20 as an initiative for cities and by

cities to actively engage with the G20 process. They invited peer cities in G20 countries to join them during the G20 meeting under Argentina's presidency in 2018.

U20 strived to inaugurate a lasting engagement practice between the G20 and cities, to emphasize their unique role in the global development agenda. A key goal of the initiative was to create instances to engage with G20 discussions. As such, an Action Plan was developed and divided into two main elements to achieve this goal: first, a presentation of U20 priorities (encapsulated in the U20 Joint Statement) in line with the Argentine G20 Presidency; secondly, a roadmap for the initiative's existence beyond the Argentine G20 Presidency.

This second element was not to create a new institution, but to outline the overall goal and recommended activities to ensure that U20 continued as an ongoing dialogue mechanism with the G20 and that the collective efforts achieved under the 2018 Argentine Presidency endure.

After two sherpa meetings, the involved cities released a Joint Statement (U20 2018) to call on the leaders of the G20 to consider the experience and contributions of cities as they explore policies for a better world. Besides, the U20 cities committed to: "(1) contributing their unique perspectives and best practices to the G20 agenda on relevant urban issues; (2) proposing joint solutions and experience-based recommendations to enhance and achieve the objectives of the G20 agenda; (3) promoting dialogue and cooperation between G20 nations and cities through a regular effort, and (4) delivering detailed recommended actions to achieve the priority areas of U20."

Furthermore, the statement set the joint position of 25 cities on the priorities of the 2018 G20 Presidency:

1. *Climate action*: building sustainable, inclusive, and resilient cities.

2. *The future of work*: preparing citizens for a shift in the labor market.

3. *Social integration and inclusion*: delivering opportunities, safety, and equality for all.

The inaugural U20 Summit took place in Buenos Aires in October 2018, where 35 mayors and city representatives invited by Mayor Rodríguez Larreta pledged to promote dialogue and cooperation between the G20 and cities around the world and presented a common position to G20 President Mauricio Macri. The result of the Summit was the communiqué to the President of Argentina to be shared with the G20 world leaders.

Six years after its creation, Urban 20 is an established mechanism that amplifies local voices fulfilling the commitments under which it was created: (1) generating a shared platform on behalf of global urban centers, to be shared in a coherent and organized manner with G20 leaders; (2) enriching the general G20 discussion by exploring cities' unique perspectives and good practices; (3) promoting inter-city collaboration in implementing G20-led measures to maximize benefits and ensure positive results; (4) proposing joint solutions to specific obstacles to economic development, using tools from the current G20 urban agenda and cities' experience-based recommendations.

Urban 20 Agenda: A Reflection of the Supply and Demand Dynamics of Global Challenges

The internationalization of cities and their engagement in multilateral forums happen under dual dynamics. Cities turn to the world to enhance their development opportunities, and the world turns to cities in search of innovation and solutions for major global challenges. So, we can say that there is a dynamic of supply and demand of global challenges, where spaces like U20 play a major role in advancing sustainable development at the local level. The U20 agendas over the years are a clear reflection of that dynamic.

Since its launch in 2018, there have been 6 editions of the U20 Mayors Summit hosted by the city where the G20 Summit has been held. Each host city has worked on its summit's agenda and sent a communiqué to the G20 Presidency.

Besides the thematic agenda, the first edition of U20 in Buenos Aires (2018) had a clear goal: "to contribute our knowledge and advice to G20 forums; to ask the G20 to formally recognize the broad, ongoing efforts at city-level to address the most pressing global challenges; and to call on the G20 to translate the recommendations in our Joint Statement and Communiqué into action (...) We therefore urge the G20 to acknowledge urban experiences and contributions as essential tools and components of the solutions to the global challenges of our time." In other words, establish Urban 20 as a long-lasting mechanism that cities could use to accelerate their priorities within the G20 and be recognized as leading voices to address the most urgent global challenges.

In terms of global agendas, the 2018 Communiqué calls on the G20 Member States on 17 points, divided into 5 thematic areas:

1. *Step Up Climate Ambition.* Regarding climate action, U20 cities call on the implementation of the Paris Agreement and the achievement of carbon neutrality; the diversification of financial resources for mitigation and adaptation solutions; support city commitments to build resilience and achieve an inclusive and equitable low-carbon transition; consider the specific challenges faced by cities as a result of air pollution, disasters, poverty, inequality, and climate-induced migration when determining policy, programming and budgeting at the national level; support policy to achieve the objectives of the Paris Agreement and accelerate a global shift away from fossil fuels toward clean and renewable energy.

2. *Empower Citizens for Future Labor Markets.* Focusing on collaborating with cities in developing and implementing education, training, skill-building, apprenticeship systems, and employment programs and policies to support and empower employers, workers, and citizens; promoting entrepreneurship, support micro, small, and medium-sized businesses, and foster the development of enterprises with specific focus on youth opportunities and gender empowerment; and improving women and girls' access to education, skills, training and financial support to enhance their economic empowerment.

3. *Achieve Social Integration and Inclusion.* The U20 calls on G20 Member States to work proactively to make our societies more inclusive, welcoming, peaceful, safe, and discrimination-free; foster civic participation in policymaking, neighborhood planning, and city governance to ensure all citizens are represented in decision-making processes; ensure that cities

have the funding and power to secure access to safe, genuinely affordable housing near community services; and support the social integration of migrants and refugees.

4. *Develop a Safe and Sustainable Food Future.* The Communiqué focuses on addressing food security, particularly in a rapidly urbanizing world, to ensure the access, availability, stability, and utilization of food; ensuring that sustainable production, distribution, retail, and consumption patterns are supported throughout urban-rural food systems; and improving access to quality food supply, facilitate recovery and redistribution channels for surplus food and further implement the "3Rs"—reusing, reducing, and recycling food.

5. *Enable Wider Access to Finance for Infrastructure.* They call on Member States to Collaborate with cities to improve access to bilateral, multilateral, and private sources of capital to implement sustainable infrastructure projects; and ask that Simpler and more direct access to financing be accompanied by joint efforts to strengthen good governance and promote transparent, participatory, and research-based planning processes.

In 2019, the U20 Mayors Summit had its second edition in Tokyo, during Japan's Presidency of the G20, and its Communiqué acknowledges the 2030 Agenda for Sustainable Development as a universal and comprehensive framework to address many of the planet's most urgent priorities. Likewise, the cities "commit to identifying the links between our local sustainable development strategies and the Sustainable Development Goals (SDG), particularly in three main areas: climate action; social inclusion

and integration; and sustainable economic growth," further linking local governments to the multilateral dialogue.

As mentioned, the cities gathered in Tokyo convey their joint recommendations to the G20 around three key areas:

1. *Climate Action.* They call on Member States to set targets and develop pathways towards decarbonization by 2050 at the latest; strengthen resilience and adaptive capacity to climate change; enhance energy efficiency, encourage energy system transition and zero-emission transport; and encourage the global mobilization of city dwellers and cities for an effective response to climate change.

2. *Social Inclusion and Integration.* The U20 Cities focused on promoting equality in economic opportunity, access to basic social services and political participation; promoting resilient, accessible, and inclusive urban development; mainstreaming a gender perspective across the G20 agenda to achieve greater gender equality; addressing proactively needs of aging populations; and facilitating socio-economic integration of migrants in societies.

3. *Sustainable Economic Growth.* The Communiqué recommends promoting inclusive economic development and solving urban challenges by harnessing digitalization and emerging technologies; developing sustainable, resilient, and quality infrastructure to ensure no one is left behind; enhancing local governments' access to adequate finance for sustainable infrastructure; and ensuring a just transition to decarbonized development.

In 2020, the U20 Mayors Summit was hosted by Riyadh and, unsurprisingly, the agenda and Communiqué revolved around the COVID-19 pandemic. Acknowledging the legacies built by the Buenos Aires and Tokyo Summits, the Communiqué stated the commitment to achieving equitable, carbon-neutral, inclusive, and healthy cities -adding a new priority to the agenda. Likewise, it highlights the importance of Voluntary Local Reviews (VLRs) as tools and processes to implement global agendas, continuing the previous year's trend.

The Riyadh Communiqué calls on G20 leaders to build back better cooperation with all levels of government and external actors and to work in order to:

1. *Partner by investing in a green and just COVID-19 recovery.* It focuses on green stimulus and funding for net-zero carbon, climate-resilient, and inclusive societies; economic revitalization, ensuring cities' funding needs are reflected in International Financial Institutions (IFIs) lending; enhancing cities' creditworthiness and de-risk short-term lending; social infrastructure investment—health, education, public transport—and acknowledge the informal economic sector's role in the economy; ensure technology and innovation access; and guarantee global vaccine access.

2. *Safeguard our Planet through national-local collaboration.* The cities call for immediate action to reduce greenhouse gas emissions; achieve carbon neutrality by 2050; invest in nature-based solutions in collaboration with IFIs; develop green and blue infrastructure; ensure the active participation of cities in local implementation efforts; coordinate national and local efforts by aligning action plans, Nationally Determined

Contributions and Voluntary National Reviews.

3. *Shape new frontiers for development*, by accelerating the transition to a circular, carbon-neutral economy. The Communiqué asks for the advancement of circular economy regulation; the support of local governments for circular economy, enhancing financing and focusing on retrofitting technologies and fostering new industries; the investment in carbon-neutral, affordable zero-emission mass transport systems; the increase of investments in renewable energy; and the establishment of a universal right to access urban sanitation and waste management.

4. *Empower people to deliver a more equitable and inclusive future.* The cities focused on affordable housing and urban development; food security and urban-rural linkages; youth development and skill development; the future of work and education; and empowering local governments to strengthen urban cultural and social identity.

The 2021 U20 Mayors Summit, hosted by Rome and Milan, called on G20 leaders to partner with cities in achieving human-centered, equitable, carbon-neutral, climate-safe, inclusive, and prosperous societies. Similarly to previous Communiqués, it highlighted the importance of the Sustainable Development Goals (SDGs) and VLRs and the need for a more inclusive multilateral system where cities have a seat at the decision-making table.

Thematically, it is organized into 3 priorities set by the G20:

1. *People.* The Communiqué called for strengthening health systems, supporting strong frameworks of basic services and

multi-stakeholder engagement; guaranteeing local public service provision, through capacity building and direct access to financing; prioritizing equal access that leaves no one behind; investing in cultural life; and fostering social cohesion.

2. *Planet.* The U20 Cities asked for Smart investments for a green and just recovery, focusing on green stimulus, green energy, sustainable mobility, and introducing the 15-minute city concept, and by securing financial streams; accelerating climate action ahead of COP26, with a strong commitment to net-zero emission, enhanced Nationally Determined Contributions, a financial package for developing countries, and clean energy, among others; supporting intermediary cities; building cities with nature for climate resilience and wellbeing; and transforming food systems.

3. *Prosperity.* The call for G20 Leaders is aimed at adapting to the future of work and a just transition; strengthening local democracy; promoting fiscal autonomy by enabling conditions to create an ecosystem of public and private financial partners; fostering local economic development; and protecting digital rights.

In 2022, Jakarta hosted the Urban 20 Mayors Summit, and the Communiqué reaffirmed the United Nations General Assembly Resolution No. ES-11/1 on Aggression against Ukraine and, hereby, urged the cessation of violence without delay to end the war. Additionally, they ratified, once again, their commitment to achieving the SDGs, the New Urban Agenda, and the Paris Agreement.

They appealed to the G20 on three large priorities:

1. *Investing in health and housing is a cornerstone of an economic and social recovery for all.* This included health systems resilience; mental health, social protection and cohesion; sustainable and affordable housing; and urban regeneration land use.

2. *Fostering a sustainable energy transition and equal access to sustainable mobility.* The cities called for fossil fuel phase-out; financing the renewable energy transition; reducing systemic, technological, and financial barriers and constraints of renewable energy and energy efficiency; undertaking social campaigns to raise awareness and understanding of the importance of transitioning to renewable energy; and sustainable mobility.

3. *Providing education and training in the future of work to give all people equitable access to the job market.* G20 Member States were called to ensure inclusive job opportunities; elevate workers' holistic well-being; bolster just and sustainable jobs through investment, workforce development, training, and just transition policies; unleash the potential of micro, Small, and Medium Enterprises (MSMEs) productivity; bridge the disparity of digital infrastructure and innovation between and within cities and countries, and harness innovation.

Finally, in 2023, the Comuniqué produced by the U20 Mayors Summit in Ahmedabad, during the G20 Presidency in India, set a clear goal: move from intention to action and called for more ambitious cooperation between national governments, cities, citizens, and other stakeholders to achieve the SDGs, the Paris Agreement and the Kunming-Montréal Global Biodiversity Framework.

The document centers on the following topics:

1. *Encouraging environmentally responsible behaviors.* Specifically in terms of localizing global sustainability agendas, creating a framework for sustainable and just transitions that leave no one behind, and enabling whole-of-society behavioral change towards environmentally responsible practices.

2. *Ensuring water security.* It recommended mainstream sustainable water management practices; protecting and revitalizing water ecosystems, and strengthening effective water governance.

3. *Accelerating climate finance,* by overhauling development finance to increase support for climate action in cities; creating an enabling environment for the flow of climate finance to cities and improving city readiness for climate financing.

4. *Championing local culture and economy.* It calls for promoting local and regional economic development and community well-being; fostering a "sense of place," meaning promoting a fairly represented, equitable, and diverse participation of citizens and local stakeholders in planning, design, and operation of public spaces; and leveraging traditional knowledge and frugal innovation, by enhancing the capacity and agency of local communities to implement local solutions and retain/reclaim ownership of community commons.

5. *Reinventing frameworks for urban governance and planning.* U20 Cities called for promoting frameworks for planning and governance of emerging urban patterns; shifting to a 'strategic" planning framework, by reforming land use-oriented planning to include strategies for green-blue infrastructure,

economic growth, cultural development, low-carbon mobility, net-zero built environment, disaster preparedness and affordable housing for all; and facilitating equitable and sustainable urban regeneration of existing areas.

6. *Catalyzing digital urban futures.* G20 Leaders are called to ensure that the benefits of the digital economy are shared universally; facilitate data-informed decision-making; and encourage digital innovations.

Channels, Aspirations, and Limits: U20's Influence in the Multilateral Dialogue

The generation of aggregated consensus U20 creates throughout the global cities' ecosystem unraveled the need to transform traditional structures to address some of the most pressing development goals, especially regarding financial architecture.

Between the 2018 and the 2019 Communiqués, deeper integration into the multilateral dialogue and a trend in local priorities can be observed. Although the Buenos Aires Communiqué refers to topics included in the 2030 Agenda and the New Urban Agenda, the Tokyo Communiqué explicitly mentions SDGs and the commitment of cities to integrate the Agenda into their local planning. This also happens in a global context where cities start producing VLRs and report voluntarily to the UN their progress on the SDGs. In terms of priorities, climate action, social inclusion, and integration, gender equality and financing—climate action and infrastructure leading this headline—continued to be at the center of the cities agenda.

In 2020, with the disruption of the pandemic, a new spotlight was given to cities for various reasons. Firstly, due to its competencies

in health systems, transport, education, and public safety, many local and subnational governments were the first line of action against COVID-19. Secondly, at the international level, cities represented the perfect example of what cooperation between peers meant by exchanging knowledge, good practices, and data not only in terms of health systems management but also regarding the world they wanted after the crisis. Likewise, they took these practices to the multilateral dialogue revitalizing an already outdated system. Thirdly, cities started further promoting the "new public goods"—access to green and public spaces, and sustainable mobility, to mention a couple—that gained new value during the crisis and that are deeply connected to the development agendas and life quality improvement.

This last point makes cities even more appealing to the multilateral dialogue and the interests of international organisms. Furthermore, it is here that the dual dynamic mentioned before—cities searching for new opportunities in the world, and the world searching for solutions in cities—reaches its peak. The Communiqués of Rome-Milan (2021), Jakarta (2022), and Ahmedabad (2023) reflect cities stepping up their ambition in promoting the development agenda, demanding the attention and co-action of national governments, and advocating for a stronger position in the multilateral fora.

So, cities take their ambitions higher, they take actions that move the needle to better quality of life and the multilateral system demands bolder solutions for the pressing development challenges. However, the one tool that the international system must implement is a type of solution that does not move at the same pace and is not easily—or affordable, for that matter—available for cities, limiting the length they can reach.

In the last few years, the restructuring of financial architecture has been discussed deeply. The possibility of cities being able to access the Lost and Damage Fund after the COP20 in Dubai is a step forward. The Pact for the Future's inclusion of the "Request the Secretary-General to provide recommendations on how engagement with local and regional authorities could advance the 2030 Agenda, particularly the localization of the Sustainable Development Goals, by the end of the seventy-ninth session for Member States' consideration" (UN 2024), shows a similar trend.

Moreover, cities continue championing this quest. The creation of the SDSN Global Commission for Urban SDG Finance, a high-level group of mayors, experts, city networks, and scholars, are delivering actionable recommendations for how cities can obtain larger and better financing—shows how cities' advocacy persists. U20 Co-Chairs endorse their Green Cities Guarantee Fund Proposal that aims to show "how current efforts ranging from the recently launched Green Guarantee Fund to the World Bank's Multilateral Investment Guarantee Company do not support city borrowers" (Penn IUR 2024) and, eventually, translate into funds for cities.

All the work done by cities over the years—the creation of their own spaces, like U20; the generation of aggregated consensus as U20 Communiqués, the localization of global agendas, and their increased participation in the multilateral fora—puts the 2024 U20 Mayors Summit, co-hosted by Rio de Janeiro and São Paulo, in a unique position. The agenda already reflects the cities' priorities with a strong focus on reforming multilateral institutions, besides tackling climate change and the global fight against hunger and poverty. It is yet to be seen if the Communiqué can further advance local interests and allow cities to unleash their fullest potential.

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5.

For a City Network Jurisdiction

João Carlos Cochlar

What Do Climate Change and the Rule of Law Have in Common?

Climate change and the decline of the rule of law are two world crises of the 21st century. The first is a consensus. Between 2010 and 2024, global temperature broke year records nine times (NCEI 2024). From 2001 to 2023, there were 488 million hectares (Mha) of global tree cover loss, equivalent to a 12% reduction since 2000, and 207 Gt of CO_2 emissions.[1] Rising temperatures, historic pollution, and the devastation of our forests led to an existential threat to humanity: an environment of sterility and scarcity of natural resources incompatible with life. Therefore, action to fight climate change's urgency is a race for life.

The second might sound more subtle, but it is also severe. As Brazilian Chief Justice Luís Roberto Barroso pointed out, States face a democratic recession, and one of its expressions is the weakening of the operative capacity of institutions of power control

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1. See more in "Global Forest Watch": https://www.globalforestwatch.org/dashboards/global/.

(Barroso 2023a). According to the 2023 World Justice Project (WJP) Report, 78% of countries between 2016 and 2023 experienced rule of law deterioration,[2] and countries with weaker rule of law have experienced larger declines than countries with stronger systems. Expressions of the rule of law such as the absence of corruption, regulatory enforcement, and civil justice are atrophying, posing a threat to social cohesion.

Lord Tom Bingham, in his seminal book *The Rule of Law* (2010) defined this concept as what he called a core principle: "all persons and authorities within the state, whether public or private, should be bound by and entitled to the benefit of laws publicly made, taking effect (generally) in the future and publicly administered in the courts."[3] Rule of law is, as stated by the 2023 WJP Report, an indispensable condition to ensure safety for investments and business, quality of public infrastructure, and halting implications of pollution, wildlife poaching, and deforestation for the environment.

Here, both crises find an intersection. Based on Professor Bingham's lessons, fighting climate change requires more than shifting the laws and practices that regulate the way we are, live, and consume towards a more sustainable society. It also demands ensuring there are institutions capable of bonding agents to their environmental liability and entitling citizens to the benefit of the fundamental right

2. In the last seven years (2016–2023), the rule of law has declined in 78% of countries, where on average the rule of law has deteriorated by -5.0%. The factors with the most countries experiencing declines in the past seven years are Constraints on Government Powers (74%), Fundamental Rights (77%), and Criminal Justice (74%). See more at: https://worldjusticeproject.org/rule-of-law-index/downloads/WJPInsights2023.pdf.

3. Bingham contextualizes just afterward that: "This statement, as will appear in Chapters 3–10, is not comprehensive, and even the most ardent constitutionalist would not suggest that it could be universally applied without exception or qualification. There are, for example, some proceedings in which justice can only be done if they are not conducted in public, as where a manufacturer sues to prevent a trade competitor unlawfully using a secret and technical manufacturing process. But generally speaking, any departure from the rule I have stated calls for close consideration and clear justification."

to an ecologically balanced environment.[4]

This is where the climate crisis consensus unfolds in several challenges and barriers, such as (i) the need for implementing costly projects and policies of adaptation; (ii) facing all kinds of resistances due to political, economic, and social repercussions of such measures[5]; and (iii) the urgency for environmental conflicts to be overcome so that the necessary adaptation measures are implemented before a point of no return is reached. Therefore, strengthening the rule of law is an urgent matter for building efficient governance, ensuring sufficient financing, and pacifying the political environment towards sustainable urban development.

In an increasingly urban world, cities are called to reconcile their expansion and development with sustainability and climate resilience (U20 Ahmedabad 2023). At the same time, they are "responsible for around 75% of global energy consumption and 70% of global greenhouse gas emissions." (IEA 2024) Hence, dealing with climate change at the local level requires worldwide coordination and even alternatives to the traditional national governance structures.

The constitution of city networks, such as C40—which coordinates the U20 Summits—, is an initiative to exchange expertise on policies to combat climate change, but also a reaction to possible barriers and inefficiencies of traditional State institutional designs (Silva 2023, 53). City networks allow information and expertise exchange, setting common goals and standards. They become

4. For example, Article 225 of the Brazilian Constitution provides that: "Everyone has the right to an ecologically balanced environment, a common good for the people and essential to a healthy quality of life, imposing on the Public Authorities and the community the duty to defend and preserve it for present and future generations."

5. "A despeito das dimensões do problema e do considerável consenso científico a seu respeito, são enormes as resistências a tais mudanças, dadas as repercussões políticas, econômicas e sociais das medidas necessárias ao enfrentamento da questão climática." (Mello 2023, 263)

a parallel system of governance to the State structure (Silva 2023, 53) responsible for gathering financing and resources, elaborating projects inspired by successful cases, and monitoring their implementation. By the same token, cities' protagonism in fostering climate change led them to organize themselves to improve their capacities at the local level, and one of the highlights of this movement can be seen at the Rio de Janeiro edition of U20,[6] in 2024. It is recognized as an axis of city action initiatives such as tackling climate change and reforming multilateral institutions, highlighting the perspective of local governments and the diversity of urban realities among G20 members.

Against this backdrop, this article proposes that city networks should consider exchanging successful policies to strengthen the rule of law as part of the effort to combat the climate crisis and ensure a safe regulatory environment for climate investments. We also sustain that city networks should go a step further and offer a new service to their members: jurisdiction, *id est,* the capability of identifying the applicable law to a conflict and enforcing it to a particular situation (Bermudes 1995, 22–23). City networks should offer structures where their members may solve their controversies with other government levels, companies, or foreign institutions in a self-composing manner or count on an impartial, expert, and effective deliberation board. Conflicts, both in the public and private sectors, are an important source of delay for the goals intended by policies and financing. Time is not on our side. In this context, city networks should foster the rule of law—an *environmentally sustainable* rule of law, if we may say so.

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6. U20 is a city diplomacy initiative that brings together cities from G20 member states under a common framework to discuss global economic, climate, and development issues. Check U20 São Paulo Press Release at: https://www.urban20.org/wp-content/uploads/2024/07/U20-2024-Sa%CC%88o-Paulo-Press-Release.pdf.

Despite its indispensable role, national and international ordinary fora are sometimes insufficient to solve such disputes. We argue that cities that seek sustainable urban development cannot prescind effective dispute resolution mechanisms arising from the new paradigms imposed by the urgency to address the climate crisis. With their city networks, they are capable of forming dispute boards, mediation, and arbitration chambers as dispute resolution mechanisms. They might enhance legal certainty and efficiency to climate investments and environmental damage compensations towards their goals in due time and with less border constraints of decision enforcement.

The development of this article is based on a literature review and relevant environmental disputes raised by or involving cities. Its structure unfolds in five parts. In the first, we address the climate crisis as a justice crisis, giving three justifications for why climate change generates not only new disputes but also challenges to find mechanisms to solve them. In the second part, we argue that climate change can lead to transnational litigation when domestic jurisdictions compete with each other to present themselves as the most effective outside their borders. In this topic, we present a Brazilian case to justify why it is problematic. Thirdly, we suggest how cities and city networks might unite efforts towards strengthening the rule of law towards climate and environmental adaptation. Finally, we present the main conclusions and proposals that may contribute to the development of these mechanisms.

Climate Crisis as a Justice Crisis

Mary Robinson, former President of Ireland, pioneered the

message that climate change transcends science or environmental law. For Robinson, there is no effective fight against climate change without addressing global injustice. As she wrote in her seminal book *Climate Justice* (2018):

> *If there is a climate change problem, it is in large part a justice problem. […] Raising awareness about climate justice requires us to marry the standards of human rights with issues of sustainable development and responsibility for climate change. (Robinson 2018, 18)*

Climate change impacted on the idea of justice since many of our values and habits shall change to fight it. An economy based on plastic, jobs based on fossil fuel production, or development based on damaging nature are just some examples of long-term structures we need to reform. Tackling these topics is synonymous with facing severe resistance.

Daniel Vargas (2017) defined justice as "the metric a community uses to resolve its collective conflicts." John Rawls, in his seminal book *A Theory of Justice*, states that conflict of interest is an inherent phenomenon in any organized society. However, the maintenance of social organization depends on its ability to absorb these conflicts through general agreement of principles that appropriately distribute the benefits and burdens of social cooperation (Rawls 1999, 4).

Climate change, however, strains such capability of absorbing conflicts for at least three reasons. The first is that climate change has not only created new conflicts but has also disrupted the metrics by which these are resolved. Building on Rawls' thinking, it is evident that the governance models of States over the past

centuries were based on principles established in a world where the climate crisis was not seen as an existential threat. When traditional economic development and social organization models generate this existential threat as negative externalities, demand for its reform produces instability. This gives rise to a demand for new metrics of justice from the affected groups, which not only address the externalities produced by the existing institutional framework but also call for effective institutions and mechanisms to implement them.

To give an example of the intricate tension of the disorganization of metrics of conflict solving, Roberto Mangabeira Unger (2008) pointed out that people who have lived in the Brazilian rainforest for generations were submitted to public policies that didn't incentivize the construction of a harmonic economy with nature. Some people act on mining or reckless deforestation because of pressure from economic forces and the discouragement of the state. There will be no justice for these people if their way of living is constrained without having the capability of surviving otherwise amidst an apparent climate urgency. This is an example of the disorganization of metrics imposed by climate change.[7]

The second reason is that, beyond conflicts of interest, there is the challenge of holding multiple agents accountable. The climate crisis involves considering a multitude of public and private actors responsible for adjusting their behaviors, which requires immense coordination and alignment efforts among these agents—from the isolated individual to large corporations in the private sector, from municipal administration to national states or transnational bodies

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7. Brazilian writer Silvio Meira wrote a romance called "The Gold from Jamanxim" [*O Ouro do Jamanxim*] as the story of a Brazilian migrant who goes mining in the rain forest to find his way of living.

in the public sector. This broad responsibility of agents not only complicates the organization of necessary actions to combat the crisis but also obscures the role of each part. This loss of clarity undermines the efficiency of actions against climate change.

To better clarify this second justification, consider the following contrast. It is not an exaggeration to say that the existential threats of the 20th century did not revolve around an "eco-dystopia." They involved issues such as economic collapses, genocides, and nuclear, chemical, and biological wars. These crises were predominantly political-economic in nature, with decision-making power about the future of humanity concentrated in the hands of a few powerful states or financial actors. The climate crisis, on the other hand, is multidisciplinary, transnational, and a shared responsibility. However, the resistances are numerous. Companies resist changing business models due to high costs. Federal states suffer from internal conflicts about their roles. Centralized states restrict the actions of subnational units. Individuals refuse to change behaviors due to entrenched habits and the short-term "costs" such changes might bring. Maintaining old ways of living could threaten humanity and the world as we understand it. The search for identifying and extending the responsibility of these climate change actors is one of the critical areas of attention in establishing sustainable development governance.

Overcoming these two challenges is the final goal of climate justice. As precisely stated by Brazilian Chief Justice Luís Roberto Barroso, who also refers himself to President Robinson:

> *Climate Justice is understood as the fair distribution of responsibilities, costs, and consequences arising from the impacts of climate change. This distribution*

involves developed and developing countries, rich and poor people, as well as current and future generations. (Barroso 2023b)

Nonetheless, there is also a third justification: the democratic recession and the decline of the rule of law itself. In addition to the new conflicts of interest and the multiplicity of agents with different responsibilities, the 21st century is witnessing illiberal waves emerging in various States. There are noticeable signs that contemporary constitutional democracies are viewed with skepticism and disbelief regarding their ability to implement the necessary changes or solve the newly arisen conflicts. As we said, while the pursuit of development is a common goal for everyone, the means to achieve it are the focal point of controversies that hinder progress on this issue.

What happens if nation-states are incapable of properly solving conflicts? Or if the solution they provide does not meet the communities' expectations? Joaquim Falcão (2021) answers: "Conflicts do not disappear, obviously; they are merely postponed. They escalate. Some spiral out of control. In the face of unresolved issues, parallel systems emerge. Not necessarily peaceful ones. They compete with each other. An ecosystem of conflict resolution is established."

The domestic State monopoly of conflict resolution becomes a myth. In each time more globalized world, even the capability of solving conflicts is now part of a market, in which different jurisdictions—official or not official—present themselves as more efficient and capable of solving conflicts whether due to the quality and persuasiveness of the solution presented or the strength of the

decision in reality. In this topic, city networks might have a role to play.

The Market of Jurisdictions, Climate Litigation, and the Brazilian Drama

In a speech delivered in New Delhi in 1996, former Brazilian President Fernando Henrique Cardoso stated that globalization reached goods, services, and persons, but the stimulation of an increasing uniformity of the institutional and regulatory framework in all countries was still in progress. It could lead to a movement towards a world where legal orders would gradually resemble or even reach an integrated governance through which law-making and jurisdiction could flourish.

However, the world of centralized global governance that federalists once imagined the end of the 20th century would lead to has not been accomplished. History showed a different tendency. While they contended that "only when the interests of both parties are served by binding third-party settlement are disputes referred to forms of adjudication" (Commission on Global Governance 1995), international bodies did not become responsible for issuing binding decisions. We see several examples of domestic courts (instead of global courts) ruling on international controversies and deciding cases whose effects occur in the territory of another jurisdiction.

There are several examples of environmental controversies that abide by that tendency. In *Milieudefensie et al. v. Royal Dutch Shell*, a Dutch court ordered the whole Shell group, which is now British, to reduce its worldwide operations' CO_2 emissions by 45% by 2030 compared to 2010 levels and to zero by 2050, in line

with the Paris Climate Agreement.[8] A foreign arbitration court ordered the suspension of an Ecuadorian decision against Chevron that convicted the company of paying US$ 9.5 billion due to environmental damages. Brazilian NGO *Comissão Pastoral da Terra* sued BNP Paribas in French jurisdiction seeking compensation for "providing financial services to companies that allegedly contribute to the deforestation of the Amazon rainforest" (Setzer and Higham 2023). The list goes on. Climate litigation created an emergent sector of a transnational litigation network.

This is not new. If we go beyond climate topics, research shows that U.S. district courts apply foreign law at an estimated rate of 44.5% in transnational litigations (Whytock and Quintanilla 2011)—not to mention the vulture hedge funds case in Argentina, when the country defaulted on its debt in 2001. Vulture funds bought Argentinian bonds for a small percentage of its value and demanded in the U.S. Courts for the whole amount. A U.S. District Judge, Thomas P. Griesa, granted it, leading the country to severe external debt as a consequence. These examples reveal that jurisdiction is a service of the rule of law, and the most efficient wins their clients. It leads, according to Whytock and Quintanilla (2011, 31), to the "United States and the United Kingdom acting as the leading providers of courts and law for transnational disputes."

Climate litigation is an imperative mechanism for serving civil society, individuals, and others, even governments, with one possible avenue to address inadequate responses by the public and private sectors to the climate crisis (Burger and Tigre 2023). There is a reason why the rule of law is fundamental to combat sources of climate

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8. See more at: https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2021/20210526_8918_judgment-1.pdf.

change—from human-provoked disasters to ensuring compliance with environmental policies. A Brazilian drama shows that.

In November 2015, a dam, owned by Samarco, in the municipality of Mariana, in Minas Gerais state, ruptured, resulting in the spill of more than 60 million cubic meters of mining waste into the Doce River valley. As a result, there were 19 deaths, over 600 people displaced and homeless, thousands of people without access to water, as well as incalculable environmental and socioeconomic damage throughout the Doce River Basin, affecting around 40 municipalities in the states of Minas Gerais and Espírito Santo. The sludge traveled 650 kilometers and reached the Atlantic Ocean (Porto et al 2016).

As if that wasn't enough, another dam rupture happened in another municipality of Minas Gerais, called Brumadinho, in January 2019. When this dam, owned by Vale, which is one of Samarco's holders, collapsed, it resulted in the spill of approximately 12 million cubic meters of mining waste. The disaster provoked 270 deaths, left dozens missing, and caused significant environmental and socioeconomic damage. The sludge contaminated surrounding areas and had a direct impact on the local population and the environment, as it traveled about 10 kilometers before reaching the Paraopeba River, causing severe impacts on water quality and aquatic life.

Although Brasil has one of the finest legislations concerning environmental protection, injured people are yet to receive proper compensation from the companies for such damages. Mariana's procedures, for example, started delivering convictions only in 2024, and it is still subject to all sorts of appeals until they might have access to reparations.

Due to this despair, these affected cities hired foreign law firms to present their cases abroad. Cities filed tort procedures against the holders and auditors of the dam owners in British, Dutch, German, and American jurisdictions. The most prominent of such cases, *Município de Mariana v. BHP*, is scheduled for trial in October 2024 and involves a demand of £40 billion. The London-based law firm Pogust Goodhead, responsible for several cases of these disasters abroad, presented a Q&A where they answered why the firm is filing this procedure in England and not in Brasil. The answer is simple: "Pogust Goodhead believes that those affected will be adequately compensated within a reasonable time in England."

As a backlash, a representative of those companies, which have been resisting paying proper compensation for such damages, presented a constitutional demand before the Brazilian Supreme Court, asking it to declare it unconstitutional for cities to litigate in foreign jurisdictions. Brazilian cities wouldn't have a legal personality before foreign jurisdictions, and the plaintiff of this constitutional case argues that only the country itself would be capable of representing its subnational levels abroad. They employ this sovereignty argument because if a city loses the procedure, a foreign jurisdiction will possibly constrain not only the cities to pay costs and fees but also the national level, even if the Union was never a part of the dispute. If the Brazilian Supreme Court grants this demand, municipalities will be ordered to drop the lawsuits presented in those foreign jurisdictions. The issue is so controversial that, in a talk at the Rio de Janeiro City Attorney's Office in August 2024, I asked Justice Ines Härtel, of the German Federal Constitutional Court, if German cities can litigate compensatory environmental damages in foreign courts. She commented it wouldn't be possible since it would constitute a violation of the federal principle.

There is a tension between, on one side, sovereignty, and the federative principle, and, on the other, effective jurisdiction and protection of human rights. From one side, a national jurisdiction has been failing to ensure that companies that destroyed entire cities, and their surrounding environment, killed citizens, and made such areas close to the uninhabitable should compensate for their damages and ensure proper urban and environmental reconstruction. On the other, a sake to keep the constitutional framework effective and operative.

Which way to get out of this puzzle? Cities in general, which are the final spaces affected by those tragedies, should find a way to ensure they have room for solving controversies. This is where city networks might provide some assistance.

Cities' Roles and a City Network Jurisdiction as a Possible Contribution

Cities have at least three roles in the climate crisis. If we understand the idea of a city as a geographically delimited urban space, its role is a polluter causing climate change, whose action should be constrained and adapted. According to the United Nations Human Settlements Programme (UN-Habitat), cities account for approximately 70% of global CO_2 emissions related to energy, with the urban transportation sector responsible for 16% of greenhouse gas emissions. They generate 60% of the world's solid waste, often subject to inadequate treatment. Cities are characterized by soil impermeabilization and the formation of heat islands. They exhibit reckless consumption patterns, absorbing around 75% of the planet's natural resources (ONU-Habitat 2011).

From a second perspective, the idea of a city might be also understood in its political-administrative dimension. Cities refer not only to a geographic space but also to the organized bureaucracy that manages it. Local administration is the state unit closest to the needs and characteristics of a community, thus being well-positioned to have immediate knowledge of local needs. In addition to being oriented towards community participation due to their proximity to major decision-making centers, cities are not bound by the various national and subnational levels for the implementation of public policies. It enables them to implement quicker responses to citizens' demands.

Modern constitutions, written in the 20ᵗʰ century, have the characteristics of detailing the political roles of cities. Germany, for instance, provides in Article 28 of the *Grundgesetz* that cities "must be guaranteed the right to regulate all local affairs on their responsibility within the limits prescribed by the laws. Within the limits of their functions designated by a law, associations of municipalities shall also have the right of self-government in accordance with the laws." Brasil's 1988 Constitution also postulates that municipalities are entitled to legislate about local issues and ensure proper land use management, through planning and control of land use, subdivision, and urban development. The Indian Constitution in the same vein specifies that municipalities are entitled to enable institutions of self-government, notably to the preparation of plans for economic development and social justice.

If we set a magnifying glass on these competencies, we realize that city administrations are predominantly responsible for activities such as land regularization and control, urban planning, solid waste management, pollution control, green space protection, water

management, sustainable urban planning, primary environmental awareness education, land use regulation, property management and regularization, construction licensing, and control, protection of public interest areas, and land conflict management. It is, therefore, at the local level where efforts to combat climate change have the best chance of moving beyond rhetoric and making a tangible impact.

Finally, if its administrative powers are not the proper way of conforming behaviors, there is the third dimension: cities are subject to rights in court. Taking Brazilian law as an example, the Constitution provides that the Federative Republic of Brasil is formed by the indissoluble union of the States, Municipalities, and the Federal District. The Brazilian Civil Code states that municipalities are legal entities under public law, and therefore, holders of rights and duties. They have the legitimacy to file not only tax enforcement actions but also actions for holding agents accountable for damage to the environment, historical and scenic assets, and urban planning in Court, for example.

Just like private citizens, cities worldwide suffer from constraints of the rule of law deficit we mentioned in the previous section of this paper. This is why cities' networks should strive to build systems of conflict resolution that have legitimacy, promptness, high expertise, lower costs, and high effectiveness. International arbitration chambers guarded by city networks might pave this way.

City networks do a remarkable job of fostering clean air and construction policies, zero waste and net zero carbon emission standards, and allowing connections between members and investors to get these ambitions done. However, this precious structure created by city networks might be modeled in a way that

might provide incentives to cities, companies, and other relevant agents to find self-composing solutions to climate controversies. If it is not possible, arbitration chambers for disaster compensations or investment controversies are a promising path for helping cities strengthen the rule of law toward climate adaptation.

There are some reasons for this. Since the 1958 New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards, 172 country parties recognized arbitration as a mandatory decision to be adopted by national courts. Since it present an international arbitration standard for the parties, borders might no longer be a source of tension between sovereignty and effectiveness. Cities, companies, and investors should gather around those chambers to ensure legal certainty and effective jurisdiction, especially when cities suffer from damages or need to conform to policy implementation at a quicker pace, for example. Arbitration has some advantages over litigating in regular Courts. In a seminal paper by U.S. Judge Harry T. Edwards (1982), factors such as speed and expense are benefits for the arbitration procedure. It is positive to have arbitrators chosen by the parties, who might be prominent experts of the controversy's subject, can lead the conflict with neutrality, and suit the procedure according to the specifics of the case.

Arbitration is indeed a voluntary procedure, and parties should make an arbitration agreement for disputes arising from a previous legal relation or agree posteriorly, once the conflict is established, to submit it to arbitration. But as a policy, city networks may provide the chamber to their members, so that cities are able to incentivize or condition economic activity in their urban spaces to an arbitration agreement for conflicts arising from environmental damage or

compliance of investments on climate adaptation policies. Other levels of government or international suppliers can help in this incentive task since it afford safety for investments and constraints for violations.

Arbitration in such cases would also be a solution to the Brazilian dilemma. If we consider it reasonable that cities do not have the legal capability of litigating in foreign jurisdictions, it would not be the case for cities to be part of arbitration since there are countries, including Brasil, where public administration and different levels of government are allowed to submit controversies to this procedure. It is the case of Brasil, Spain, Germany, and Australia, for example. An arbitration award issued by a prestigious chamber of a city network will ensure its enforceability in many more jurisdictions than if issued by a national one so that the content of the award might be executed in the most effective jurisdiction.

Brasil has started to create a culture of municipal arbitration (Schmidt 2018), but there is an open issue: is not uncommon to say that municipalities in general might have precarious technical-legal and administrative capacity to create and issue, by themselves, the respective regulations and procedures (Falcão and Cochlar 2021). Expanding worldwide, city networks can supply such difficulty while providing the necessary structure to lead the arbitration and implement administrative support.

This work is a provocation to incentivize more reflections about rules and procedures that can help cities achieve the best framework they can to attract investments to climate change adaptation and constraining or, if not possible, compensating promptly for environmental damage. This text is an initial step to stimulate more improvements to follow.

Final Remarks

Climate change and the decline of the rule of law are two crises that mark the contemporary globalization dynamics. To say they are global crises, however, is misleading. While climate change affects the whole world, people everywhere in the world experience it differently in their daily lives. It can be slight as a soft temperature rise and it can be devastating like floods, rising seas, or landslides. The same goes for the rule of law. In the plain of discourse, we see democratic recession when we talk about the institutions' inefficiencies, the invasion of Parliaments (as happened in the U.S. and Brasil), or the politicization of Supreme Courts. But people everywhere also experience it differently in their daily lives. It can be as minor as a delay to have access to a public service or devastating as not constraining a company to pollute and contaminate the place someone lives.

Both crises reveal global-local tension. It is not uncommon to deliver extraordinary importance to world leaders' summits on climate change as the key moments of deliberating for the necessary changes to address this crisis. It reflects what sociologist Roland Robertson (1995) considered an ordinary expression of globalization. According to Robertson, it normally polarizes global phenomena to micro-sociological events understood from a local perspective. It polarizes universalism to particularism. Global to local. Small communities to national and international governance.

This perspective, especially concerning climate change, is a miscomprehension of globalization. Universal and particular must combine in order to generate proper responses to such challenges. The climate crisis is local and global at the same time. Local, because it affects people's everyday activities by rising temperatures, often

requiring people to move from their houses due to rising floods or landslides. Global, because the impact of human activity on the environment generates effects that do not depend on borders.

This is why it is proper to say that the climate crisis is a "glocal" crisis. In this global tension—which is rooted in old designs of governance that constrain city action—local administrations should act to find together new mechanisms of governance. This is also why city networks are so important. They are meant to provide goals, rules, and expertise that might foster cities' environmental resilience. As stated by Guilherme Soares (2023, 49), they must assume their roles as components of world climate governance and regulation.

The mechanisms of dispute solving are pivotal for fostering compliance towards an urban sustainable development from climate investments to environmental damage compensation. There are successful examples of institutional designs for such initiatives, such as the International Chamber of Commerce (ICC) or the North American Free Trade Agreement (NAFTA) Arbitration procedures. It is time to design one so that cities can, through strengthening the rule of law, ensure climate action will move forward.

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Section 2
Global Paths to Impact

1.

How the *Cidade Maravilhosa* Became More Marvelous, Lessons for the G20

Eugénie L. Birch

As the G20 heads of state gather in Rio de Janeiro, these high-level visitors and their entourages will likely marvel at the city's natural beauty, travel on its varied transport systems, enjoy its cultural assets–including the luminous Museum of Tomorrow–, and maybe even sneak a peek at samba school dancers preparing for Carnaval. They will probably remember Rio as the host of the 2016 Summer Olympics. And they will see a great city that lives up to its name, "*Cidade Maravilhosa.*" But will they ask, "How did Rio become so great?" Will they realize that its greatness results from the nation's enabling conscious and intentional leadership having access to funding to meet the challenges and seizing the opportunities that make cities great—a phenomenon that also makes their parent nations great?

Will they make the connection from last year's G20 declaration, *One Earth, One Family, One Future* which called for "enhanced mobilization of finances and efficient use of existing resources to

make the cities of tomorrow inclusive, resilient and sustainable" and, in a word, great? (India 2023, 18). They can refer to the OECD report, *Financing Cities of Tomorrow* (2023), for guidance, but they might be better served by studying the city before them: Rio, it has much to tell them.

Great cities become great by design. Great cities are the work of heroic leaders who drive transformative projects and find ways to pay for them. Great cities are dynamic. Great cities are reinvented. The world knows how, when, and why some cities have become great over time because they have biographers. David Pinkney identified key qualities in *Napoleon III and the Rebuilding of Paris* (1958) as did Jan Morris in *Venice* (1960); Carl Schorske in *Fin-de-Siecle Vienna: Politics and Culture* (1980); Robert Hughes in *Barcelona* (1992); Geert Mak in *Amsterdam* (1995); Peter Ackroyd in *London* (2000); Simon Sebag Montefiore in *Jerusalem* (2011); and, most recently, Luke Stegemann in *Madrid* (2024).

In fact, some cities command multiple biographers. Take New York, for example. Its reinvention story started with American historian Robert Albion's *The Rise of the New York Port 1815–1860* (1939) and has gone forward to economist Edward Glaeser's *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier and Happier* (2012). He observed: "being headed for the trash heap of history in the 1970s," the Big Apple's entrepreneurial mayors not only enhanced the advantages of the city's density, transportation efficiencies, and education but also made living in the city "fun."

Rio de Janeiro joins the list of multiple biographers. To name a few: Norma Evenson's *Two Brazilian Capitals* (1973) focused on design; Beatriz Jaguaribe's *Rio de Janeiro: Urban Life Through*

the Eyes of the City (2014) offered a sociologist's view; Daryle Williams, Amy Chazkel and Paulo Knauss's *Rio de Janeiro Reader: History, Culture, Politics* (2016) captured the city's 450-year history; while Luis Cesar de Queiroz Ribeiro's *Urban Transformations in Rio de Janeiro* (2017) and Janice Perlman's sequence, *The Myth of Marginality: Urban Poverty and Politics in Rio de Janeiro* (1980) and *Favela: Decades of Living on the Edge* (2010), shared the story at different geographic scales—from the metro to the neighborhood.

However, missing from Rio's list is an updated tale of the city's reinvention. Such a story takes Rio from the 1960s to the present, emphasizing how it serves as an example for other places in the rapidly urbanizing world. It shows how Rio has had its share of shocks: the loss of status as the country's political capital in 1960 and subsequent economic and environmental difficulties (e.g. bankruptcy in 1988, drug-oriented crime, unrest and hyper-inflation in the 1990s, landslides, and floods in 2010, 2011, and others). Yet, in the past decades, it has become a new, 21st-century Rio, significantly reinvented, not perfect, but great.

This chapter begins to tell the story. It starts by outlining how the city absorbed massive population growth. It then provides a cameo of some transformative projects that enhanced its assets and addressed perceived liabilities. In a parallel effort, it explores Rio's becoming an in-demand global center. The next topic illustrates the innovative governmental and municipal financing capacities used to support Rio's greatness. Finally, it ends with three lessons for those who want to make their cities great.

Absorbing Three Million Residents in Two Generations

Few cities can successfully absorb massive population growth as has Rio. Between 1960 and 2020, some 3.4 million people moved into the city, with the population peaking at 6.7 million in 2022 (see Table 1).

Population Change Rio City and Metropolitan Area							
Year	Rio City	Change	Change (%)	Rio Metro	Metro Growth	Change (%)	Rio City % of Metro
1960	3,281,908			NA	NA	NA	NA
1970	4,251,918	970,010	30%	NA	NA	NA	NA
1980	5,090,723	838,805	20%	8,783,870	3,693,147	NA	NA
1990	5,487,346	396,623	8%	9,697,487	4,210,141	14%	58%
2000	5,857,904	370,558	7%	11,306,768	5,448,864	29%	57%
2010	6,320,446	462,542	8%	12,378,884	6,058,438	11%	52%
2020	6,747,815	427,369	7%	13,458,075	6,710,260	11%	51%
2022	6,211,223	(536,592)	-8%	13,634,274	7,423,051	11%	50%

Table 1. Population Change Rio City and Metropolitan Area
Source: IBGE.

Over time, Rio has maintained a central position in its rapidly growing metro—more than 13 million in 2022. Of note is the half million population loss between 2020 and 2022, likely attributed to the suburban-like growth of the metropolitan area along with economic advances in surrounding cities in the state (see Figure 1).
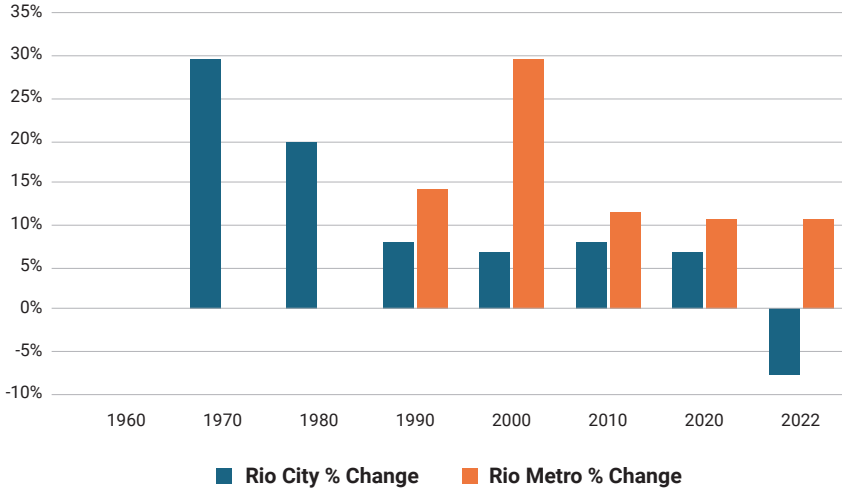
Figure 1. Comparative Growth Rates Rio City and Rio Metro 1980–2022
Source: IBGE.

Rio's growth occurred as Brasil was rapidly urbanizing: the country went from 46 percent to 66 percent urban between 1960 and 1980 and continued this trajectory, moving to 80 percent urban in 2000, and by 2020 some 87 percent of its population lived in cities. In 1960, São Paulo and Rio had populations of 3+ million—in subsequent years, both continued to grow along with other Brazilian cities. Some 65 percent of Rio's growth came from internal migration, not a natural increase (see Table 2).

Growth of Brasil's Ten Most Populous Cities 1960–2020			
	1960	**1980**	**2000**	**2020**
São Paulo	3,781,446	8,943,226	10,434,252	12,325,232 Metro 22m
Rio de Janeiro	3,281,908	5,090,723	5,857,904	6,747,815 Metro 13m
Brasília		1,176,908	2,051,146	3,055,149 Metro 4.6m
Salvador	649,453	1,007,195	2,440,828	2,886,698 Metro 3.9m
Fortaleza	514,818	1,308,919	2,141,402	2,686,612 Metro 4m
Belo Horizonte	693,328	1,780,839	2,238,526	2,521,564 Metro 5m
Manaus	622,723	922,477	1,347,590	2,219,580 Metro 2.7m
Curitiba	356,830	1,025,079	1,586,848	1,948,626 Metro 2.6
Recife	788,336	1,203,899	1,422,905	1,653,461 Metro 4m
Goiânia	148,000	707,000	1,085,199	1,536,097 Metro 2.5

Table 2. Growth of Brasil's Ten Most Populous Cities 1960–2020
Source: IBGE.

Brasil's national development policies focusing on industrialization stimulated Rio's (and other cities') rural-to-urban migration. However, Rio was unprepared for the newcomers who then settled in informal settlements–or, as they are called in Rio, *favelas*–with numbers so high that many failed to find employment in the formal economy (Pino 1997). While some favelas in Rio predate the 1960s growth spurt (e.g., Providencia [1898] and Rocinha [1933]), most did not. As they came, they occupied the interstitial areas of the hilly city. By 1970, Rio would have an estimated 500 favelas; in

1980, more than 600; and today, about 1,000 (CatComm n.d.). Rio's favela population grew more rapidly than the overall one. For example, between 1980 and 1990, the number of favela residents increased 41 percent, and the city increased 8 percent. From 1990–2000, favelas grew 24 percent while the overall rate was 7 percent (O'Hare and Barke 2002).

Non-favela growth occurred along and immediately behind the city's extensive waterfront. Over time, densification accompanied the population increases in every neighborhood, likely heightened by city investments in infrastructure (e.g., the metro starting in the 1970s) and open space amenities (e.g., Flamengo Park and Copacabana). Intense real estate development yielded high-rise apartments to accommodate the city's middle- and upper-income residents, while self-help construction would transform fragile wooden shacks into more substantial brick and cinder block lodging in the favelas.

Rio's surge in population growth took place against a background of Brasil's dramatic political and economic turmoil as the country pursued various development policies. Between 1950 and 1964, Brasil had eight presidents, with only two (Juscelino Kubitschek [1956–61] and João Goulart [1961–64]) serving more than two years. A military coup in 1964 led to years of martial rule, ending in 1985. Runaway inflation, rising from 30.5% in 1960 to 79.9% in 1963 and 92.1% in 1964, contributed to the instability, a situation that would prevail to the early 1970s and re-occur from 1985–1994. As the country swung from democracy to authoritarianism and back to democracy, Rio also experienced major changes beyond population growth.

A major shock for Rio occurred in 1960 when President Kubitschek

relocated the capital to Brasília. Rio then became its own state, Guanabara. This 564 square mile area existed for 15 years, overseen by three governors: Carlos Lacerda (1960–1965), Francisco Negrão de Lima (1965–1971), and Antônio de Pádua Chagas Freitas (1971–1975) who collectively pursued development policies focused on modernization. They attempted to provide basic infrastructure (the metro, sewer, and water) but could barely keep up with the population growth. They sought to eradicate favelas by moving the population to state-built housing settlements on the periphery of the city–but this strategy was politically unpopular and ultimately unsuccessful (Benmergui 2022).

After losing the capital status, Rio went into decline while its sister city, São Paulo, overtook it demographically. In 1950, the two cities had nearly equal numbers of residents (2.3 million in Rio and 2.1 million in São Paulo). In 1960, São Paulo grew a bit faster, surpassing Rio by only half a million people. However, between 1960 and 1970, São Paulo's 55 percent growth rate yielded 5.9 million people while Rio, struggling to reinvent itself, experienced a lower growth rate (30 percent) that resulted in a 4.3 million population.

From the mid-1970s through the 1980s, Rio was the beneficiary of important administrative restructuring. In 1975, the military government–with the agreement of the two states' governors–dissolved Guanabara and the neighboring Rio de Janeiro State. It reconstituted a new Rio de Janeiro State (area of 17,000 square miles), designating Rio de Janeiro as its capital with a mayor appointed by the state governor. In the following years, the 21-year military government gradually transitioned to democratic rule and, in 1982, provided for the popular election of mayors. It relinquished power in 1985. By 1988, the country had a new constitution,

establishing it as a federal republic. Notably, the constitution's strong decentralization provisions delineated state and municipal powers.

For cities, it specified the mayoral election process and term, city council size, and such competencies as the ability to levy taxes, regulate urban land and its development, and provide key services including mass transportation, elementary education, and health services. It mandated that large cities (more than 20,000 population) develop and regularly revise master plans (*plano diretor*) that had the force of law regarding land use. Rio complied with this directive. Of note, its 1993 master plan explicitly expressed a growth strategy focused on sports and culture (Silvestre 2012).

Transforming Rio through Major Projects: A Cameo

From 1960 to the present, Rio has been under a constant state of reinvention, overseen by leaders who intentionally focused on enhancing the city's assets and addressing its liabilities. Most importantly, Rio's leaders engaged in the conscious positioning of the city as a global center and found inventive ways to do it. While they viewed sports as critically important to this effort, they also encouraged other means—based on culture, multilateralism, and commerce (business and industry in association with academia)— to bring attention to the city.

Enhancing Assets

With its natural beauty, location, and climate, natural features and monuments have defined Rio's role as Latin America's most popular tourist attraction. For decades the city's leadership has

worked to protect and enhance its major assets: the beaches (e.g. Copacabana, Ipanema, and later Barra da Tijuca); open spaces (e.g. landfill-constructed Flamengo Park [1965]; and Sugar Loaf Mountain, reached by cable car [renewed in 2009]); and well-conserved monuments (e.g. Corcovado's nearly 100-year-old Christ the Redeemer, located within the city's 15 square miles of Tijuca National Park with its renowned 54 acres Botanical Garden [1808]).

Copacabana, for instance, offers an example of how Rio's city and state leaders have consciously magnified its tourist attractions (Hoogendoorn et al. 2021). A few low-scale buildings and village streets bordered the beach at the turn of the 20th century, no seaside boulevard existed, and access from the center was limited. In the late 19th century, the city opened the Túnel Velho (1892) and Túnel Novo (1906) that linked to the historic center, leading real estate investors to develop the newly attractive sites as streetcar, later buses and, still later, metro operators extended lines from the center. As part of a larger beautification effort of Francisco Pereira Passos (mayor from 1902–1906), a pioneer in promoting Rio as a global center, the city added the first version of the Avenida Atlântica (1906) in front of the famous Copacabana Palace (opened 1923).

Copacabana Beach, in the late 1950s and 1960s, was 55 meters wide and was now bordered by high-rise apartments (height restricted through a 1937 zoning ordinance). A congested Avenida Atlântica ran along the side, and with some 3.5 million cubic feet of sand added between 1970 and 1972, the beach spanned 90 meters, and the Avenida Atlântica became a parkway bordered by the memorable Copacabana Promenade (1970). Designed by landscape architect Roberto Burle Marx, the promenade featured an artistic version of the Portuguese traditional *calçada,* a paving design first used

in Rossio Square in central Lisbon and in the earlier versions of the Avenida Atlântica in Rio. As part of this project, the city built another tunnel above Túnel Velho, increasing access to Copacabana, and thus stimulating real estate development—the area's population peaked at 200,000 (Godfrey 2012).

Other than maintenance and regulation of public events, the city did little to the beach between the 1970s and the late 1980s. In 1990, however, the city promulgated a program, called Rio-Orla, to monetize, beautify and order the waterfront. Rio had a reason to undertake this effort because it had declared bankruptcy in 1988 (Simons 1988). The fortuitous approval of the nation's 1988 Constitution offered a rescue as it gave cities new powers including jurisdiction over public space. Rio's mayor seized the opportunity through the Orla Rio program, ordering the removal of unlicensed vendors and replacing them with regulated concessions. Within two years, Rio replaced 525 ragtag beachfront vendors, requiring the concessionaires to provide permanent kiosks supplied with water, electricity, telephone, and sewer located within a restricted area that left room for a bike path without "invading" the beach (Souza 2016).

A few years later, the Olympics planners chose Copacabana as the site for a temporary beach volleyball stadium. With its spectacular view of the sea, observers remarked, "As sporting communions go it takes some beating—sun, sea, sand, and beach volleyball on Brasil's Copacabana in an open-air, 12,000-seater arena just meters from the waves crashing onto Rio de Janeiro's golden shore," said one as another declared: "Beach volleyball typically boasts one of the most scenic venues at each Olympics, especially Sydney and London—and Rio might contend for the best ever" (McGowan 2016; Ackerman 2016).

Copacabana was also featured in Rio's efforts to deal with sanitation and storm sewers. Along with the 1970s beach refurbishment, the city constructed a large (5.5 m tall, 5 m wide) interceptor tunnel under the widened Avenida Atlântica to capture runoff from the surrounding hilly areas as part of a 9 km long sewer system to discharge at an ocean outfall in neighboring Ipanema beach. Yet, with ongoing population growth, managing sewers was challenging in the subsequent years. After the merger of Guanabara and Rio de Janeiro state, water and sewer service became the responsibility of a newly created Rio de Janeiro State Water and Sewage Company (CEDAE), an entity that struggled for decades to meet the demand for clean drinking water and sewer treatment. In fact, during the 2016 Olympics, Copacabana, the site for the triathlon and open water swimming, was subject to numerous news reports about its pollution and unsafe competition. Overall, Rio was unable to meet an Olympic pledge to provide water and sanitation services to 80 percent of the city's population by 2016. By 2021, strapped for cash and unable to perform its functions, CEDAE auctioned sewer concessions to private sector entities based in Singapore and Canada, and some of the proceeds flowed to Rio's municipal budget (Biller 2021; World Bank 2022).

To reinforce the necessity of enhancing other assets, Rio's leaders worked with the state and federal governments to secure a highly sought-after world heritage site designation from the United Nations Educational, Scientific and Cultural Organization (UNESCO). The nation's Institute of the National Historical and Artistic Heritage (IPHAN) initiated the nomination in 2009, within two years, the mayor submitted the key supporting documents, including the *Master Plan for the Sustainable Urban Development of the Municipality of Rio de Janeiro* (City of Rio de Janeiro 2011).

The plan outlined management plans for the area containing the natural features (7,300 hectares) and a large buffer zone (8,600 hectares)—some 13 percent of the city's land area. The buffer zone included several densely settled neighborhoods having almost half a million residents (IPHAN 2014). By 2016, the multi-year process was successful. This recognition would support the city's tourist attractions and solidify the public stewardship of natural areas in the face of development pressures from the real estate sector.

In recent decades, mayors Cesar Maia (1993–1997; 2001–2009), Luiz Paulo Conde (1997–2001), and Eduardo Paes (2009–2013; 2013–2017; 2021–2024) focused on another set of assets, the city's cultural amenities. They followed along the lines of earlier government leaders who had built the Municipal Theater (1909), National Library (1910), National Museum of Fine Arts (1938), and Museum of Modern Art (1955). In 2003, Maia commissioned the construction of the Cidade das Artes, a performing arts center in the fast-growing Barra da Tijuca neighborhood. Despite having a troubled history related to funding, it subsequently opened in 2013 as the largest modern concert hall in Latin America. With the samba placed on UNESCO's list of intangible cultural heritage in 2005 and flourishing in Rio's Carnaval, both Maia and Paes would invest in supportive facilities: Maia funded the Cidade do Samba (2006) home to several schools, and Paes funded the expansion of the Sambódromo (2012), a nearly half-mile parade ground accommodating 90,000 spectators.

After a failed attempt to attract a branch of New York City's Guggenheim Museum to Rio in 2005, Maia and later Paes remained committed to the use of culture in their quest to reinvent the city. The result was the addition of two architecturally dazzling

museums to the city's inventory. The first, the Rio Museum of Art (2013), featured the adaptive reuse of three buildings (a former port inspector's headquarters [Dom João VI Palace from 1910], a former central bus station, and a police hospital from the 1940s). The second, the Museum of Tomorrow (2015), illustrated sustainable design through its use of solar energy and other devices. A recent evaluation of the museums concluded that they were successful in attracting local and tourist audiences and, in fact, the Museum of Tomorrow had become an "icon … being a symbol of Rio de Janeiro and object of countless shared images of the city… [and] is aligned with the process of city branding, which implies selling the image of the city as 'a good destination' for investment and tourism, generating symbolic and economic gains" (Corrêa et al. 2022).

The two new museums anchored the city's 1,200+ acre Porto Maravilha urban redevelopment of the city's port and its surrounds, an area long contemplated for revitalization (World Bank 2020). Developable land being limited, Rio's once thriving port was rendered obsolete by technological advances in shipping accelerated high vacancy rates. Inadequate infrastructure and isolation from the waterfront by a two-mile elevated highway, the Perimetral (1950–78), were barriers to any spontaneous private sector investment. Rio's winning the Olympic bid in 2009 gave impetus to the project, with the city placing the communications center there.[1]

Some 28,000 people lived in the port area that the city believed could accommodate 300,000 if redeveloped according to its $ 2.8 billion regeneration plan. PORAM, the plan, envisioned a special mixed-use community that combined existing and new residences,

1. The role of convenings in the city's reinvention will be discussed in a later section as will the innovative financing scheme employed for the project.

traditional and new-age businesses, and local and global arts and culture. Of note, in addition to building the new museums and making land available for modern office buildings, the city actively protected local character. For example, upon hearing of the eviction of more than 50 artists from a derelict factory they had transformed into studios, Mayor Paes expropriated the building, putting it under city ownership and retaining its function (Clarke 2012). A key piece of PORAM was the massive reconfiguration of the area's infrastructure, including dismantling the Perimetral and replacing it with a 17-mile light rail, a two-mile promenade for bikes and pedestrians, and five miles of tunnels as well as water and sanitation infrastructure, electricity, gas, telecommunications, and public lighting (World Bank 2020).

Addressing Perceived Liabilities

While Rio engaged with such new projects as the Porto Maravilha, it also began to address what might be called a perceived liability, its massive number of favelas within but isolated in the city due to their lack of basic public services (water, sanitation, police, and fire protection), existence without legal tenure, and dependence on informal employment. The proliferation of favelas during Rio's explosive growth and beyond had yielded to a city with some 23 percent of its population living in these areas in the late 20th century.

In the 1960s, as the favela populations "invaded" public and private land, the city and state embarked on forcible eviction, clearance, and relocation strategies. Between 1960 and 1973, the government removed some 175,000 people living in favelas (Bruma 2016), resettling them in newly laid out districts at the edge of the city. The City of God ("Cidade de Deus" or CDD), made world-famous due

to an award-winning film based on it, is an example. Developed on a 175-acre site for some 3,000+ homes in 1965, the designers plotted a gridded street pattern with five-acre blocks accommodating 144 dwellings. Over the years, newcomers occupied vacant areas at the CDD's periphery, and public services, especially policing, declined, resulting in the proliferation of drug-related crime and violence, making the "ideal" settlement notorious for its failure.

The city's approach to favelas changed dramatically in the succeeding decades. Funded by some $ 600 million over thirteen years by loans from the Inter-American Development Bank (IDB) and city funds, Rio embarked on the first phase of the Favela-Bairro project (1994–2000) in 88 favelas, installing infrastructure (water, sewer, lighting), advancing public services (health, garbage collection, and education) and building recreational spaces while incorporating significant resident participation in all operations (IDB 1999; Cabral 2014).

In the second phase (2000-2008), the city focused on 70 favelas, continuing the infrastructure work and adding employment training for youth and adults, slope protection, and reforestation (Libertun de Duren and Rivas 2020). All observers viewed this upgrading program as successful in the near term (Gewertz 2000). However, a later evaluation reported deterioration in the services, leading to queries about whether the program's expense ($ 4,000/per household) yielded sufficient benefits (Libertun de Duren and Rivas 2021). Others held that reasons for the decline could be found in population growth (between 2000–2010 favela population increased 24 percent while the city grew 3.4 percent), lack of maintenance on the part of the city and residents, and vandalism and crime, not program deficiencies (Libertun de Duren and Rivas 2020).

The city initiated a third upgrading program with IDB in 2010, renamed the Popular Settlement Urbanization Program which continued along the same lines as the Favela-Bairro project—$ 300 million divided between the IDB loan and city revenues. Its 2020 closing assessment reported that 9,000 households received title to their land through the program (IDB 2020).

In 2008, the state joined the city in addressing favela issues, focusing on crime. In preparation for the 2016 Olympics, it initiated a policing program called UPP ("*Programa de Unidade Pacificadora*"), covering 196 favelas inhabited by some 700,000 people (Azzi 2020). Under the program, labeled "proximity policing," high-security police forces first cleared a favela of drug gangs then a second force followed to establish permanent stations. Between 2008 and 2016, the program, although controversial, resulted in a 27 percent reduction in homicides as well as decreases in thefts (Azzi 2020).

When updating the city's master plan in 2023, Rio introduced two new elements: dedicating a chapter to favelas and including a section on community land trusts (CLT), a provision that allows a non-profit organization to own, develop, and manage land for affordable housing and associated services, keeping title in perpetuity (Papamanousakis and Fidalgo 2024). The innovative CLT concept requires complicated approval processes and, as yet, has not been tested.

Rio as an In-Demand Global Center

While many observers point to Rio's hosting of the FIFA World Cup (2014) and Olympics (2016) as the turning points that made the city a global center so important that it would be the natural host

for the G20, they are mistaken. Clearly, accommodating two major sports events was critically successful in demonstrating the city's capacities, but Rio built this accomplishment on a strong earlier record of holding multiple and varied visitor-attracting events in addition to sports.

Among them were UN-based international meetings, religious pilgrimages, massive rock concerts, Carnaval, and emerging new economy convenings as listed in Table 3.

Rio Hosts Global Events			
Year	Date	Event	# Of People
1950	June 24–July 16	FIFA World Cup	200,000 spectators
1990	April 20–21	Paul McCartney*	180,000 attendees
1992	June 3–14	Earth Summit	25,000–30,000 attendees
2007	July 13–29	Pan Am Games	90,000 attendees at the opening, and 5,600 athletes
2010	March 22–26	World Urban Forum	15,000 attendees
2011	July 15–24	Military Games	4,900 athletes
2012	February 7	Sambódromo renewed**	
2012	June 13–22	Rio+20	45,000 attendees
2013	July 23–28	World Youth Day	3 million visitors
2014	June 12–July 13	FIFA World Cup	32 teams and 1 million visitors
2016	August 5–21	Summer Olympics Games	11,000 athletes and 7.5 million visitors
2024	April 15–18	Web Summit***	35,000
2024	September 13–22	Rock in Rio****	700,000
2024	November 18–19	G20	

Table 3. Rio Hosts Global Events
Source: Author.
*Representative of several massive concerts. ** Emblematic of public space dedicated to the annual four-day festival. *** An example of the many trade events that showcase the city's new economies; Web Summit 2023 in Rio was the first one held in Latin America. **** Rock in Rio has occurred every two years since its founding in 1985 (with a hiatus during the COVID-19 pandemic).

Perhaps Rio's hosting of the FIFA World Cup in 1950 was the inspiration for the city's late 20th-century reinvention policy focusing on sports. For Brasil, the event represented more than sponsoring a competition. The country that had joined the Allies in World War Two was ready to claim a more important position in global affairs. Thus, the 1950 World Cup would serve as a platform for not only being the first match since 1938 but also being a means for the country to be perceived as an important world leader (Merlo 2015). Accordingly, the state built the world's largest stadium, the Maracanã, accommodating 200,000 spectators.[2]

In the early 1990s, Rio's leaders seriously considered bidding for the Olympics. They studied how Barcelona had used the 1992 Olympics to reinvent their city and formed a multilevel bid committee that hoped to emulate the Spanish experience. However, the International Olympic Committee (IOC) thought otherwise, turning down Rio's two bids in 1995–96 and again in 2003–2004. Not to be defeated, Rio set about showing the IOC that it was up to the job by securing the Pan American Games for 2007.

They used the Pan American Games to demonstrate Rio's facilities and capacity to handle large events—the games brought 5,600 athletes from 42 countries to compete in 38 sports. Rio sized the sports facilities built for the 2007 games according to Olympic standards. When submitting what would be a successful bid in 2009, the city promised to use the Olympics to transform key infrastructure and public facilities as Barcelona had. President Luiz Inácio Lula da Silva attended the decisive IOC meeting, guaranteeing national financial support—some $ 17 billion for transportation improvements. The

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2. Over the years, the Maracanã would attract all sorts of crowds: it rang with the voices of Frank Sinatra, Paul McCartney, Tina Turner, Madonna, Sting and others, Pelé would kick his 1,000 goal and over time the pope would celebrate three masses there.

state also chipped in several million dollars as the city outlined its plans to improve several existing facilities as well as build new ones and provide transportation for the anticipated crowds (Silvestre 2012). In 2011, to demonstrate progress, Rio hosted the Military Games accommodating nearly 5,000 competitors who came from 108 countries to participate in 20 sports.

As the recently released *Legacy of the Rio 2016 Olympic Games: Economic Impacts* (Da Mata and Sampaio 2024) reported, the city fulfilled many of its promises to the IOC. The improvements included the Porto Maravilha regeneration project described earlier. They also encompassed major investments in transportation (e.g. Metro line 4, BRT expansion and greening, roads and tunnels), water (e.g. Seropédica Waste Treatment Center, environmental recovery of Guanabara Bay, Jacarepaguá Basin, and Lagoon Complex), and in athletic facilities, living arrangements, and associated cultural and educational legacy projects (e.g. Olympic Park and Village, the Sambódromo). Rio welcomed some 7.5 million people to the city itself while many more witnessed the events via television—some 2.5 billion people watched the opening ceremony (IOC 2017), a phenomenon that reinforced the city's reputation around the world.

Beyond the Olympics, Rio hosted other visitor-attracting events to reinforce its claim to be an in-demand global center. The UN-sponsored 1992 Earth Summit and the 2012 Rio+20, which set the scene for today's global climate change campaigns, are examples. At the 1992 conference, some 25,000 civil society advocates assembled in forums in central Rio locales like Flamengo Park while the officials met farther away in Riocentro, the city's convention center built in 1977 and renovated for the 2016 Olympics. Twenty years later, Rio+20 had become a megaconference. The 190 official

delegates still met in Riocentro, but 45–50,000 civil society attendees participated in the People's Summit, the Business Action for Sustainable Development Conference, 4,000 side events (only 500 at Riocentro) and/or marched through Rio's downtown streets in one of 23 demonstrations (Ivanova 2013).

Other events in the roster before and after the Olympics include UN Habitat's Fifth World Urban Forum (2010) which brought 15,000 urbanists to meet in re-conditioned warehouses in the port district; the World Youth Day in 2013 that attracted 320,000 young Catholics to the city and culminated in a mass celebrated by Pope Francis on Copacabana Beach before an estimated three million attendees (Ottaro 2013). And in the popular music world, Rio has been the home of Rock in Rio, a four-day concert spree held biennially since 1985. The September 2024 edition attracted 700,000 attendees. Further, the famed four-day Carnaval that plays out throughout the city attracted some two million spectators and participants in 2024, and trade shows like the Web Summit whose organizers picked Rio as a "tech-hot" city joining Hong Kong, Dublin, Doha, and Toronto, assembled 35,000 attendees for its meeting in April 2024.

Not to be forgotten on the account of Rio's being a global center is its participation in the business side of the country's gross domestic product (GDP), the world's 7th largest economy in 2024. While São Paulo dominates as a general business center, Rio nevertheless plays a critical role by serving as headquarters for some of the country's highest-value companies. Vale ($ 90 billion in assets, a multinational mining conglomerate) and Petrobras ($ 202 billion in revenues, an energy business) are headquartered in the city (along with Shell, Chevron, and Total). Rio is also the headquarters of Grupo Global, Latin America's largest media company. Of note, the

headquarters function of the mining interests has grown recently due to Brasil's huge supply of critical minerals (lithium, nickel, graphite, manganese, copper, and niobium) needed for the energy transition (Vásquez 2024).

Finally, Rio's leaders have created specialized educational and industrial districts that have supported the city's reinvention. Home to nine top public and private universities, the 69,000-student body Federal University of Rio de Janeiro (UFRJ), whose main campus is on the landfilled Ilha do Fundão (1948–51), is an example of the type of the high performing research institution with associated technology parks found in the world's global centers. Further, Rio's research centers account for 17 percent of the country's scientific output (World Bank 2022, 5).

Rio has concentrated on an important industry in the Santa Cruz industrial district. This is the home of the Ternium steel company (founded in 2010, formerly the ThyssenKrupp Companhia Siderúrgica do Atlântico [TKCSA]) that produces five million tons of steel plate annually. It employs 8,000 people and has its own combined heat-to-energy power plant and its own deep-water port. While it has had a troubled environmental history, in March 2024, its Luxembourg owners announced the inauguration of a small year-long industrial symbiosis project in partnership with the Danish Kalundborg Symbiosis, Rio's Greenova Hub, and Aedin, the industrial districts business association (CREA 2024; Aedin 2024). The area is so important that it merited a campaign visit by current mayor Eduardo Paes in August 2024.

An important aspect in this account of Rio's positioning is how it plays into Brasil's historic and ongoing quest for recognition as a global leader. Brasil has long sought representation in the world's

formal organizations—the United Nations (UN), the International Monetary Fund (IMF), and World Bank, but these efforts have not come to fruition. However, Brasil has gained traction in informal organizations—the BRICS and G20, as indicated by its leading role in the BRICs, assuming the BRICS presidency in 2025 and hosting the G20 in 2024 (Stuenkel 2022). This success in the informal areas has secured other leadership positions for Brasil, including hosting the Clean Energy Ministerial (October 2024) and COP30 (2025).

When Rio grabs the world's attention through its various convenings, it heightens Brasil's global reputation.

Innovative Governance and Finance

Leading the reinvention of a city of more than six million demands vision, responsive governance, efficient management, and sophisticated financial expertise. Brasil's 1988 Constitution provided the enabling environment that, in the 1990s through the first decades of the 2000s, allowed Rio's talented leaders, especially its nimble mayors, to employ and enhance municipal planning and budgetary power. They have been able to engage multilevel government support and work with civil society and private sector partnerships at home and around the globe to target, execute, and operate critical investments in the country's and the city's challenging economic and political environment.

Three interrelated illustrations of the city's agility in connecting policy, programs, and finance effectively underline the leaders' intentional reinvention of Rio, living up to its name as the *Cidade Maravilhosa*. They are financing the Porto Maravilha regeneration project (2009 to present), creating the Operations Center (2010

to present), and implementing the climate action plan (2021 to present). They encompass activities related to hosting the first South American Olympics (2016) and to those taking place in the post-Olympic/post-COVID-19 period (2021). In little more than a decade, the city transferred its attention from accommodating 7.5 million athletes and tourists to dealing with epidemic-caused financial stress and climate change. These efforts, built on the important but fragmented work of previous decades described earlier in this chapter, have enabled Mayor Eduardo Paes to make the marvelous city more marvelous through dexterity, acumen, and imagination.

Financing the Porto Maravilha Regeneration Project

To implement the Porto Maravilha regeneration project, the city developed administrative structures and innovative financial instruments. It created an Urban Consortium Operation (UCO) establishing development rights (or Certificates of Additional Construction [CEPACs]) whose proceeds had to be used for regeneration. The city also established the Companhia de Desenvolvimento Urbana da Região do Porto do Rio de Janeiro (CDURP)—recently renamed Companhia Carioca de Parcerias e Investimentos (CCPar)—a special purpose vehicle, responsible for overseeing the CEPACs sales and engaging in public-private partnerships (PPP) for the execution of projects. Between 2011 and 2013 CDURP raised nearly $ 2 billion through the CEPACs auctions (World Bank 2020; Silvestre 2022), a sum that allowed the city to complete 85 percent of its planned infrastructure investments by 2016 (World Bank 2020). And, in less than a decade, developers who purchased the CEPACs had built some 2,089,963 square feet

of Class A office buildings. CCPar also auctioned off a derelict gas storage site to Flamengo, one of the football clubs of the city, for a new stadium to be developed by 2029. Moreover, plans were in the works to market a section of the area as "Maravalley" (a play on the US's Silicon Valley) intended to attract the tech industry as well as provide space for an undergraduate degree program offered by Rio's highly regarded Institute of Pure and Applied Mathematics (IMPA) (SiiLA News 2023; Rial 2024).

As the regeneration program pursued its goal of connecting the port and downtown, the city instituted Reviver Centro, a tax relief and development rights program to encourage residential development in the center. Not only does the program provide multi-year exemptions from several real estate taxes, but it also permits developers who convert or build residential to construct the same amount for market housing or 150 percent of the total for social housing in other designated areas of the city. Due to the various incentives, private developers are finding the center and Porto Maravilha region attractive. Valor, Rio's business journal, reported that three important firms, AVO, Cury, and Encamp expected to build 10,200 new units in the next two years.

Creating the Operations Center

In April 2010, Rio faced a huge storm that dropped 11 inches of rain in 24 hours wreaking havoc in the city: massive landslides killing 250 and displacing 10,000 displaced people; disabled transportation infrastructure; a collapsed emergency response system; and millions of reals (BRL) in damages. Rio's mayor, Eduardo Paes, was mad and frustrated at the management breakdown. However, at that time, Rio was a participant in IBM's Smarter Cities Challenge with its

half million dollars of digital improvement consulting work. The city had already created a chief digital officer position and was poised to have a workshop on additional recommendations when the storm broke (Singer 2012; Freitas and Nogueira 2021). Paes immediately called on IBM to help address the city's management and communications problems. He asked them to develop some sort of multipurpose center—one that could not only have an early warning system but also coordinate the city's responses to large events, incidents, emergencies, and crises.

Taking up the challenge, IBM oversaw the creation of the Operations Center, assembling CISCO, Samsung, and local providers on a platform that integrated incoming data (such as phone, text, radio, and email) on flooding and traffic and dispersed the information to the responsible units of the 30 participating city agencies. COR (as in "Centro de Operações da Prefeitura do Rio de Janeiro") opened in December 2010—eight months after the landslide disaster—equipped with a system to predict storms, the capacity to manage large events (e.g. Carnaval with more than 450 samba parades and 350 sites whose routes could be scheduled and mapped with security and clean-up programmed) or respond to a wide variety of crises (e.g. dealing with a collapsed building or managing COVID-19 policies needing services from the fire, police, health and/or transportation agencies).

The results were measurable: within the first year, it developed the capacity to predict heavy rains 48 hours in advance, and traffic incidents fell 30 percent, illustrating a mayoral management style placing the city a leader in global innovation recognized by Rio's receiving the Smart Cities Award in 2013 (EBRD 2021). Over time, Rio changed partners including moving to NASA, the US space

agency for storm prediction, Google's WAZE for traffic, and social media for citizen warnings. Costing $ 14 million ($ 20 million in 2024), the COR received worldwide press attention, drawing visits from some 10,000 city managers between 2011–2016, eager to replicate it. In 2023, building on its success, the city supported COR expansion, increasing the size of the situation room and resources for its resilience (COR 2022).

Implementing the Climate Action Plan

Rio is vulnerable to the full range of difficulties caused by global warming: sea level rise, flooding, extreme heat, drought, and landslides, as well as such associated problems as disease and displacement. The city has suffered particularly in the realm of heavy rain-caused landslides that have caused hundreds of deaths and massive displacement of favela households over time.

Memorable tragedies occurring in 1966 and 1967, 1988, 1996, 2010, and 2019, led municipal officials first to address a given disaster and later to stimulate the comprehensive mitigation and adaptation policies that have placed the city as a leader in innovative climate action around the world (Benmergui and Gonçalves 2019; C40 2015).

From the 1960s to 2000, the city engaged in preventive infrastructure investment through the Geotechnical Institute (founded in 1966) to undertake shoring up projects in hilly favela neighborhoods (Barbosa and Coates 2021). However, the 2010 landslide that stimulated COR's creation would push Mayor Eduardo Paes to engage more broadly with climate change. Some link his dedicated leadership to this topic to his vision to make Rio a global center while others see it as part of the broader management reforms he

carried out upon taking office, ones that resulted in tripling the municipal budget or his engagement with other global city mayors from C40 (which he chaired from 2013–2016) that made him a spokesperson for climate change agendas (Mendes 2022).

Regardless of the motivation, Paes sustained a strong climate action program during his mayoralties (2008–2016) and (2020–2024). In the first eight years, he developed the foundation for the city's climate strategy through a series of laws, plans, and programs. They included the 2011 passage of Municipal Law 5248, mandating the city inventory its greenhouse gas emissions every four years; a series of three-year strategic plans (2009–2011, 2011–2013, 2013–2016) with detailed measures and indicators related to climate change subject to triennial evaluation and report of percent of targets reached; revision of the city's master plan (2011); work with the World Bank on Rio's Low Carbon Development Program (2012) to certify that Rio's GHG remission measurements conform to the world standards (2013); collaboration with the University of Rio de Janeiro on a study, "Technical Assessment and Support of the Development of a Climate Adaptation Plan for the City of Rio de Janeiro (2013), that led to the Climate Adaptation Strategy for the City of Rio de Janeiro (2016); acceptance into the Rockefeller Foundation's 100 Resilient Cities program (2014); and subsequent publication of Rio Resilient (2015), the first resilience plan in Latin America, overseeing the launch of the C40 City Climate Finance Facility (2015) at the Local Leaders Summit hosted on the sidelines of COP21 Paris and fostering the Plan for Vision Rio 500 (2016). Alongside these efforts, he aligned many of the Olympic programs with a climate agenda, especially the infrastructure investments in transportation.

Returning to office in 2021, Paes issued the city's Plan for Sustainable Development and Climate Action of the City of Rio de Janeiro, a detailed 500+ page roadmap that specifies investment in special projects related to energy, transportation, reforestation, mapping them along sustainability corridors that illustrate the location and types of programs. Among the initiatives Paes supported was working with the World Bank, the city secured loans amounting to $ 270,000 million for fiscal reform programs to enhance the city's creditworthiness and for accelerating the transition to low-carbon, climate-resilient and inclusive urban development (e.g., BRT enhancement, cycling network, and low emission district). In addition, it secured funding from the C40 City Finance Facility and a PPP to develop the city's first large solar farm to be built over a sanitary landfill, initiated another PPP to procure green energy for the city's municipal buildings by 2026, passed Local Law 7907 to stimulate a carbon market incentivized by local tax deductions for companies, and launched an AI/drone mechanized reforestation effort (City of Rio de Janeiro 2021).

Conclusion

The dynamism that fuels making a city great is complicated, often disruptive, and challenging to those experiencing the fast-moving and dramatic public and private decision-making that accompanies it. Varied views about the correctness of approaches, allocation of resources, and uses of urban space in a democratic society play out in political arenas marked by debates or confrontations and disputed assessments of the benefits of a given policy or program but ending in consensus, innovation, and re-invention. High short-term costs may lead to significant long-term gains in terms of urban

revival. Again, leadership is key—having the ability to make hard decisions, communicate them effectively to the city's stakeholders, and execute them efficiently is fundamental.

This is the story of Rio. It provides important lessons for other cities, especially those experiencing explosive demographic growth and/or political and economic turmoil. Some summarized lessons to reflect upon:

- Lesson 1. *A city must invest in its assets and address its liabilities.* Rio enhanced its natural assets, as the Copacabana case illustrates, while it also worked to improve the living conditions of the favelas. The job is not yet complete, but it has begun and is ongoing. It successfully pursued a UNESCO World Heritage designation to justify preserving and protecting its natural assets and their surroundings. When failing to secure a branch of an internationally famous museum, it built two of its own that are not only dazzling anchors but turned a liability—a derelict neighborhood—into a future asset, and also, through their sustainable designs, exemplify its claim to leadership in climate action.

- Lesson 2. *A city must know who it is and wants to be.* Its leaders need to set it on a course to achieve those ends. When Rio lost its status as the nation's capital, it reeled and went into decline, but after a time, it was able to take on a new role—becoming a global center—and capturing a range of important convening. While the Pan American Games and Olympics were central to hosting international meetings like the two UN environmental conferences and UN-Habitat World Urban Forum, serving as headquarters of large natural resources and communications industries, attracting

assembles like the Catholic Youth, the Web Summit, and Rock in Rio music festival underlined its importance as THE place for important convenings. Moreover, as a climate-vulnerable city, it has used this unique situation to become a world leader in climate change responses to be visited or emulated.

- Lesson 3. *A city must be nimble and steadfast in plotting its future,* taking advantage of available resources, adopting reforms when necessary, welcoming technology, using innovative finance wherever possible, and pursuing a clear vision patiently. In the first two decades of the 21st century, Rio exhibited these qualities as explained in the examples of the Porto Maravilha project, the creation of the Operations Center, and the pursuit of climate action plans.

- Lesson 4. *A city needs strong and savvy leaders.* People who have the imagination, knowledge, experience, and communication skills to advance and share a vision to make a city great. People who develop and execute a plan and more detailed road maps to achieve it. People who inspire constituents, from voters to members of the state and national government, to support the work. People who build the management capacity and assemble financial resources to support the necessary efforts. People who represent the city on the world stage. Rio has had such leaders over time. Today, Mayor Eduardo Paes has been that leader.

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2.

Enlightened City Leadership: A New Model for a Sustainable Urban Future

H.E. Fahd Al-Rasheed

In the 21st century, cities are at a critical juncture. They drive 80% of global Gross domestic product (GDP)[1] and significantly affect our quality of life. Yet, they face immense challenges, from climate change and rapid urbanization to social inequality and technological disruption. As existing cities expand and new ones emerge, the need for strategic, skilled leadership becomes increasingly urgent.

Despite these challenges, there is a glaring gap in the formal training of city leaders. Many mayors and city administrators have not had access to the multidisciplinary education required to manage the complexities of modern urban environments effectively. This paper addresses the need for specialized city leadership programs to equip current and future leaders with the necessary skills to

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navigate the challenges cities face and ensure a sustainable future for urban populations.

Cities Are Consequential

Cities are at the heart of human prosperity and progress. As the primary drivers of economic growth, they contribute 80% of the global GDP, making them the most vital engines of our global economy. However, this prosperity comes at a cost, with cities also responsible for 70% of global emissions (IPCC 2022). For individuals, cities impact every aspect of life. They are where we live, work, raise our families, and build our wealth. In fact, choosing a city to call home is one of the most significant investments we make, shaping our personal and financial futures.

Yet, as we navigate the remaining decades of the 21st century, cities face unprecedented challenges. The global population is rapidly increasing, and the need to manage our cities effectively has never been more important. To sustain economic growth, enhance the quality of life, and protect the environment, we must confront these challenges head-on.

Challenges of the 21st Century

As our global population continues to rise, cities around the world will encounter a set of formidable challenges that demand urgent attention and strategic management. Addressing these issues is essential for the long-term prosperity and sustainability of urban areas. Among the most pressing challenges are:

Climate Action in Cities: Urban areas are responsible for 70% of global CO_2 equivalent emissions, making them key battlegrounds for climate mitigation efforts (IPCC 2022). With increasing incidences of extreme weather events, cities must develop and implement robust climate strategies to protect their infrastructure, economies, and residents. This includes transitioning to sustainable energy sources, improving building efficiency, and creating green spaces to absorb carbon emissions.

Air Quality and Public Health: Poor air quality is a pervasive issue, with 41% of cities worldwide experiencing pollution levels more than seven times higher than recommended by the World Health Organization (Breathe Cities 2024). The impact on health is staggering—air pollution was responsible for 8.1 million deaths in 2021 alone (Health Effects Institute 2024). Beyond the human cost, air pollution leads to around 1.2 billion lost workdays annually, potentially rising to 3.8 billion days by 2060. The economic toll is immense, with the World Bank estimating health damages associated with air pollution at $ 8.1 trillion, equivalent to 6.1% of global GDP (World Bank 2022).

Social Inequality and Poverty: Cities are the primary venues for wealth creation and social mobility. However, they are also marked by significant inequalities in access to housing, healthcare, education, and employment. An estimated 1.1 billion people currently live in slum-like conditions, a number projected to rise to 3.1 billion within the next 30 years (UN 2023). Addressing this disparity is central to creating inclusive urban environments where all residents can thrive.

The Unknown Impact of Emerging Technologies: The rapid advancement of technologies such as artificial intelligence (AI), autonomous vehicles, and digital infrastructure will profoundly

transform cities. However, the full extent of this transformation is uncertain. Urban leaders must proactively understand these technologies to leverage opportunities while mitigating disruptions. Failure to do so could widen social disparities and create governance challenges.

Urban Decline and Resilience: While some cities will continue to grow, others face the threat of decline. The *Envisaging the Future of Cities: World Cities Report* (UN-Habitat 2022) states that nearly half the cities in the developed world are shrinking. Another study found that in the United States alone, nearly half of the 30,000 cities could experience population decreases of 12–23% by 2100 (Sutradhar, Spearing and Derrible 2024). Cities decline for many reasons, including industrial restructuring, demographic changes, competitive dynamics, political issues, and numerous city-specific issues. Yet irrespective of the reason, declining populations reduce cities' ability to generate income, provide essential services, and maintain quality of life, often leading to a cycle of increased poverty and crime. Resilience in the face of these shifts is essential, requiring cities to pivot their economic models and policies to adapt to changing circumstances.

The Need for New Cities: By 2050, 68% of the global population is expected to live in urban areas, necessitating the development of new cities and the expansion of existing ones (UN-Habitat 2022). How we build these new cities will have a profound impact on humanity's well-being. Proper planning and management are critical to ensure that these new cities are sustainable, inclusive, and resilient.

In confronting these challenges, cities' futures depend on the quality of their leadership. Enlightened, skilled, and strategic urban governance is no longer optional; it is imperative.

Why Managing Cities Is Difficult

Managing cities is a complex and multifaceted endeavor. Cities are not just clusters of infrastructure and services; they are dynamic ecosystems that must accommodate various social, economic, and environmental needs. This complexity is compounded by the rapid pace of change in urban environments and technology. Here are the key reasons why managing cities effectively is so challenging:

Cities as Complex Organisms: Cities are the most intricate creations of humanity. They serve as marketplaces, cultural hubs, and centers for social mobility while also acting as drivers of economic growth and sustainability efforts. Managing such a diverse range of functions requires an understanding of various interconnected systems—from transportation and utilities to housing, healthcare, and education.

Cross-Sector Knowledge Requirements: Effective city leadership demands a comprehensive understanding of various sectors and issues. Urban administrators must be well-versed in urban economics, infrastructure, energy, public safety, community engagement, and more.

*The Need for Systems-Based Thinking***:** City management requires system-based thinking to understand how different components of urban life interact. A decision about housing policy, for example, affects not only real estate markets but also social equity, public transportation, and environmental sustainability. City leaders must, therefore, adopt holistic approaches that consider both the immediate and long-term impacts of their policies.

Inertia: Inertia is a significant challenge in city leadership, often

stemming from complex bureaucracy, financial constraints, and risk aversion. Cities have multi-layered governance structures, creating slow decision-making processes and difficulty in coordinating new initiatives. Short-term political cycles further limit long-term planning, while financial limitations and the high costs of overhauling legacy infrastructure deter action. Additionally, resistance from stakeholders, regulatory barriers, and risk-averse attitudes make transformative change difficult. Overcoming inertia requires strategic, patient leadership capable of navigating diverse interests, building consensus, and balancing immediate needs with long-term vision.

The Need for Enlightened City Leadership

Given the complexity of managing modern cities, it is clear that we require a new appreciation of city leadership—one that extends beyond traditional political or corporate frameworks. "Enlightened City Leadership" embodies a unique combination of technical knowledge, strategic thinking, and a deep commitment to the well-being of citizens. But what exactly does this entail?

Defining Enlightened City Leadership: Enlightened city leadership is characterized by a deep understanding of urban dynamics, a commitment to serving the public good, and the ability to implement long-term, holistic strategies. Unlike conventional political roles, where leaders may focus on short-term wins, city leadership requires a vision that spans decades. It calls for an ability to anticipate and navigate future trends, including technological disruptions, economic shifts, and demographic changes.

Beyond Political and Corporate Leadership: While city leaders

must have the negotiation skills of politicians, they also need the strategic mindset of large corporations' Chief Executive Officers (CEOs). However, city leadership draws further. Unlike corporate executives, city administrators deal with public goods, social equity, and long-term public welfare. The consequences of their decisions—ranging from public health policies to climate action— directly impact millions of lives and have far-reaching effects on global sustainability.

Required Technical Skillsets: City leaders need a broad awareness of various disciplines, including urban economics, infrastructure management, sustainability, public health, and digital transformation. They must understand the principles of smart infrastructure and environmental resilience while being conversant with legal and regulatory frameworks. For example, responding effectively to climate change requires knowledge of green building practices, renewable energy systems, and sustainable transport networks. City leaders must also navigate digital infrastructure and leverage technologies such as AI to enhance services, optimize operations, and engage citizens.

Compassionate and Altruistic Leadership: Enlightened city leadership goes beyond technical proficiency. It requires compassion, empathy, and a genuine desire to improve the quality of life for all residents. City leaders must prioritize inclusive policies, recognizing that their decisions affect diverse populations, and must address inequalities in housing, healthcare, and access to public services.

The Resulting Leadership Profile: When we amalgamate these technical skills, strategic thinking, and compassionate outlook, we form a new leadership profile—a city administrator who is not just a manager but a visionary steward of urban life. These leaders are

equipped to develop innovative policies, drive economic resilience, and ensure the long-term sustainability of their cities. To illustrate, consider this job description for an "Enlightened City Leader:"

Job Title: Enlightened City Leader

Location: Global (urban centers of varying sizes).

Position Type: Full-Time (Elected or Appointed).

About the Role: The Enlightened City Leader is at the forefront of urban transformation, serving as a visionary steward for the city's future. This role requires a multifaceted approach to leadership, balancing economic growth, social equity, and environmental sustainability. As an enlightened leader, you will guide the city through the complexities of modern urban life, leveraging strategic planning, cross-sector knowledge, and compassionate governance to shape a thriving and inclusive urban environment.

Key Responsibilities:

Strategic Vision: Develop and implement a long-term vision for the city's growth, balancing economic prosperity, sustainability, and quality of life for all residents.

Urban Planning: Oversee the design, construction, and maintenance of city infrastructure, including transportation, housing, utilities, and public spaces, ensuring they meet the needs of current and future populations.

Economic Resilience: Drive economic development initiatives, pivoting the city's economic model in response to market shifts, technological advancements, and demographic changes.

Climate Action: Implement robust strategies to address climate change, reduce carbon emissions, and promote sustainable practices across all city sectors.

Cross-Sector Collaboration: Collaborate with various sectors, including public health, education, technology, and social services, to address complex urban challenges holistically.

Smart Technology Integration: Embrace emerging technologies, such as AI and autonomous systems, to optimize city operations and enhance citizen engagement.

Community Engagement: Act as a compassionate advocate for residents, ensuring their voices are heard in policy decisions and that services are accessible and equitable.

Policy Development: Develop and enforce policies that address urban challenges, including air quality, public health, affordable housing, social inequality, and sustainable transportation.

Stakeholder Management: Engage with government agencies, private sector partners, and academic institutions to drive collaborative initiatives that benefit the city's growth and well-being.

Crisis Management: Lead the city through crises, such as economic downturns, public health emergencies, and natural disasters, with foresight and effective communication.

Key Qualifications:

Multidisciplinary Expertise: Proven knowledge in urban planning, public administration, infrastructure management, sustainability, digital transformation, and economic development.

Strategic Thinker: Ability to develop and execute long-term plans that account for economic, environmental, and social factors.

Leadership: Strong negotiation, decision-making, and team-building skills, with a track record of managing large-scale projects or organizations.

Compassion and Altruism: Deep commitment to public service and improving the quality of life for all city residents.

Innovative Mindset: Familiarity with smart city technologies, data analytics, and the latest trends in urban development.

Public Engagement: Excellent communication skills, with experience in public outreach, stakeholder engagement, and community advocacy.

The Current Training Gaps

Although many institutions offer training in disciplines such as urban planning, civil engineering, and public administration, there is a noticeable gap in providing multidisciplinary training for city leaders. Urban administration requires a blend of knowledge from

various fields, yet most programs do not offer a comprehensive curriculum that adequately prepares city leaders to comprehend both the technical and socio-economic aspects of their roles. This lack of training hinders city leaders from effectively addressing the complex issues they encounter daily.

Mayors, in particular, face an even steeper learning curve. Often appointed or elected without formal training in city administration, they are thrust into roles that demand immediate, informed decision-making. The parallel in the corporate world would be placing an executive in charge of a multi-billion-dollar company without a background in business management.

Some progress has been made to address this gap. The Bloomberg Harvard City Leadership Initiative, for example, has trained 314 incumbent mayors and over 540 senior city leaders from 33 countries since 2017 (Bloomberg Philanthropies 2024). Other universities have launched programs in urban affairs. But the gap is massive. A broader and more structured approach to city leadership education is essential to prepare the thousands of leaders required to manage the cities of today and tomorrow effectively.

How Many Trained City Leaders Do We Need?

The scale of urban challenges ahead underscores the urgent need for a new generation of well-trained city leaders and administrators. But how many professionals will we need to meet the demands of both existing and emerging cities globally?

Managing New Cities: Today, there are around 700 cities globally with populations exceeding one million people. By 2080, that number is expected to rise to approximately 1,600 cities (Clarke

2022). This suggests that nearly 900 new cities with populations of over one million will need to be built or significantly expanded over the coming decades. To effectively manage these 900 new cities, each will require a new administration. Let us build a city administration for each of these cities. Assuming each city requires a mayor every four years over the next 56 years, we need 14 mayors for each of these new cities. Furthermore, assuming each mayor will have 8 senior city administrators reporting to them with an average tenure of 8 years, the total number of senior city administrators we will need would be 56 administrators for each city over the period. Finally, assuming that each one of these city administrators will oversee three department heads, each with a tenure of 12 years, the total number of department heads required over the period would be 112 per city. When we sum up the three levels, the average number of leaders required per new city is 182 city leaders from now till 2080. This results in a demand for roughly 162,000 trained city administrators for the 900 new cities.

Managing Existing Cities: The current 700 cities with populations exceeding one million already have on-the-job-trained leaders. So, assuming over the period from today to 2080 they will need only half of the leaders of a new city, the total per city would be 91 leaders and 63,700 leaders in total for the 700 cities over the period.

Managing smaller cities: Beyond these large cities, there are ten thousand small urban areas with populations of above 50,000 residents. Due to both lower affordability and lower complexity, we will assume that we will only need 20% of the number of leaders required for the bigger new cities. As such, the total number of leaders per city required over the horizon is 36 per city, and 364,000 leaders in total till 2080.

This implies that the total number of city leaders required from now till 2080 is roughly 590,000 leaders. And because we need 3-4 suitable candidates for each position, the actual number of potential leaders we will need to train will exceed two million. That is astounding.

A lot of assumptions have been made here. And cities have different requirements, governance, and employment cycles, so the cities you know may be different. But the idea is to instigate a discussion on the direction, not on the specific quantum.

Call to Action

City leaders understand the magnitude of these challenges as they go about their daily work. It is our responsibility to ensure that current city administrations are equipped with the necessary skills to manage our cities effectively. More importantly, we must prepare the next generation of city leaders to confront the deluge of challenges that cities will continue to face, worldwide.

The time for action is now. We must work collaboratively—city leaders, governments, the private sector, and academic institutions—to develop robust educational programs tailored to the complexities of city administration. Whether through the establishment of a formal "Master in City Administration" (MCA) or other training initiatives, the goal is clear: to create a pipeline of knowledgeable, strategic, and compassionate city leaders capable of navigating the future of urban life.

The future of our cities depends on it.

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Advancing the Urban Climate Finance Agenda: The Green Cities Guarantee Fund[1]

Mauricio Rodas

The Need for New Urban Finance Mechanisms

Cities are at the forefront of addressing some of the world's most pressing challenges, including poverty, inequality, inadequate access to basic services, and climate change. As urban populations continue to grow—now comprising over half of the global population and projected to reach 70% by 2050 (UN 2018)—the role of cities in tackling these issues becomes even more critical, adding complexity to local governance and significantly increasing the financial demands on cities.

However, cities face a global financial system rooted in the Bretton Woods framework, which was designed with a focus on nation-states and offers limited financial access to subnational

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1. This article is based on *The Green Cities Guarantee Fund: Unlocking Access to Urban Climate Finance* (Birch, Campo and Rodas 2024).

governments. This system, established in the 1940s, was created in a far less urbanized world. Today, the reality is vastly different, and this outdated structure is ill-suited to address the global challenges that are now concentrated in cities.

A striking example of the dysfunction in the current system is that the majority of countries—56%—prohibit cities from borrowing. Only 44% of nations permit cities to access international finance, but even then, cities must meet stringent requirements (Press-Williams et al. 2024). In many countries, this involves obtaining a sovereign guarantee, which is frequently withheld due to political tensions between national and local governments. Additionally, many cities lack the technical expertise to develop viable, bankable projects. Other barriers, such as high interest rates, short loan terms, complex and lengthy approval processes, or outright credit denial, further hinder cities from accessing the finance needed to implement critical projects.

Furthermore, according to the World Bank (2017), "recent estimates show that less than 20% of the largest 500 cities in developing countries are deemed creditworthy in their local context, severely constricting their capacity to finance investments in public infrastructure." This challenge is compounded by the fact that future urbanization is projected to occur primarily in medium and small-sized cities across the Global South, where resources and institutional capacities are even more constrained.

Cities account for over 70% of global CO_2 emissions and, due to their demographic, economic, and environmental characteristics, are pivotal in the fight against climate change. Without cities playing an active and effective role in addressing the root causes of the climate crisis, countries will never meet their Nationally

Determined Contributions (NDCs) and the goals of the Paris Agreement. Although many mayors worldwide have embraced bold and ambitious climate agendas, the slow pace of funding for essential mitigation and adaptation projects—or worse, the complete lack of access to finance—has severely impeded progress. According to the 2024 State of Cities Climate Finance report by CCFLA (Press-Williams et al. 2024) an estimated US\$ 4.3 trillion per year will be needed to transform urban infrastructure into a climate-resilient one, a figure that is unattainable for cities under the current financial system. This report estimates that annual urban climate finance amounts to only US\$ 831 billion, while other assessments suggest that cities have received less than 10% of the US\$ 1.9 trillion currently available for annual climate finance (Lütkehermöller 2023).

Most funding for urban climate infrastructure projects in the Global South has come from Development Financial Institutions (DFIs), but this represents only a small fraction of the resources required given the scale of the climate crisis. Furthermore, the nation-led governance structure of traditional DFIs offers little incentive to depart from the status quo and direct the necessary resources to subnational governments.

It is evident that the current system is no longer effective. Without reforms in the international financial architecture to provide alternative financing mechanisms for cities, they will continue to struggle to address climate change. Numerous stakeholders have called for a financial system that better aligns with urban needs, offering a range of innovative proposals. For instance, the 2020 Urban 20 Chairmanship introduced the pioneering concept of the "Global Urban Resilience Fund." Another notable idea is the creation of a

"Green Cities Development Bank," proposed in 2019 by C40 Cities and others in the report "Financing a Sustainable Urban Future: Scoping a Green Cities Development Bank" (Alexander et al. 2019). In addition to other meaningful initiatives being pursued in this space, the Sustainable Development Solutions Network (SDSN) Global Commission for Urban SDG Finance has been developing over the past year the concept of a cities-focused guarantee fund aimed at facilitating timely and affordable borrowing—a potential game-changer for unlocking finance for many cities and advancing the urban climate agenda.

The SDSN Global Commission for Urban SDG Finance

In Paris, on June 21, 2023, Mayor Anne Hidalgo of Paris, Mayor Eduardo Paes of Rio de Janeiro, and SDSN Founder and President Jeffrey Sachs officially launched the SDSN Global Commission for Urban SDG Finance, where they serve as co-chairs. Today, the Commission includes over 80 members, comprising mayors, governors, climate and finance experts, leaders of city networks, practitioners, and scholars. Its members hold key positions in municipal and regional governments, international organizations, development finance institutions, investment firms, consulting companies, civil society organizations, and academic institutions. The Commission's Secretariat is hosted by the University of Pennsylvania's Institute for Urban Research, providing essential support to its mission.

The Commission builds on the expertise and ongoing efforts of its members to advance innovative solutions and strategies aimed at enhancing urban SDG financing, with a particular emphasis on

addressing climate change. Through collective collaboration, the members have formulated a series of actionable recommendations, including the proposal for the Green Cities Guarantee Fund (GCGF).

In the report titled *The Green Cities Guarantee Fund: Unlocking Access to Urban Climate Finance* from the SDSN Global Commission for Urban SDG Finance, the Commission's Secretariat offers a comprehensive analysis of the Green Cities Guarantee Fund concept. This analysis is based on an extensive literature review, assessments of guarantee fund annual reports, and numerous interviews with current and former mayors, climate finance experts from both the public and private sectors, guarantee fund specialists, national government officials, and professionals experienced in launching and incubating new development finance entities and funds.

Key Challenges in Urban Climate Finance

Cities in low- and middle-income countries face significant obstacles to securing affordable debt for development and climate-related projects. One primary issue is the global financial system's country-focused structure, which channels most development finance through national governments rather than directly to cities. National governments control fund distribution, often without considering local priorities. While reforms to Multilateral Development Banks (MDBs) are being discussed, city-specific financing needs have been mostly overlooked. Lenders and rating agencies also perceive cities as high-risk due to political instability, limited institutional capacity, and a lack of resources to carry out complex projects. As a result, cities that can access financing often face high interest rates and short loan terms, which can strain the

budgets of local governments and increase the likelihood of default.

However, the European Investment Bank (EIB) found evidence indicating that the actual risk of lending to cities is relatively low, which runs contrary to the commonly held viewpoint of investors (EIB 2023). A 2022 analysis comparing default rates of private and subnational borrowers, using pooled data from major DFIs revealed that from 1994 to 2022, subnational borrowers had a lower average default rate (2.2%) compared to private borrowers (3.6%). This means that subnational governments were more likely to repay their loans than private companies over this period. Yet cities continue to be underestimated by investors, banks, and ratings agencies.

In countries where subnational borrowing is permitted, cities are often required to obtain sovereign guarantees for debt transactions. This provides lenders with assurance that the national government will step in and repay the debt in case of default. However, sovereign guarantees are an unreliable tool for cities to secure capital. Rigid fiscal frameworks make obtaining these guarantees a slow and bureaucratic process, causing significant delays for cities. Moreover, national governments may withhold or deny guarantees due to differing political priorities or a lack of understanding of municipal infrastructure needs.

Credit Guarantees Overview

Credit guarantees have the potential to address some of the core financing challenges that cities face today. But first, what is a credit guarantee? Put simply, a credit guarantee is a "promise to pay" (GCF 2022). More specifically, a credit guarantee is a commitment by a guarantor to repay a debt on behalf of a borrower in the event

that the borrower cannot fulfill its debt obligations.

Guarantees provide an added layer of downside protection to lenders, encouraging investment in sectors and geographies that may traditionally be viewed as too risky. Guarantees generally enable borrowers to access debt on more affordable terms—as guaranteed transactions generally have lower interest rates and, in some cases, longer tenors.

Guarantee funds are neither borrowers nor lenders. So, what role do they play in infrastructure transactions? Guarantee funds play the role of *facilitator* in infrastructure projects. By providing credit enhancement, guarantee funds facilitate investment in projects that may not otherwise reach financial close.

Credit Guarantees within the Climate Finance Landscape

Climate finance involves a diverse array of investors from both the public and private sectors. Guarantees currently play a relatively insignificant role in the climate finance sector which is dominated by loans, equities, and grants. Public contributors include governments, national and multilateral development finance institutions, multilateral climate funds, state-owned enterprises, and state-owned financial institutions. On the private side, commercial banks, corporations, households, or individual investors play significant roles. Today, climate finance flows exceed US$ 1 trillion annually (Buchner et al. 2023).

It is well known that there is not nearly enough public capital available to achieve the objectives set out in the Sustainable Development Goals (SDGs), which has drawn attention to the

topic of expanding private investment in climate solutions (UN 2023). Research by the Blended Finance Task Force (BFTF) highlighted that credit guarantees are both highly effective at mobilizing private capital for climate projects and underutilized by development finance institutions, such as the World Bank. Their findings showed that MDBs currently mobilize just 30 cents of private investment for every dollar of loans allocated to climate projects—a capital mobilization ratio of 0.3 (Neunuebel et al. 2021). By contrast, between 2012 and 2018, climate-focused guarantees provided by MDBs had a capital mobilization ratio of 1.5, which is 5 times higher than that of loans. By expanding the share of guarantees within their climate portfolios, MDBs may be able to dramatically expand the amount of private investment they crowd in for climate projects.

Recently, climate-oriented guarantee funds have emerged to address environmental challenges. GuarantCo, founded in 2005 in partnership with the UK Foreign Commonwealth Development Office (FCDO), has issued US$ 1.9 billion in guarantees for sustainable infrastructure in Africa and Asia.[2] The Green Guarantee Company (GGC), launched in 2024, is a US$ 1 billion fund, and the first emerging markets climate-focused guarantor with backing from the Green Climate Fund and several governments.

Furthermore, there's evidence that credit guarantees may be able to stimulate the growth of municipal debt markets. In the United States, credit guarantees/insurance were highly correlated to the growth of what is today a US$ 4.1 trillion market (GlobeNewswire 2023). In the developing world, no country has a municipal debt market near the size or sophistication of the United States. However,

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2. See more at: https://guarantco.com/.

several countries across Latin America and the Caribbean, Africa, and Asia, have growing subnational debt markets that have not reached their full potential (Smoke 2019). Introducing cities-focused guarantee funds to these countries could directly support the growth of subnational debt markets, enabling more cities to access finance for critical infrastructure.

There are important city-focused guarantee initiatives now in the early stages of implementation. The UN Capital Development Fund (UNCDF) is launching its Guarantee Facility for Sustainable Cities, with a strategic focus on Africa and Southeast Asia, while the French Development Agency (AFD) has established Cityriz, a guarantor for local governments in Africa. Both facilities are in the process of deploying their first guarantees. The Green Cities Guarantee Fund aims to complement these and other significant efforts in addressing the financial challenges cities face across various regions of the world.

The Green Cities Guarantee Fund and its Potential

The proposed Green Cities Guarantee Fund (GCGF) seeks to address some of the key urban financing challenges. The GCGF would act as an intermediary between lenders and cities, incentivizing lenders to provide loans to cities that may lack a history of creditworthiness. For cities, these guarantees could improve their credit ratings, reduce borrowing costs, extend loan and bond terms, and broaden access to investors. This Fund would be flexible in its mandate and designed to support a range of green projects through various debt instruments available to cities, associated entities, and the private sector.

The potential of the GCGF is significant. It could boost local debt markets, increase municipal participation in global capital markets, foster public-private partnerships, and attract private investment in urban infrastructure. The GCGF could support diverse markets and investors, strengthening the urban climate finance sector in general.

Similarly, the GCGF can demonstrate the viability of local banks lending to cities on a commercial basis. In some emerging markets, domestic commercial lending to local governments is already common, as local banks recognize the potential in financing cities. However, in most countries, commercial banks either perceive cities as too risky or cities are restricted from accessing commercial capital altogether.

The GCGF could also help cities tap global bond markets, which are largely dominated by hard currency transactions. These transactions, while protective for lenders, pose risks for cities that generate revenue in local currencies, exposing them to exchange rate fluctuations. The GCGF could mitigate these risks by structuring guarantees in partnership with platforms that help hedge currency risk and assisting cities in accessing grants to cover hedging fees. The ability to borrow in local currency is crucial for mayors in many countries, particularly in developing nations. The GCGF would have the flexibility to support operations in either hard or local currency, tailored to the specific context of each project. GuarantCo's successful implementation of local currency guarantees across Africa and Asia illustrates the viability of this model.

In addition, the GCGF could help cities navigate Green, Social, and Sustainable (GSS) bond issuances. With GSS bonds becoming a US$ 1 trillion market, dominated by the US, Europe, and China,

there is significant opportunity for cities in emerging markets to participate. However, municipal issuance remains rare, comprising less than 1% of the market in 2023 (World Bank 2024). The GCGF could help cities overcome barriers to issuing GSS bonds by offering support in structuring deals, ensuring compliance, and managing reporting requirements.

Some cities have developed essential urban infrastructure through publicly owned utility companies or Special Purpose Vehicles—SPVs. This approach is particularly beneficial for cities that are legally unable to borrow or struggle to obtain the sovereign guarantees required to access financing. For instance, in 2017, the French Development Agency (AFD) provided a US$70 million loan to Quito's Water and Sanitation Municipal Company for a key water supply and sustainable treatment project that serves over 500,000 residents. The company's strong financial standing allowed it to secure this financing without the need for a sovereign guarantee—the first time this has occurred in Ecuador—since the legal requirement for such a guarantee only applies to credit operations conducted directly by the city. The GCGF could play a key role in supporting similar initiatives by mitigating risks for investments in projects developed by utilities or SPVs, solidifying these models as effective solutions for expanding climate-resilient urban infrastructure.

The funding supports critical infrastructure projects, including the Chalpi Grande-Papallacta project, which aims to capture 2.2 cubic meters per second of water from the Chalpi Grande River and its tributaries. This will secure Quito's water supply until 2040, benefiting over 500,000 residents. The loan also finances the expansion of the Paluguillo Water Treatment Plant and the construction of the Paluguillo-Parroquias Orientales Transmission

Line to deliver treated water to parishes in eastern Quito. A notable aspect of the project is the installation of a 7.6 MW hydropower plant, designed to optimize water resource management and contribute to the project's overall financing

One way to provide subnational governments with access to capital is through public-private partnerships (PPPs), where subnational governments are shareholders in a company or project. Private sector ownership and involvement in municipal infrastructure projects can generate greater investor confidence. In countries with underdeveloped subnational debt markets, municipal PPPs could be a key channel through which cities can access greater capital for mitigation and adaptation infrastructure. The GCGF could provide credit guarantees for green, municipal PPPs, and also provide technical assistance to cities structuring PPPs.

Besides supporting municipal debt and public-private partnerships, the GCGF can also provide guarantees for private sector-led urban infrastructure projects, such as water systems, energy, waste collection, and public transit, among others. In many countries, private companies can secure the right to develop projects through concessions awarded by municipalities to design, build, and operate public infrastructure. The GCGF could support these companies in raising funds through domestic or international capital markets. A notable example of such a private sector guarantee is GuarantCo's US$ 25 million guarantee for the Lagos Free Zone in Nigeria.[3] This enabled a US$ 65.5 million bond issuance, facilitating the development of the country's largest port-based economic zone, which has attracted US$ 2.5 billion in private investment to the Lagos metropolitan area.

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3. See more at: https://guarantco.com/our-portfolio/lagos-free-zone-company/.

Next Steps: Operationalizing the Green Cities Guarantee Fund

The first step in moving the GCGF from a concept to an operating fund is defining its structure and governance framework, capitalization model, and hosting institution. Crafting a robust and sustainable business model is also key. As a hybrid entity combining insurance and development finance functions, the GCGF's goal is to be self-sustaining, drawing revenue from guarantee premiums and returns on its assets. The next phase will focus on conducting comprehensive technical studies to refine these critical elements.

In this context, the Commission Secretariat conducted preliminary analyses of regions, countries, and sectors to guide a market study for the Green Cities Guarantee Fund (GCGF). The analysis considered urbanization rates, infrastructure gaps, subnational funding, and enabling environments. It also examined the availability of public development assets and the geographic distribution of existing guarantee funds, noting that Latin America holds just 4% of the world's guarantee funds. Based on this research, the Secretariat has identified Latin America and the Caribbean as a high-potential region for the Fund's initial pilot phase, with plans to expand globally in the future.

The Secretariat also briefly reviewed the specific types of urban infrastructure projects of interest to the GCGF. They are public transport, energy, water and sanitation, local public infrastructure, waste treatment and disposal, nature-based solutions, and climate disaster risk management. Moving forward, the market study needs to develop performance and risk profiles for these sectors. It should also identify the public or private entities that are responsible for them in each selected country, as national governments can take very different approaches to infrastructure financing and

development (Almeida et al. 2022).

In addition to backing up infrastructure projects, the GCGF could also offer flexibility in supporting institutional financing aimed at strengthening municipal governance, enhancing planning and procurement processes, and building operational capacities for the implementation of climate initiatives. A prime example of the type of operations that could be guaranteed by the GCGF is the AFD's US$ 120 million credit to the city of Barranquilla in 2020. This financing supported the implementation of the City's Development Plan, focusing on sustainability, climate adaptation, biodiversity conservation, and social inclusion. Notably, this marked AFD's first local currency operation in Latin America, underscoring the potential impact of such initiatives on urban development in the region.

One major question that investors, bankers, lawyers, and other stakeholders who may be unfamiliar with the urban climate finance space ask is—do cities want this? To further build a case for the GCGF, the Commission Secretariat will seek to establish a pipeline of cities that are actively raising green financing and receptive to working with the GCGF. This stage will involve engaging with city leaders who want to develop climate mitigation and adaptation infrastructure in their cities. This process is expected to unveil the strong enthusiasm from city leaders throughout the developing world who are ready and willing to take bold climate action and seek innovative finance mechanisms to do so.

Additionally, partnering with a wide range of organizations will be instrumental to the successful launch and operations of the GCGF. The GCGF is a unique vehicle in that it combines elements of municipality, climate, and development finance. Cities, national

governments, civil society organizations, development finance institutions, climate funds, investment banks, ratings agencies, institutional investors, urban finance consultants, law firms, and more will collectively form a network of partners with the GCGF.

Momentum for the Creation of the Green Cities Guarantee Fund

Global efforts to increase climate finance for cities have gained significant momentum. In 2023, the UAE COP Presidency and Bloomberg Philanthropies hosted at COP 28 the Local Climate Action Summit, the first event of its kind, focusing on local-level climate finance and energy transition. The creation of the Coalition for High Ambition Multilevel Partnership (CHAMP) initiative, endorsed by over 70 nations, aims to integrate subnational governments into the development of the next Nationally Determined Contributions (NDCs), potentially expanding cities' access to climate finance.

Some DFIs are also playing a significant role. The European Bank for Reconstruction and Development's (EBRD) Green Cities program has mobilized more than US$ 5 billion in investments across 50 cities, while the City Climate Finance Gap Fund, managed by the World Bank and European Investment Bank, has provided technical assistance to 183 cities in 67 countries since its launch in 2020.[4] CAF, the Development Bank for Latin America and the Caribbean, has made significant strides in expanding its support for subnational governments. In recent years, CAF pledged

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4. To know more about the ERBD Green Cities program, see it here: https://ebrdgreencities.com/green-cities/about/. For the EU Guarantee program, see the InvestEU Green Cities Framework: https://investeu.europa.eu/investeu-operations-0/investeu-operations-list/investeu-green-cities-framework_en. And, finally, for the Green Climate Fund financing, see more at: https://www.citygapfund.org/.

a substantial portion of its capital towards lending to subnational entities, such as municipal governments and local projects, through innovative financial mechanisms, some of which do not require a sovereign guarantee (CAF 2022).

Relevant international players, such as the OECD and UN-Habitat, offer critical data and policy support, helping cities navigate climate finance. City networks like C40, ICLEI, GCoM, and the Resilience Cities Network are at the forefront of pushing for more financing for urban climate projects.

The proposed GCGF, along with other city guarantee mechanisms currently being established, represents a timely and strategic initiative. This effort has the potential to significantly enhance financial flows toward the development of climate-resilient urban infrastructure.

The GCGF does not aim to be a universal solution to urban financing challenges. Its impact will not extend to every city, nor will it support every project. A guarantee, by nature, cannot transform a poorly designed project into a successful one; only projects with solid foundations are eligible. However, the GCGF holds the potential to substantially enhance the urban climate finance landscape, emerging as one of several critical tools needed to address the growing demand for sustainable urban infrastructure solutions.

The GCGF is designed to address the green financing needs of cities across diverse geographies and regulatory frameworks. In countries where cities are legally permitted to borrow without the need for a sovereign guarantee, the GCGF can help local governments access debt more affordably. In countries that require sovereign guarantees

for subnational borrowing, or where cities are legally unable to borrow directly, the GCGF can facilitate urban infrastructure development by channeling capital to municipal utility companies, Special Purpose Vehicles, and the private sector.

In nations where sovereign guarantees are optional, the GCGF may serve as an alternative mechanism. In cases where cities and municipal public entities are completely prohibited from accessing capital markets, the GCGF shifts focus to supporting the private sector in securing finance for critical mitigation and adaptation infrastructure projects. This adaptability would enable the GCGF to benefit a large number of cities by customizing its approach based on local regulatory environments. Its focus in urban finance allows the GCGF to deliver innovative subnational financing solutions tailored to different needs and challenges in countries.

The GCGF is envisioned as an entity specialized in addressing the distinct dynamics of cities, including the political cycles and administrative timelines of municipalities, which often differ significantly from those of national governments. Urban projects also come with their own set of complexities, making tailored financial solutions essential. By specializing in urban challenges, the GCGF can serve as a pivotal mechanism to meet the growing financial needs of cities and respond effectively to the increasing pressures faced by urban areas. This specialization positions the GCGF as a relevant player in advancing urban development in a meaningful and targeted manner.

The time for action is now. Cities can no longer afford to fall short of their climate ambitions due to the constraints of an outdated financial system. To meet the urgency of the climate crisis, we must seize the current momentum in urban climate finance and

develop innovative financial tools. These tools will empower cities to become pivotal leaders in the global fight against climate change, enabling them to implement bold and impactful strategies that are crucial for the planet's future.

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4.

Climate Change Perceptions in the Urban Global South and Its Implications

Yoon Jae Ro, Seungho Lee and Munsu Kang

Climate change presents one of the most pressing challenges for urban areas in the Global South nowadays, with profound implications for their inhabitants across multiple dimensions. The rapid urbanization occurring in the Global South intensifies these impacts, creating a unique context where climate change and urbanization intersect. Against this backdrop, understanding how urban residents in the Global South perceive climate change becomes increasingly important, as their perceptions offer critical insights into the multi-domain challenges of climate change.

Densely populated cities in the Global South contribute significantly to global CO_2 emissions. They also serve as hot spots of vulnerability to climate change, given the scarcity of essential resources, resilient infrastructure, housing, and economic opportunities. Rural-to-urban and cross-border migration adds another layer of complexity

to their sustainable mitigation and adaptation efforts. All in all, these dynamics position urban populations in the Global South at the forefront of global efforts to combat climate change (Hunt and Watkiss 2011; Okaka et al. 2018).

In this chapter, we focus on the perceptions of climate change among urban residents in eight major countries across the Global South. Specifically, we begin by offering an overview of the extent to which individuals are concerned about climate change and their beliefs regarding its origins. We then provide a picture of how individuals perceive the potential impacts of climate change on key aspects of their daily lives, including health, employment opportunities, family planning, and outmigration intentions. Special emphasis is placed on understanding how a set of climate-related factors influence their intentions to migrate out of urban areas. Despite the significant challenges posed by climate change in urban areas of the Global South, relatively less scholarly attention has been paid to urban dwellers' perceptions of climate change consequences directly relevant to everyday urban lives in the Global South context and the underlying factors driving their perceptions.

The study of public perceptions of climate change has recently gained significant traction. Numerous studies have explored climate change perception based on primary surveys at the individual level, investigating to what extent individuals are knowledgeable about climate change (Whitmarsh 2011; Bliuc et al. 2015; Lee et al. 2015; Okaka et al. 2018; Asai et al. 2022; Dechezleprêtre et al. 2022; Barreira et al. 2023), how they assess its threats and consequences (Lee et al. 2015; Alam et al. 2017; Okaka et al. 2018; Bollettino et al. 2020; Asai 2022; Barreira et al. 2023), and what they perceive as preferred responses of governments or the international community

to climate change in terms of mitigation and adaptation (Asai et al. 2022; Dechezleprêtre et al. 2022; Barreira et al. 2023; Dabla-Norris et al. 2023).

While these studies offer valuable insights through within-country analysis in both Global North (Whitmarsh et al. 2011; Bliuc et al. 2015; Barreira et al. 2023) and Global South contexts (Alam et al. 2017; Okaka et al. 2018; Bollettino et al. 2020), as well as cross-country comparisons (Lee et al. 2015; Asai et al. 2022; Dabla-Norris et al. 2023), notably less research has been conducted on cross-country analysis of climate change perceptions in countries in the Global South, and even more scarcely on comparing urban citizens' perceptions of climate change across these countries.

We seek to fill this research gap by exploring how urban dwellers in the Global South perceive climate change consequences across several critical domains. While some studies have specifically addressed urban perceptions of climate change in both Global North and South contexts (Madureira et al. 2018; Okaka et al. 2018), few have focused on how urban residents in the Global South perceive the potential impacts of climate change on their daily lives. The areas of our focus—health, family planning, and outmigration decisions—are among the most important aspects of their everyday experiences. Understanding how urban citizens perceive climate change's potential effects on these domains is therefore essential for effective policymaking and urban planning. Such insights can inform the development of city-level climate mitigation and adaptation strategies tailored to meet the needs and concerns of urban populations.

Among the various domains affected by climate change, health consequences have received substantial attention. Previous studies

have documented how climate change affects human health through direct and indirect mechanisms (Costello et al. 2009; Maibach et al. 2015; Watts et al. 2015). While research shows growing public concern about climate-related health risks in urban areas (Watts et al. 2015), only a few studies investigate the extent to which individuals attribute health problems to climate change within selected countries (Akerlof et al. 2010; Maibach et al. 2015; Casson et al. 2023).

There is also a growing body of literature examining the impact of climate change and the economic restructuring associated with climate change mitigation and adaptation (Martinez-Fernandez 2010; ILO 2018). However, relatively little scholarly attention has been devoted to understanding how individuals associate climate change with their job security, despite the theoretical expectation that climate change and related economic shifts could exacerbate job insecurity. Bui et al. (2024) is one of the few works that links climate change to perceptions of job insecurity among individuals in Australia. However, research on how urban residents in the Global South perceive the ways in which climate change is reshaping their employment opportunities remains scarce, highlighting a significant gap in the literature.

There is also evidence that people are increasingly connecting climate change concerns to their reproductive intentions (Schneider-Mayerson & Leong 2020) and actual reproductive choices (Ghimire and Mohai 2006). However, empirical evidence about the relationship between concerns about climate change and individual fertility intentions and choices remains scarce. Only a limited number of studies (Arnocky et al. 2012; De Rose and Testa 2015; Schneider-Mayerson and Leong 2020) investigate perceptions about climate impacts that children will experience or

concerns about the carbon footprint of procreation, mainly within the context of developed countries.

The final area of focus in this chapter examines the relationship between climate change and migration decisions, encompassing both the choice to migrate and the willingness to accept migrants from other regions. As urban residents in the Global South become increasingly vulnerable to the compounded effects of climate-induced events, dense populations, inadequate infrastructure, and migration flows, it has become crucial to examine whether climate change has emerged as a significant factor influencing their intentions to migrate out of these areas. While climate-induced migration intentions and behaviors destined for urban areas are extensively documented in the Global North and South contexts (Thiede et al. 2016; Sedova and Kalkuhl 2020; Clement et al. 2021; McLean and Brahim 2023), research on how urban dwellers in the Global South associate climate change with their intentions to out-migrate remains limited.

By investigating urban inhabitants' perceptions of potential climate change impacts across interconnected domains—health, employment opportunities, family planning, and outmigration—and their associations with general perceptions of climate change and climate-related experiences, this chapter provides a comprehensive framework for understanding how climate change permeates various aspects of urban lives in the Global South.

Perceptions of Climate Change and Its Daily Life Impacts

As climate change intensifies, urban residents in developing countries face heightened vulnerability. Rapid urbanization has led

to densely populated cities with inadequate infrastructure to manage environmental challenges. As a result, climate change increasingly influences daily life, impacting health, jobs, residence, and family planning decisions. We now delve into how urban dwellers in major cities in eight countries across Africa, Latin America, Southeast Asia, and South Asia perceive climate change and how they anticipate its effects on their lives. The results, gathered from our survey conducted in early 2024, paint a picture of rising concern and a growing recognition of climate change's pervasive impact on everyday existence.[1]

The survey details are described in Ro et al. (2024). It explores the factors influencing variations in urban residents' attitudes toward climate change. Conducted online between January and February 2024 in both English and local languages, the survey sampled residents aged 18 and older, gathering responses from 3,243 individuals, with a minimum of 400 participants per country. The internationally comparable results allow for comprehensive regional and country-specific analyses, offering valuable insights into the perceptions of urban residents in developing countries regarding climate change.

Table 1 presents key findings that highlight the levels of concern and beliefs regarding the causes and impacts of climate change. Across the eight countries surveyed, an overwhelming majority of respondents expressed concern about the future of the planet due to climate change. People are worried about the abstract, global

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1. The survey details are described in Ro et al. (2024). It explores the factors influencing variations in urban residents' attitudes toward climate change. Conducted online between January and February 2024 in both English and local languages, the survey sampled residents aged 18 and older, gathering responses from 3,243 individuals, with a minimum of 400 participants per country. The internationally comparable results allow for comprehensive regional and country-specific analyses, offering valuable insights into the perceptions of urban residents in developing countries regarding climate change.

consequences, and how these changes will directly affect them, their families, and their livelihoods.

	Country							
	Indonesia	Vietnam	Bangladesh	India	Colombia	Peru	Kenya	Morocco
% who express concern about global climate change	86%	74%	78%	81%	81%	75%	81%	80%
% who think climate change is caused by human activity	97%	95%	98%	98%	92%	92%	98%	89%
% who believe urban communities face greater challenges	81%	69%	62%	75%	35%	43%	51%	40%
Climate Change Threat	49%	46%	37%	39%	20%	19%	30%	44%
Health	69%	68%	72%	76%	72%	68%	74%	69%
Job	45%	50%	56%	48%	51%	49%	57%	42%
Income	40%	47%	52%	48%	43%	46%	56%	40%
Moving	21%	28%	24%	38%	22%	19%	21%	20%
Family Plan	30%	32%	35%	44%	23%	22%	33%	21%

Table 1. Climate Change Risk Concerns and Perceptions of Daily Life Impacts.[2]

2. Note: To calculate percentages, we converted the original 5-point scale responses into a binary format. For the question "How concerned are you about global climate change?" responses of 4 ("Worried") and 5 ("Extremely Worried') are considered as expressing concern. Similarly, binary responses were used for the questions: "Do you believe that human activity is a significant cause of climate change?" and "Which type of community—urban or rural—faces greater challenges in terms of livability due to the effects of climate change?" Respondents are also categorized based on their answers to the question: "What is the greatest threat to your country in the next five years?" Responses are grouped into six categories: climate change, humanitarian issues, unemployment, conflict, infectious diseases, and high inflation. The percentage of respondents who identified climate change as the greatest threat was calculated. In addition, responses to five key questions, each originally rated on a 5-point scale (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree), were dichotomized. Responses of "Agree" and "Strongly Agree" are calculated as a percentage of those in agreement: 1. To what extent do you believe climate change will negatively impact your health? 2. How much do you think climate change will affect your job over the next five years? 3. To what extent do you expect climate change to negatively influence your income in the next five years? 4. Have you considered relocating due to concerns about climate change? 5. Have you thought about altering your family plans because of climate change concerns?

One of the core questions posed in our survey asked: How concerned are you about global climate change? The responses, which ranged from "not worried at all" to "extremely worried," revealed a deep-seated anxiety, with a significant portion of the population rating themselves as either "worried" or "extremely worried." In Indonesia, for instance, 86% of respondents expressed this level of concern, while a similarly high proportion was found in India, Colombia, and Kenya, with 81% of respondents feeling the same way. Urban residents, it seems, are acutely aware that climate change is not a distant, future problem—it is something that has already begun to shape their environment.

Another notable survey aspect was the widespread belief that human activity is a significant cause of climate change. Despite differences in education and socio-economic status, a remarkable 97% or more of respondents in countries like Indonesia, Bangladesh, India, and Kenya agreed that human actions—such as industrial pollution, deforestation, and overconsumption of resources—are driving the planet's ecological instability. This level of consensus highlights how ingrained the concept of anthropogenic climate change has become in the global consciousness, even in developing countries. It reflects a growing awareness that the actions of humanity have led to the crisis, and perhaps more importantly, it hints at the potential for public support for measures aimed at reducing carbon emissions and protecting the environment.

Opinions were more divided when asked whether urban or rural areas face greater challenges due to climate change. Some respondents saw rural areas—often dependent on agriculture and more vulnerable to climate shocks like droughts and floods—as the most affected. Yet, a considerable number of urban dwellers pointed

to the unique challenges that cities face: overcrowding, pollution, heat waves, and deteriorating infrastructure. In cities like Jakarta and Mumbai, the population density makes adapting to climate change particularly difficult, with a staggering 81% of Indonesians and 75% of Indians believing that urban areas are more challenged than their rural counterparts. This perception is likely influenced by the lived realities of city life. Urban residents often experience the effects of climate change in concentrated, acute ways, from frequent water shortages to heightened health risks due to pollution and heat.

While climate change is often framed as a global problem, the survey revealed how it is perceived as a very local threat. When asked about the greatest threat to their country over the next five years, many respondents identified climate change, placing it above other pressing concerns such as unemployment, inflation, and conflict. In countries like Indonesia and Morocco, nearly half of the population (49% and 44%, respectively) saw climate change as the most significant challenge facing their nation. This indicates that, for many urban dwellers, climate change is not just an environmental issue—it is a social and economic one, likely to influence everything from food security to job opportunities.

Beyond abstract concerns, the survey also examined how urban residents perceive the direct impacts of climate change on their daily lives. Five key questions were posed to capture this, asking to what extent respondents believed climate change would affect their health, jobs, income, migration decisions, and family planning.

Health was consistently identified as an area of vulnerability. In India and Bangladesh, for example, over 70% of respondents anticipated that climate change would negatively impact their health. These fears are not unfounded; rising temperatures, poor air quality, and

the increased spread of diseases are all linked to climate change.

Jobs and incomes were also areas of concern. In Kenya and Bangladesh, more than half of the respondents expected climate change to affect their employment opportunities in the next five years. Urban workers, particularly those in informal sectors or agriculture-dependent industries, feared that climate-related risks could threaten their livelihoods. Similar worries were shared across Vietnam, India, Peru, and Colombia, where climate-related disruptions to key industries like agriculture and tourism are becoming more frequent.

Perhaps most striking were the findings related to migration and family planning. A significant number of urban residents have begun to reconsider their future plans in light of climate change. In India, for instance, 38% of respondents admitted that they had considered relocating due to climate-related concerns, while in Bangladesh and Vietnam, nearly a third of respondents expressed similar sentiments. Family planning decisions were also influenced, particularly in Southeast Asia, where environmental instability prompted many to reassess their choices. Notably, 44% of Indians and 35% of Bangladeshis had reconsidered family planning due to concerns about future climate conditions.

Climate Concerns as a Driver of Migration Decisions

As urban residents increasingly recognize the tangible impacts of climate change on their daily lives, these concerns begin to influence critical decisions—whether to migrate, adapt, or support policy measures aimed at climate change mitigation and adaptation. The survey findings in the following chapter explore how these concerns

translate into migration decisions. Results from Table 2 reveal a clear pattern, with many of these factors showing a positive correlation with a higher likelihood of migration driven by climate concerns.

Country							
Indonesia	Vietnam	Bangladesh	India	Colombia	Peru	Kenya	Morocco
Worried 0.12	0.10	0.06	0.07	0.06	0.12	0.06	0.05
Human Activity -0.08	0.19	0.02	0.26	0.13	0.01	0.10	0.10
Urban more challenged -0.02	0.07	-0.01	0.15	0.09	0.05	0.02	0.12
Climate Change Threat 0.00	0.11	-0.02	0.07	0.11	0.10	-0.04	-0.02
Health 0.10	0.14	0.10	0.12	0.11	0.08	0.09	0.07
Job 0.15	0.16	0.11	0.20	0.11	0.08	0.05	0.09
Income 0.14	0.16	0.10	0.19	0.10	0.08	0.07	0.09
Family Plan 0.18	0.22	0.16	0.20	0.17	0.17	0.17	0.16
Drought -0.04	0.14	0.01	0.22	0.03	0.12	0.04	0.05
Flood 0.10	0.11	-0.01	0.16	0.02	0.06	0.05	0.12
Sea level 0.07	0.10	-0.01	0.20	0.07	0.05	0.06	-0.01
Landslide 0.04	0.13	0.02	0.19	0.02	0.02	0.10	0.04
Wildfire 0.08	0.15	0.11	0.22	0.06	0.07	0.11	-0.00
Heatwave -0.02	-0.00	0.01	-0.02	-0.01	-0.08	0.03	-0.00
Storms 0.04	0.03	-0.01	0.03	0.05	0.10	0.14	0.09

Table 2. Correlation Between Climate-related Factors and Migration Decisions.[3]

3. Note: Each number represents the regression coefficient of a factor influencing migration decisions. We interpret this as a correlation between the two variables.

Individuals who express deep concern about climate change and its impacts are more inclined to view migration as a potential solution. For example, respondents from Indonesia, Vietnam, and Peru who were particularly worried about climate change were more likely to consider relocation. Similarly, those who perceive climate change as a significant threat to their country—especially in Colombia and Vietnam—tend to lean toward migration. While many believe human activity is the root cause of climate change, this belief alone did not correlate as strongly with migration decisions as other factors.

Urban residents who see cities as more vulnerable than rural areas are also more likely to consider moving, as seen in India, Colombia, and Morocco. In these countries, urban centers face frequent environmental challenges, such as heatwaves, water shortages, and pollution, making it increasingly difficult for residents to adapt to life in the city under the mounting pressure of climate change.

Health risks and economic instability emerge as powerful drivers of migration as well. Across all countries surveyed, those who believe climate change will harm their health are significantly more likely to consider relocating. Economic fears—particularly concerns over job loss and declining income—are similarly linked to migration decisions. Family planning decisions are also intertwined with these concerns. This is unsurprising, given that the surveyed countries rely heavily on climate-sensitive industries like agriculture and informal labor, with many respondents expressing uncertainty about their long-term economic prospects.

Direct experiences with climate-related disasters strongly predict migration. Individuals affected by droughts, floods, and other extreme weather events show a significantly higher likelihood of relocating, with India and Vietnam showing particularly strong

correlations between such experiences and migration decisions. In India, droughts and wildfires are among the most powerful drivers, though floods, landslides, and sea-level rise also contribute. Similarly, in Vietnam, those who have faced drought, sea-level rise, wildfires, and landslides are much more likely to consider migration. These findings highlight the growing realization that remaining in climate-vulnerable areas is becoming increasingly untenable for many urban residents.

Interestingly, the experience of heatwaves and storms did not show as strong of a correlation with migration intentions. Heatwaves did not significantly affect people's decisions to migrate, possibly because they have already developed adaptation mechanisms for dealing with extreme temperatures.

The correlation between migration and climate-related factors varies significantly across the surveyed countries, highlighting the complexity of how climate change shapes individual decisions. These variations underscore that, while climate change is a global issue, its impacts—and people's responses—are deeply shaped by local contexts and personal experiences.

Attitude towards Climate Change-Related Government Policy and Implications

The survey highlights key areas of concern for urban residents in the Global South, including health risks, economic instability, and migration pressures. Government policies must be tailored to address these specific vulnerabilities. For instance, improving public health infrastructure, particularly in cities, will be critical to managing climate-related health risks. Additionally, investments in

climate-resilient industries can help mitigate economic instability, while policies that facilitate safe migration pathways should be prioritized in areas facing extreme weather events.

As climate-related migration rises, it is essential to improve infrastructure in urban areas to accommodate newcomers, while also supporting rural resilience through financial aid for farmers and climate-sensitive industries. This chapter explores urban residents' support for policies that benefit urban and rural communities, using survey data on their attitudes toward various initiatives.

Findings in Table 3 indicate strong support for financial assistance to rural farmers, with over 70% of respondents from Indonesia, India, Colombia, and Kenya in favor, reflecting urban residents' ties to rural areas and awareness of farmers' vulnerabilities. Another survey question further emphasizes this trend by asking participants to identify priority sectors for international cooperation, as shown in Table 4. Respondents were allowed to select up to three options, and the majority prioritized support for the agriculture, fishery, and forestry sectors. This consensus across eight countries underscores the significance of these sectors to their economies and livelihoods.

Gov't Policy	Country							
	Indonesia	Vietnam	Bangladesh	India	Colombia	Peru	Kenya	Morocco
Provides financial support to rural farmers								
Do not support	4%	15%	15%	8%	9%	22%	4%	20%
Neutral	23%	30%	15%	15%	15%	22%	6%	20%
Support	73%	55%	69%	77%	76%	56%	89%	60%
Provides subsidies to rural people to relocate to your local area								
Do not support	52%	25%	32%	16%	35%	40%	39%	42%
Neutral	22%	32%	28%	20%	24%	31%	27%	32%
Support	26%	43%	40%	64%	41%	30%	35%	26%
Improves vulnerable urban infrastructure								
Do not support	12%	15%	26%	14%	12%	17%	8%	18%
Neutral	32%	31%	21%	21%	20%	23%	13%	25%
Support	57%	54%	53%	65%	67%	60%	79%	58%
Improves urban public services such as health and education								
Do not support	3%	10%	17%	3%	11%	16%	5%	18%
Neutral	13%	24%	19%	15%	13%	14%	6%	17%
Support	84%	66%	64%	81%	77%	71%	89%	65%
Builds new coal-fired power plants								
Do not support	43%	49%	42%	34%	43%	40%	44%	48%
Neutral	21%	27%	22%	21%	27%	25%	17%	28%
Support	36%	25%	36%	45%	30%	35%	39%	24%
# of respondents	428	401	402	405	402	400	408	410

Table 3. Preferences for Government Policies on Climate Change.

However, urban residents, except in India, largely oppose government policies that subsidize the relocation of rural populations to cities, fearing increased congestion and resource

scarcity. This suggests that policies affecting quality of life may face resistance. In contrast, over 60% of respondents favored improvements in public services, particularly in Indonesia and Kenya, indicating a preference for policies with direct daily impacts.

Moreover, the findings indicate a strong desire for international cooperation in public health and sanitation, especially regarding climate change adaptation (see Table 4). These results imply that urban residents are more likely to support policies perceived as directly beneficial to their lives. Their concerns about the immediate impacts of climate change further suggest a greater receptiveness to tangible solutions, which may explain the lower support for urban infrastructure improvement initiatives, despite their essential role in addressing climate-related risks.

Priority Sector	Indonesia	Vietnam	Bangladesh	India	Colombia	Peru	Kenya	Morocco
Support for agriculture, fishery, and forestry	65%	47%	69%	48%	53%	52%	79%	51%
Support for vulnerable group	12%	21%	16%	19%	21%	23%	13%	21%
Public health and sanitation	47%	62%	49%	48%	39%	47%	41%	35%
Education	24%	26%	37%	38%	33%	41%	36%	34%
Clean water	41%	41%	23%	44%	39%	28%	27%	42%
Clean energy	52%	52%	21%	38%	44%	27%	52%	50%
Green city	44%	25%	38%	44%	32%	31%	26%	28%

Table 4. Priority Sectors for International Cooperation.[4]

4. Note: Respondents are supposed to select up to three (3) alternatives among sectors provided in the questionnaire.

Finally, respondents opposed new coal-fired power plants, highlighting a preference for climate change mitigation measures and support for clean energy initiatives, particularly in Southeast Asia and Africa.

Conclusion

As climate change intensifies, urban residents in developing countries face significant challenges that shape their daily lives. Our survey reveals a widespread concern about the direct impacts of climate change on health, employment, and migration, indicating that this is not merely an abstract issue but a pressing reality for many. Respondents from eight countries demonstrate a strong awareness of the anthropogenic causes of climate change, with a consensus that human activity significantly contributes to environmental instability.

The findings highlight the dual vulnerability of urban areas, where overcrowding and inadequate infrastructure exacerbate climate-related risks. Urban residents are increasingly considering migration as a response to these threats, with health and economic stability emerging as key factors influencing their decisions. Moreover, direct experiences with climate disasters have intensified these concerns, underscoring the need for effective policy responses.

Our results also suggest that urban residents are receptive to government initiatives that address their specific vulnerabilities, particularly in health and economic sectors. Strong support for financial assistance to rural farmers and international cooperation reflects the interconnectedness of urban and rural communities. However, there is notable resistance to policies perceived as

detrimental to urban quality of life, such as subsidizing rural relocation.

In summary, the complexities of climate change require tailored approaches that prioritize the needs of urban populations. Policymakers must focus on building climate-resilient infrastructure, improving public services, and facilitating safe migration pathways. By addressing these challenges collaboratively, governments can enhance resilience and support the well-being of urban residents in the face of climate change.

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5.

Cognitive and Smart Cities:
A New Perspective

**Hazem Galal, Rajat Chowdhary, Mounir Kabbara
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In 2007, a historic urban milestone was reached, for the first time, as half of the global population lived in cities. Since then, the world's urban population continues to grow, existing cities expand, and new cities are born. This accelerated urbanization is reshaping the way urban environments are managed and strengthening the development of citizen-focused sustainable models such as cognitive cities.

The concept of cognitive cities represents a pivotal juncture in our urban evolution, beyond smart cities. At the core, cognitive cities harness the power of data to transform cities into intelligent and adaptable ecosystems, furthermore, these cities are capable of managing responsive structures, optimizing resources, and making evidence-based decisions. Cognitive cities are not just technologically advanced, they are also urban spaces that enhance the well-being and livability of inhabitants by evolving with

challenging scenarios and delivering services proactively. These cities plan and operate dynamically.

Cognitive cities are not just places where new smart technologies are adopted; they are places where basic safety, security, and environmental needs are met, the economy is productive, educational attainment and knowledge thrive, and the city can maximize its performance across all its building blocks. Becoming a cognitive city demands a holistic approach that integrates data, technology, and science into urban living, resulting in targeting beneficiary needs efficiently. It is an evolutionary process that requires investments in digital infrastructure, adoption of next-generation technologies, and commitment from the public sector to continuously enhance citizen-centric digital policies.

The Benefits of Evolving into a Cognitive City

Worldwide, urban centers face the challenge of fostering economic growth while balancing social and environmental factors to remain sustainable. These challenges can vary depending on a city's socioeconomic level of development, geographical location, and context. During the past years, migration, climate change, water scarcity, and security have been listed as the most pressing issues across the globe (World Bank 2023). Therefore, finding the right solutions to address these and support the growth of proactive cities is of enormous importance.

To succeed in addressing these barriers, cities need to design and execute smart, citizen-focused initiatives that operate under the right institutional framework. For a city to commence its cognitive evolution it is essential to first assess its priorities and define its

current state within the four stages of development (Galal 2016). Once determined, cities can plan a cognitive path with key actions and required resources. The four stages of development on the cognitive journey are:

1. Rudimentary: battling to meet demand and supply.

2. Functional: meeting residents' essential needs and starting to adopt modern solutions.

3. Integrated: meeting the aspirational needs of all stakeholders and adopting a holistic approach to urban development.

4. Scalable: being ready for new challenges that emerge on the horizon and adapting quickly to address these changing scenarios.

These four scenarios demonstrate that evolving into a cognitive city encompasses much more than just technology; it aims to create a holistic ecosystem of interconnected stakeholders that contribute to creating a more livable space. The importance of evolving into a cognitive city relies on building a highly productive, adaptive area, which efficiently manages resources and proactively plans upon challenges. Moreover, the value of evolving through a cognitive path, will enhance human capabilities, streamline efforts, and improve overall quality of life.

This transformation from a passive city into a proactive one represents a significant step forward in urban development. By enabling technology and integrating it into human needs, cities will be able to provide safety and security in a manner that corresponds to advancement in technology, empower citizens to make more

informed decisions through access to data, encourage building designs that incorporate green technologies, mitigate and restore environmental impacts, become inclusive and serve everyone—from the elderly on foot to the children on bicycles and people commuting by public transit to work—, and offer the best education and health, among other transformations.

Conventional City: Passive

- Community-centered with inefficiencies in service delivery
- Unable to utilize city data
- Lack of modern digital infrastructure

Smart City: Reactive

- Semi-autonomous: Accessible city services
- Siloed data: Limited data sharing
- Adoption of smart technology and investment in digital infrastructure

Cognitive City: Proactive

- Citizen-centric: Hyper-personalized and continuously evolving
- Significant data sharing: Enabled through trust and transparency
- Ubiquitous innovation and adoption of next-gen technologies

Adapted from SDP (2023).

How Cities around the World Are Applying Cognitive Concepts

Cities are the engines of economic growth, attracting talent, creating jobs, and generating innovation. But with more people also come

more potential demands, hence, meeting the essential needs of individuals can become more challenging in urban environments.

Several cities across the world have jumped on the ambitious journey to become cognitive urban centers, where cutting-edge technology and data-driven solutions converge to enhance the quality of life, help policymakers make smarter, predictive decisions, and attract investments and resources. These cities are poised to become role models for other global spaces as they continuously adopt new-generation technologies. This urban transformation has been approached in two different ways across the world; first, as brownfield developments which involve the redesign and transformation of existing urban areas into more technological cognitive places, and second, as greenfield developments, which refer to the creation of entire cognitive cities from scratch.

When exploring model cities and real-world applications of cognitive urbanism, we find compelling examples of how cognitive principles have the potential to improve urban living and allow greater engagement with climate strategies:

Singapore

Being one of the busiest cities in the world, Singapore could build an urban landscape where people are empowered by technology. As a global digital leader, this city integrates technology into transportation systems, housing solutions, city monitoring, and other ever-evolving initiatives.

The city improved public services by persistently analyzing data to support effective planning, leading to operational cost reduction and more efficient service delivery. Some outstanding examples of this

cosmopolitan city's digital infrastructure include the Open Digital Platform, which digitalizes and centralizes district operations, and Virtual Singapore, a platform that integrates data to create 3D digital modeling with real-time input for simulations and future planning.

When talking about Singapore's environmental cognitive developments, the Digital Urban Climate Twin (DUCT) initiative comes to the stage. The DUCT is a digital representation of Singapore city that simulates scenarios to obtain climatic information (Singapore Green Plan 2023). By utilizing datasets from infrastructure, greenery, transport, and industries as input, this platform allows planners to make decisions on what-if scenarios. In cities like Singapore, where the urban heat island effect is a challenge, this tool helps policymakers to better understand the impact of new activities and to maximize climatic mitigation accordingly.

Powered by innovation, this city responds to ever-changing challenges such as mobility (utilizing real-time traffic input to manage congestion and reducing commuting times), public service delivery (developing mobile applications to provide citizens with friendly platforms to access services and information), health enhancement (implementing e-health systems for elderly to enable patients to consult with doctors remotely), and further successful examples. Overall, Singapore has succeeded in introducing a broad range of technologies that continuously improve the quality of life of its citizens (Thales 2023).

Helsinki, Finland

Helsinki has set a precedent for its efforts in converting analog information into a digital format across multiple domains, including

planning, construction, and maintenance. This advancement has allowed the city to be more proactive on high-level climatic agendas like managing traffic and using AI to monitor and forecast air quality in real-time to support citizen wellbeing.

As one-fifth of Helsinki's emissions come from traffic, the city has made significant progress in developing smart applications that encourage people to reduce their car commute and choose low-emission methods of transport. Helsinki seeks to be the most functional city in the world and has pinned its attention on developing urban technological transformations in cooperation with businesses, academia, and citizens. The current city's digital developments align with the City Strategy 2021–2025, which seeks to create a carbon-neutral Helsinki by 2030 by using diverse technological resources (My Helsinki 2024).

In summary, as stated in the Helsinki Strategy, this city aims to improve citizens' lives by digitizing services and developing smart solutions to become the most functional urban space in the world. Helsinki has already been considered a cognitive benchmark in several aspects and it is already featuring digital solutions that will improve cooperation with businesses, research institutions, and citizens (My Helsinki 2024).

NEOM, Saudi Arabia

Greenfield cities refer to new urban areas developed from scratch and the opportunity that lies for them is enormous when talking about demand planning and service delivery. These types of cities can have a significant impact on managing their population, their required resources, and the suitable environmental conditions they need to

thrive. NEOM is the world's leading example of a greenfield city.

Located in the northwest of Saudi Arabia, NEOM is being conceived as the world's first greenfield cognitive city: an urban landscape driven by technology with a future-proof design that guarantees sustainability and customized experiences for citizens. While smart cities currently hold the capacity to utilize around 1% of their data, NEOM was designed to leverage an estimated 90% of available information, which will allow it to identify people's needs, allocate resources, manage risks, predict efficiency, and oversee sustainable growth. By using autonomous technologies such as Artificial Intelligence (AI), robotics, Internet of Things (IoT), and blockchain, NEOM aims to be the most proactive city in the world (Neom The Line 2024).

NEOM has also developed the world's first AI-based platform to streamline data transfers and communication and will revolutionize how citizens live by building a digital twin with human needs at its core. A digital twin, in its simplest sense, is a linked virtual model of a physical object. By connecting the real-time data of the physical object or process into its digital representation—programmed with technological models to faithfully recreate it—the digital twin comes to life (PwC 2022). This touches base on the convergence between physical and digital domains and will help the city create simulations and predict how elements will perform. The city also uses digital services to monitor environmental systems: managing air pollution, water quality, and other indicators. By showing the world how AI can be used to create smarter, proactive cities, NEOM is creating new landscapes of cognitive urbanization.

Further examples of how cognitive technologies can revolutionize urban life in diverse sectors, fostering efficiency,

safety, and personalization, can be found across the globe. As these cities innovate, they provide insights for others on the path to cognitive transformation.

The Ecosystem Approach for Achieving Cognitive Success

As the global population continues to grow, cities face diverse challenges to deliver efficient spaces and manage resources in a sustainable manner. For a cognitive city to thrive and secure a resilient future, crucial non-technological factors like strong leadership, sound governance, financial management, and collaborative partnerships should also be addressed.

Bringing together several stakeholders to combine different perspectives, resources, and expertise to harness innovation and drive collective action is fundamental in order to secure a cognitive city transformation. The key stakeholders that play a major role in this process are policymakers, local governments, private sector and technology providers, academic institutions, citizens, and Non-Governmental Organizations (NGOs). For each stakeholder group, several key actions are required:

Regulators and Policymakers

At national, regional, and city levels, regulators and policymakers play a pivotal role in developing cognitive cities by setting unified directives that define standards, share best practices, and provide funding. Regulators have the responsibility to update and define standards and norms such as emerging technology, data management, and partnerships that can have an impact on

implementation. Furthermore, they need to provide the necessary infrastructure to allow cognitive city solutions, while facilitating funding and financing to support digital initiatives.

Cities and Local Governments

Cities need to orchestrate stakeholder cooperation by becoming demand-driven cognitive ecosystems. Regional and city governments have both a critical role in cognitive city transformation as they are responsible for defining the city's vision, strategy, and aspirations. It is vital for cities to shape a collaborative environment by engaging with relevant stakeholders with the aim of identifying problems, applying funding, and implementing cognitive solutions to deliver the services more proactively. Cities also play an important role in designing and operating enabling cross-sectoral digital platforms for data-driven and efficient evidence-based decision making.

Private Sector

The private sector needs to play a proactive role and get involved in the planning, design, and funding of cognitive city solutions. The implementation and operations of cognitive city solutions are the primary responsibility of private sector service and technology providers. Their role is to also help city governments in the conceptualization and detailing of various solutions as well as supporting the development of the cross-sectoral digital platform.

Research and Academic Institutions

As cognitive cities are an emerging trend, there is an important role

that research and academic institutions can play. They are essential to identify the latest trends and advances in emerging technologies such as Generative AI and assess their impact and viability for city solutions. Research and academic institutions can also support pilot research projects to test out innovative solutions. Finally, academic institutions can contribute to analyzing the large amount of data that a cognitive city generates to facilitate decision-making.

NGOs

A cognitive city needs to ensure technology and data work as means to improve service delivery. Thus, citizen groups and NGOs have a significant role in voicing their aspirations and identifying the challenges faced. Additionally, citizens can play an important role in engaging and providing feedback on new services being launched. This will ultimately help city governments make evidence-based decisions to ensure service demand is met.

To succeed in addressing urban challenges, multi-sector collaboration is imperative, accordingly, cities need to constantly develop smart initiatives that bolster shared benefit and mutual growth. Cognitive urban transformation can only be achieved by enabling an environment that allows stakeholders to work together effectively towards a common goal.

Conclusions

The evolution of cities from conventional to smart, and from smart to cognitive is not just a technological transformation, it is a shift from being reactive to being proactive, from predictive analysis to

perceptive analysis, and most importantly, it is meant to promote the socioeconomic development of a city equitably.

For this urban evolutionary step to take place, it is of vital importance to simultaneously strengthen non-technological factors such as leadership, governance, financing, and stakeholder collaboration. The correct management and interaction of these non-digital elements will lead to successful implementation and allow cities to respond and operate in a proactive, sustainable way.

Cognitive city transformation is a fundamental pillar for fighting climate change, as every day new technologies that support mitigation and environmental restoration emerge. In that sense, modeling scenarios to understand the impact of industrial activity, using transit management technology to reduce transport emissions, and automating waste management equipment with sensors to monitor their fill level, are just a glimpse of the technologies cities are uncovering as they transform themselves into cognitive hubs. Cognitive technologies offer an opportunity to revolutionize almost every sphere of our lives, with several use cases across the sectors, leading to a predictive and proactive urban living experience.

Urban cognitive transformation is guided by a clear framework and guiding principles for the planning and management of urban scenarios in the digital era where active participation from the community and collaboration between the public and private sectors is imperative to establish an integrated approach to the transformation process. With the multidisciplinary collaboration of city stakeholders, cognitive cities are intended to be intelligent urban environments and economic growth centers.

Cities can only achieve the vision of cognitive urban development

through a balanced integration of technological advancements and a people-centric focus. To secure a sustainable future, city governments and decision-makers must enable the necessary resources and orchestrate an ecosystem that ensures cooperation. Therefore, we make a call to action to all stakeholders to overcome fundamental barriers to development through active cognitive engagement and build a more prosperous, technology-driven, sustainable environment.

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6.

Funding Sustainable Infrastructures for Cities

Riatu Mariatul Qibthiyyah

Cities are a major driver of growth globally, though there are challenges in managing environmental problems linked with the path of economic progress. Cities account for 70% of greenhouse gas (GHG) emissions resulting from their industrial activities, transport systems, and infrastructures that are mostly constructed with carbon-intensive materials.[1] Furthermore, rapid urban expansion presents significant challenges in urban planning, infrastructure development, and service provision. It created the need for innovative financial mechanisms and strong partnerships to ensure sustainable growth and improve the quality of life for urban populations. Climate change has affected many cities and their populations, and thus there is a need to strengthen collaboration across and within countries in pursuing sustainable development.

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1. See more at: https://blogs.worldbank.org/en/sustainablecities/cutting-global-carbon-emissions-where-do-cities-stand.

The critical role of cities in regional development has been recognized by platforms such as G20, especially by Urban 20 (U20) and Think 20 (T20). Over the past few years, communiqués from these groups have consistently highlighted the importance of domestic resource mobilization and financing to achieve sustainable urban development. In 2022, the U20 summit hosted by Indonesia submitted a communiqué focusing on calls for governments and cities to invest in health and housing, sustainable energy and mobility, and education. This led to the urge to provide reliable infrastructure through sustainable financing. At the same event, T20 also had a particular agenda focusing on Infrastructure Development through Innovation and Collaborative Financing. In 2023, the same spirit grew stronger. U20, hosted by India, has submitted a communiqué that was officially endorsed by 105 cities worldwide, the highest number of backings received to date for any U20 final document, and more than twice the number of endorsements for any previous communiqués. The communiqué has been drafted as an action agenda for the six priorities, including encouraging environmentally responsible behaviors and accelerating climate finance. This year's U20 summit in Brasil has affirmed the potential roles of cities in promoting a just climate transition with better urban infrastructure, has echoed the need to localize sustainable development, and has addressed a sustainable finance framework that may work in a multi-government context.

Multi-Level Government Spending on Environment and Infrastructure

Government responds to its people's preference or to what has been stated in the leaders' political agenda and the country's

development plan. Thus, across countries, there may be differences in how they allocate resources to address the development agenda for environmental protection and infrastructure. For developed countries, according to the Organization for Economic Cooperation and Development (OECD) countries, the share of public spending for environmental protection was more than 2%, while in the case of Southeast Asia countries, it ranged from 1 to 2% (ESCAP 2022). However, in terms of the share of spending on environmental protection, even among developed countries, as shown in Figure 1, there are large differences across them.

From Figure 1, at first glance, developing countries allocate a lower share of their public spending for environmental protection, though there are countries that allocate a relatively higher share, as in the case of China and Argentina. In this case, countries that have higher risks of disaster due to climate and or environmental deterioration may also improve public investment in this area. As an example, the adoption of green budgeting emphasizes aligning the budget with the allocation of adequate resources on government program priorities which strengthen environmental protection objectives, assessment, and monitoring the impact of government programs on the environment, including aligning revenue resources that may incentivize environmental protection.
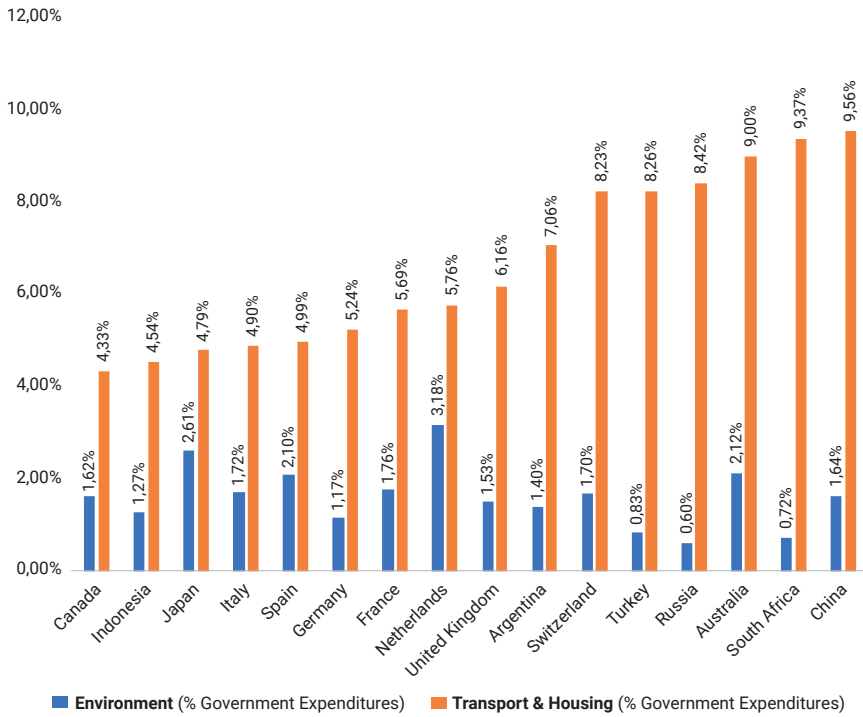
Figure 1. Share of Public Spending for Environmental Protection and Infrastructures (*General Government, Selected Countries*).
Source: Author's calculation from GFS (Government Finance Statistic) and CEIC database.

Given limited public sector resources, countries may allocate a lower share of public spending for environmental protection if there is a trade-off to more growth-enhancing activities in other sectors (Chai et al. 2021; Halkos and Paizanos 2015). There could be concern that prioritizing environmental protection initiatives may dampen economic growth. This issue may lead to under-investment in programs for environmental protection. Therefore, in the context of developing countries that emphasize growth and improvement in income distribution, environmental protection programs are also expected to be pro-growth.

In this case, there can also be initiatives that strengthen environmental protection from other functions of expenditures, which are not necessarily directly allocated through environmental spending.[2] For example, public spending on infrastructures that support cleaner (less polluted) economic activities may also contribute to better environmental outcomes. However, to some extent, a longer-term outcome from environmental protection programs is also an infrastructure development issue. A relatively under-investment in infrastructure has not only occurred in developing countries but has also been a problem in developed countries. Despite that, there are developing countries that have allocated a significant share of their public expenditures for infrastructure. As shown in Figure 1, the trend in infrastructure spending in developing countries has declined over the period 2010–2018 (Foster et al. 2022). Infrastructure underinvestment is also more apparent for cities that need to deal with rapid urbanization, as by 2050 around 68% of the world's population will live in cities (UN DESA 2018; Kaluarachchi 2021). Rapid urbanization, the growing digitalization of economies, and the challenges of climate change will all increase the need for more significant investment in infrastructure. In a regional context, as an example of Southeast Asia countries, there is an estimated US$ 3 trillion infrastructure investment gap that will require an average annual investment of US$ 210 billion by 2040 (Global Infrastructure Hub 2018; ADB 2017).

In a multi-level government, budget allocation could reflect variations of stakeholders' preferences within countries, especially

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2. To note, government spending classification based on functions of government (COFOG), in terms of coverage of spending environmental protection, is generally limited to spending on water sector, sanitation, and waste management.

referring to central and local government, which can be influenced by the division of functional assignment across levels of government. From selected countries of G20 members, as shown in Figure 2, local governments, in most of these countries, allocate a higher share of spending on environmental protection in comparison to the central government's share of spending, and similarly for infrastructure spending.[3]
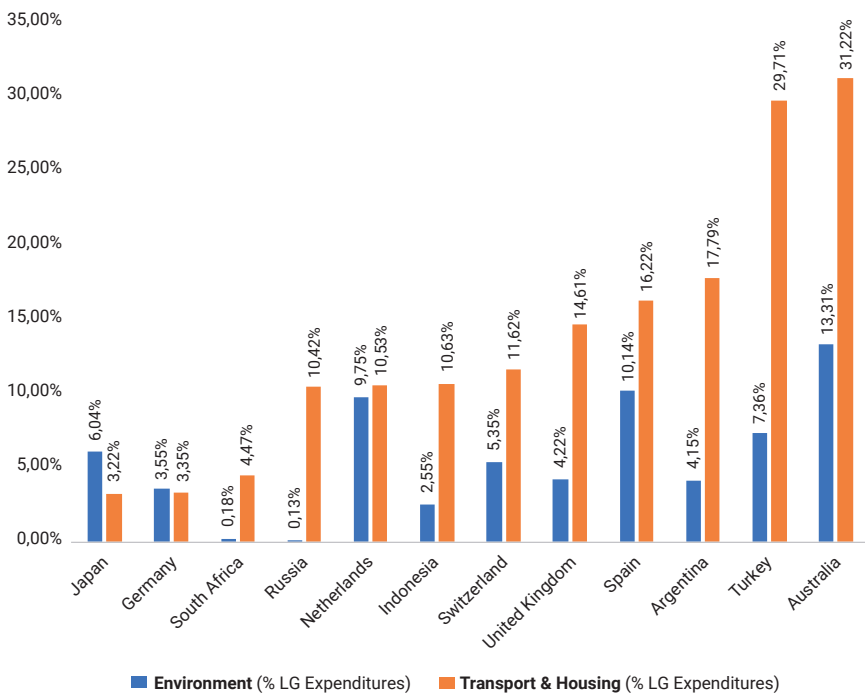
Figure 2. Share of Public Spending for Environmental Protection and Infrastructures (*Local Government, Selected Countries*).
Source: Author's calculation from GFS (Government Finance Statistic) and CEIC database.

3. It is indicated by a higher share of local government spending in comparison to the general government spending share on environmental protection as shown in Figure 1.

In terms of the size of public spending on the environment, Qin (2022) emphasizes the role of the local level on environmental protection, as it shows that lower vertical imbalances are linked to the increase of local government spending on the environment. In the case of Indonesia, urban local governments tend to allocate a higher share of spending on the environment compared to non-urban (Yudhistira et al. 2024). Meanwhile, Chen et al. (2022) show with macro-modeling a scenario in which higher fiscal decentralization may improve environmental protection and outcomes and tend to also have a positive distributive impact.

For cities, many of the large-scale initiatives on sustainability and environmental protection generally require support from the central government and other parties. Challenges persisted in reviewing local-level priorities on environmental protection, on whether it may also be informed by budget allocation. Even within environmental protection programs, it is not necessarily the case that solving certain environmental problems may not exacerbate other environmental problems. For example, mitigating extreme heat by increased use of water may aggravate problems in water conservation. In reverse, there could also be complementarity in addressing environmental problems. For example, forest protection could also lead to better groundwater protection and safeguarding of endangered species.

Local Taxes Policy and Adoption of Environmental Taxes

Local tax mobilization is part of how cities adapt to the demand of public service deliveries, including the need to respond and mitigate climate change risk. Therefore, to fund a relatively natural

expansion of government spending in cities, it will be necessary to ensure high local tax revenue growth, given that in (large) cities, sources of revenue may largely come from local taxes. The growth of tax revenues in cities is expected to be much higher than other administrative units of government within the same level. However, cities with a large size of informality may have limitations in improving tax collection. There may still be high tax revenue growth in some cities despite the size of the informality (Smolka and Cesare 2012).

In addition to spending policies, environmental protection can also be adopted through revenue-side policies. In the presence of negative externalities on activities or goods viewed as major sources of pollution or GHG emission, tax instruments in the form of environmental taxes are expected to mitigate these externalities and thus correct the market. The adoption of environmental taxes is assessed on whether it will be relatively effective in changing behavior and or affecting certain environmental goal indicators, as well as whether it can also function as a relatively adequate revenue source for the government.

In practice, environmental taxes have been broadly defined as any levies or compulsory payments related to any activities or output that have environmental relevance, including energy products, motor vehicles, waste, emissions, and natural resources (OECD 2023). These environmental taxes and fees have been adopted in 129 countries and, in terms of their performances, the revenues from environmental taxes have reached 2–3% of Gross domestic product (GDP) in most of those countries (OECD 2023). To note, in comparison, overall local government tax revenues are relatively low, especially in low-income countries, which on average is less

than 1.6% of GDP (OECD and UCLG 2016).[4]

Environmental taxes are one of the taxes that have become dominant sources of revenue, meaning they would also be a potential source of revenue for lower-level governments. Those that have adopted certain types of environmental taxes improved their effectiveness through an overall reform of local taxes and or part of a reform of decentralization schemes in the respective countries. There are examples of adopting environmental taxes as part of policy in devolving fees or taxes to local governments, as in the case of China. China devolved the environmental protection tax (EPT) to local governments in 2018. This EPT is levied to firms on four types of pollutants—air pollution, water pollution, noise pollution, and solid water. Previously, it was a central government fee, in which the revenues were shared with local governments with the arrangement share of 90:10 for local and central governments respectively.[5]

On the effectiveness of environmental tax, it is important to assess the scheme of taxes and correctly design its structure and administration. Parry et al. (2012) show lessons learned on adopting environmental principles that must be followed for a better environmental tax system. For example, Ma et al. (2024) found that high government revenues with the Association of Southeast Asian Nations (ASEAN) countries are linked to improved management of environmental damage in the form of a lower ecological footprint index. He et al. (2021) show that adopting an environmental tax in Malaysia has effectively conserved energy use and reduced GHG

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4. Referring to the year of 2013. See more at: https://www.uclg-localfinance.org/sites/default/files/Observatory_web_0.pdf.

5. There is also incentive embedded in terms of tax reduction. A 25% tax reduction applicable for firms that polluted 30 to 49% from the pollution standard and 50% tax reduction for firms polluted at least 50% less than the standard. See more at: https://www.china-briefing.com/news/china-environmental-protection-tax.

emissions. On specific sectors, Ahmad and Satrovic (2023) show that environmental taxation in transport translated to the improvement of mitigating ecological footprints. Meanwhile, in the case of vehicle-related taxes at the province level in Indonesia, there is a link between these transport taxes performance to a reduction of air pollution in the respective provinces (Qibthiyyah and Zen 2024).

Environmental tax incentives are also adopted to influence behavior—for example, policies that support firms conserving and utilizing renewable energy, as in the case of Malaysia, Vietnam, and Indonesia (Hong 2011). Despite that, energy sector policies are mostly managed by central governments, and coordination with lower-level governments is needed. Priority shift to renewable energy for electricity generation will also involve lower-level government given the wide coverage of function on environmental protection conducted at the local level. Similar to the challenge of environmental taxes adoption, tax incentives or tax relief effectiveness depends on how these incentives are implemented and whether they incentivize environmental protection efforts. It is also better to link the overall tax instruments and their policy interactions on the environmental protection framework in each level of government, including how it may link to the regional context. In this case, there is a regional initiative on climate resilience framework by 2030 and up to 2050 to complement and better prepare national-level actions (ASEAN 2021).

Intergovernmental Transfers

For cities, there may still be a limitation in terms of the type of taxes that can be collected at the local level. However, it is generally

compensated by the transfers from the central government. Saptono and Mahmud (2023) found that intergovernmental transfers in the case of Indonesia have not crowded out the local tax revenues. Local governments receiving higher transfers tend to have high local tax revenues per capita, especially for cities. In this case, mainly equalization grants in the form of block grants, rather than conditional grants that link to a positive correlation to cities' domestic resource mobilization. Meanwhile, in the case of the Philippines, intergovernmental transfers affect lower-level government's domestic revenues are relatively mixed (Lapitan and Garciano 2024; Tang et al. 2024). Lapitan and Garciano (2024) infer that intergovernmental transfers, also dominated by equalization grants, may enable provincial governments to expand the tax base in their respective jurisdictions. However, Tang et al. (2024) argue that this equalization grant affects better spending allocation, especially on distributive programs, and does not consistently improve local domestic revenues.

Intergovernmental transfer (IGT) can complement local tax in the context of environmental protection. Some countries, as in the case of Japan, adopt a head tax for forest conservation at the national level and then allocate, based on a certain formula, to its lower-level government. Addressing spillovers that require coordination across administrations might be a challenge either within the same tier or across levels of government. The design of intergovernmental transfer aiming to adapt to environmental problems in cities generally emphasizes programs that become a priority for the central government (Kalafatis 2018). The design of intergovernmental transfer can align central government priorities, for example on mitigating GHG emissions, with effort from its lower-level administration on mitigation and adaptation to climate

change, particularly at the city level. Based on GHG emission sources, many of the sector sources fall under the responsibilities of the sub-national or local level as in the case of transportation, waste management, buildings, and land use (Stern 2006; Martinez-Vazquez 2021).

Whether cities will prioritize environmental and climate change management, the issue may also depend on cities' characteristics and how other problems are affected (Krause 2011; Kalafatis 2018). The context of the trade-offs and, in reverse, the co-benefits of environmental programs should be taken into account by policymakers. For example, Huynh and Nguyen (2024) emphasize the presence of co-benefits from climate change mitigation policy at the local level. Based on Vietnam provincial-level data, they found that climate change mitigation policies of lower-level governments improve the effectiveness of governance in service deliveries related to reducing poverty. Furthermore, as stated in Martinez-Vazquez (2021), local governments in Indonesia are more responsive in addressing water pollution complaints (Bedner 2010).

In addition to a top-down approach by the central government in the design of intergovernmental transfers (IGT), in terms of utilization of the grants, there could still be bottom-up initiatives led by local governments and communities. Local movements have been instrumental in driving sustainable infrastructure development in some countries. For example, in Indonesia, while the predominant approach has been top-down, in terms of specific transfers for small infrastructures, local governments can also initiate projects through proposals for this special allocation fund called DAK (*Dana Alokasi Khusus*). For the city level, there are central government transfers of DAK allocated for improving cities' digital systems, related

to its services and the development of smart cities. The city of Bandung in West Java also provides an example of how community development movements can influence sustainable infrastructure through their smart city system.

The specific type of intergovernmental transfer based on improvement in environmental protection (for example, by embedding those environmentally relevant indicators in its formula allocation), is referred to as ecological fiscal transfers (EFT). Brasil is one country that has long adopted these ecological fiscal transfers as its vertical sharing arrangement policy (Droste et al. 2017). However, in Southeast Asia countries, ecological fiscal transfer adoption is still limited, as the most dominant vertical sharing arrangement is in the form of equalization grants.

The distributive policy is generally a priority in most of these equalization transfers. With a long history of adopting equalization grants with pool funds covering 40% of central government tax revenues in the Philippines, Tang et al. (2024) found that equalization grants have reduced poverty rates in the country. In this case, the intergovernmental transfers seem to leverage lower-level government on distributive spending. Meanwhile, in Thailand, the mandate of national government expenditures is 35% of government expenditures managed by local administrative authorities (LOAs), especially through administrative decentralization (Nagai et al. 2010). As in the case of income inequality, the distributive outcome has also been extensively assessed concerning environmental protection. In Southeast Asia, Masud et al. (2019) show that countries that experienced a reduction in income inequality are also linked to better environmental sustainability (Kumar 2019).

Innovative Finance and Cities Partnerships: Some Lessons Learned

To some extent, cities have larger discrepancies in the arrangement of their functions and use variations of financing, given the complexity of providing local public goods. One example, in terms of infrastructure provision, is the case of public transport, which consists of various types of transport modes (i.e. metro, rails, and bus network) that require specific networks of infrastructures. Even in countries with a unitary system, as in most Southeast Asia countries, large cities, as in the case of a country's capital, have specific entitlements in their administration, and, to some extent, they adopt innovation on funding public infrastructures.

As we understand the burgeoning gap between infrastructure needs and the region's financial capacities, this substantial financing gap underscores the critical need for innovative solutions beyond traditional funding sources like government budgets and international aid, which are often inadequate to keep pace with urbanization demands. Innovative financing has emerged as a critical focus in Southeast Asia due to the massive urban infrastructure needs and the limitations of conventional funding sources. These innovative mechanisms provide alternative means to generate capital for sustainable urban development, particularly in rapidly urbanizing regions. Regional forums and summits have increasingly focused on innovative financing strategies, with initiatives like U20 advocating for the exploration and adoption of sustainable financing models tailored to the specific needs of Asian cities. This push for innovative finance highlights the urgency of adopting new financial instruments to help bridge the infrastructure financing gap.

There are at least five types of innovative financing, such as value capture, state infrastructure bank, green, social, and sustainable bonds, public-private partnership (PPP), privatization, and crowdfunding (Chen and Batle 2022). Some of them have become common in Southeast Asia, which is a good sign for sustainable infrastructure and development. Mechanisms like PPP, value capture, and green bonds have been emerging topics in forums across Southeast Asia, and some countries have adopted them in their cities. Other initiatives come from T20 through its policy briefs, as some endorse a more structured international framework that incentivizes private investment in green projects in developing countries to address the sustainable financing gap, especially regarding climate concerns. One of the initiatives to provide funding is the elimination of tax barriers to international green bonds, thereby lowering borrowing costs and fostering greater participation by institutional investors (Lumbanraja and Riefky 2022). This would provide a practical solution to the fiscal constraints of both developed and developing countries and create a sustainable pathway to achieving global climate goals.

The city's role in generating economic growth is greater than ever, and municipal governments in Asia have come to realize the importance of the city's fiscal financing to fund sustainable urban infrastructures. Several Asian countries and cities have become benchmarks in implementing innovative financing for sustainable urban development. Singapore, for example, has effectively utilized green bonds and PPPs to finance projects that enhance urban sustainability and resilience. India's approach includes blended finance models that combine public and private investments to support large-scale urban projects, such as the Smart Cities Mission. Meanwhile, Thailand has focused on mobilizing domestic

financial markets to support sustainable urban projects, with specific policies encouraging investments in renewable energy and green infrastructure.

The private sector's role in sustainable infrastructure is also increasingly acknowledged in the region (see Box 1). Businesses engaged in renewable energy, waste management, smart city technology, and sustainable transportation are crucial partners in implementing urban infrastructure projects. For instance, private companies in Indonesia have been involved in PPP arrangements to develop urban rail systems, waste-to-energy plants, and smart water management systems. In the city of Jakarta, public transport management is conducted by local state-owned enterprises that can tap investments from private and central government financing from multilateral and bilateral loans. Those collaborations provide financial support and bring technological innovations and management expertise essential for successfully implementing sustainable urban projects.

Box 1. Innovative Financing in the Philippines, Malaysia, Singapore, and Indonesia

These examples illustrate various innovative financing techniques that other cities in the region can adopt to address their urban challenges effectively. These diverse approaches underscore the need to tailor financing strategies to the unique contexts of different nations and cities. In their piloting stages, these financing initiatives are generally supported through multilateral and/or bilateral financing.

Adoption of municipal green bonds. The use of green bonds in ASEAN countries is generally limited to central government-related projects and only recently there are plans to adopt bond financing for lower-level governments. In the case of the Philippines, there is an example of municipal green adoption. Municipal bonds outstanding in the Philippines are around 0.002% of total public debt (Sharma et al. 2023). There is also the adoption of municipal green sukuk (Islamic-based financing instrument) in Malaysia starting in 2021 following the Sustainable and Responsible Investment (SRI) framework, as adopted for the financing of water project conservation in Selangor in 2024 (the Star 2024).

Public and private partnership on the drainage and flood prevention system. Examples of financing through private participation would be Singapore's Bishan-Ang Mo Kio Park (AMK). This AMK restored in 2012 has been an example of a green and blue development initiative. The infrastructure provision for drainage has also functioned as flood prevention and rehabilitation of freshwater systems. Situated in Singapore's heartland, the park is now part of the Active, Beautiful, Clean Waters Programme (ABC Waters), the initiative adopted by the Public Utilities Board (PUB) in 2006 (Infrastructure Asia 2024). ABC Waters is a long-term initiative to transform Singapore's water bodies beyond their drainage and water supply functions into vibrant, new spaces for community bonding and recreation, which also involves private sectors through certification of sustainable drainage systems.

The central government supports financing local infrastructures. Indonesia has been exploring various innovative financing mechanisms to support sustainable infrastructure development. Mass Rapid Transit (MRT) phase 1 project in Jakarta has been in operation since 2017 and utilizes the financing scheme of the viability gap scheme in its construction. In this case, the central government would partially fund the project involving financing from private sectors or funding from lower-level governments. The project is partially funded by a bilateral loan and supported by JICA, in which the central government channels this two-step loan to the city of Jakarta.

Source: Sharma et al. (2023), the Star (2024), Infrastructure Asia (2024).

Conclusion

The tax policies at the local level, particularly in large cities, may have implications for environmental outcomes. Thus, policymaking at the city level must be shared and learned. The database of comparable cities across countries is still scarce, making it limited to sharing lessons learned, especially on policy design. In this context, the G20 engagement groups' cooperation and the stakeholders involved can function as a hub of knowledge sharing, strengthening the existing initiatives. In addition to U20, forums such as Cities 40 (C40) emphasize sustainable financing as a crucial element of urban development policy. Currently, they have 96 city members contributing more than 22% of the global economy. These platforms provide opportunities for city leaders and stakeholders to exchange

best practices and collaborate on initiatives to manage urban growth sustainably. Meanwhile, in terms of using tax incentives policies, there could also be an initiative to adopt tax expenditures that track tax incentives provided to private investment in cleaner economic sectors. In most developing countries, tax expenditure reports are issued at the national level and only consist of central government tax incentives.

In terms of intergovernmental transfers, the existing transfers from central to lower-level governments, in the case of Southeast Asia countries, mostly consist of equalization grants. The related transfers that may link to environmental protection are channels for providing and improving local infrastructures, which may also target indicators related to environmental outcomes. The adoption of ecological-type intergovernmental transfers is still limited.

There is also a need for a comprehensive strategy that integrates innovative financing, robust inter-city partnerships, and a firm commitment to sustainable development practices. By drawing lessons from models in cities like Singapore, India, and Indonesia, and leveraging both top-down and bottom-up approaches, cities can enhance their resilience, improve living conditions for their residents, and contribute to broader regional and global sustainability goals. Collaborative efforts promoted by platforms like U20, T20, and other regional forums and cooperation platforms, combined with active involvement from the private sector and communities, are essential for bridging the financing gap and ensuring that urbanization becomes a catalyst for sustainable development.

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7.

Bridging the Gender Digital Divide in the Americas: An In-Depth Look at the Municipal Level[1]

Rebecca Bill Chavez

Sustainable development requires women's full participation in the economy, including the digital economy. As such, it is essential to bridge the gender digital divide, ensuring that women and girls have equal access to the tools and opportunities necessary to participate in the digital transformation.

The global community has much to learn from the diverse and creative ways that cities and municipalities are bringing women into the digital transformation. Local leaders from government, civil society, and the private sector are uniquely positioned to transform historic structures of discrimination and exclusion. Already, subnational actors use their creativity and proximity to local communities to create conditions that allow women to overcome barriers to the digital economy, fueling women's economic

empowerment and financial inclusion.

When women have the same digital opportunities as men, they can leverage technology for entrepreneurship, employment opportunities, and improved productivity. This ability not only benefits individual women but also contributes to broader economic growth and resilience. Including women in the transformation leads to a more inclusive financial landscape and more diverse innovation and problem-solving, driving sustainable solutions to global challenges and progress toward the United Nations Sustainable Development Goals (SDGs), as highlighted in the United Nations Global Digital Compact (UN 2024).

Despite calls for an inclusive post-pandemic economic recovery, women throughout the Western Hemisphere have been left behind partly due to limited access to the digital economy. Over the next ten years, economic gains from digital platforms are projected to generate 70% of new value creation across the globe (ITU 2023). In Latin America and the Caribbean, however, women's involvement in the digital transformation trails significantly behind their male counterparts (IDB 2022a). As acknowledged by twenty Latin American and Caribbean (LAC) countries in last year's Santiago Declaration on artificial intelligence, this chasm will only get worse in the age of AI without direct action to address gender inequality in the digital realm (Declaración de Santiago 2023).

Gender-based digital disparity exacerbates women's economic insecurity. Poverty in LAC disproportionately impacts women, with 116 women living in poverty for every 100 men (ILO 2024). The situation is particularly severe in rural areas, where women experience poverty at rates nearly three times higher than those in urban areas. For example, in rural LAC, less than 20% of women

own land, as compared to 80% of men (UNDP 2023).

Women's participation in the labor market in LAC is significantly lower than that of men, with underrepresentation in the tech sector being especially stark. In 2018, before the pandemic, the participation rate of Latin American women over the age of 15 was 52%, 26% lower than that of men (ECLAC and ILO 2019). Even when employed, women are more likely to occupy low-paying jobs, earning 70 cents for every dollar earned by men (Ishak and Siravegna 2024). Moreover, close to 60% of women are employed in the informal sector, which typically entails a lack of job security, inadequate wages, absence of legal protection, and limited access to social benefits like healthcare and pensions (UNDP 2023). For indigenous, Afro-descendant, and other marginalized women, the disparities are even more pronounced (ECLAC 2021).

Bridging the gender digital divide will help address these economic disparities and advance women's financial inclusion. Access to technology and digital skills creates economic opportunities that can be transformative for women. Participation in the digital economy provides women with concrete benefits such as employment, income, credit, financial services, and educational opportunities. As important, it provides autonomy and progress toward exercising personal agency in today's digital world.

How the Inter-American Dialogue Examined the Digital Gender Divide

Despite the challenges, there is reason for hope. An in-depth look at the municipal level provides important elements of a path forward. The decision to use the subnational lens is rooted in the Inter-

American Dialogue's (IAD) Cities Initiative, which was launched in 2022 in recognition of the critical role of municipalities in addressing shared challenges in the Americas.

The innovative policies that are generated at the local level are more important than ever as we see many national governments stymied by polarization and gridlock, often unable to take meaningful action to address today's most pressing challenges. In many cases, local government and civil society are providing much-needed innovative solutions to a wide variety of issues, from climate adaptation to the integration of migrants to women's economic empowerment, including bridging the gender digital divide. Although not a substitute for national, regional, and international policy, cities are important supplements to and catalysts for action at the national and global levels.

With generous support from Google.org, in 2023 the IAD undertook a year-long study of subnational efforts across the Western Hemisphere with the objective of identifying concrete ways to bring women into the digital economy. Though our team shared the findings with IAD stakeholders, this is the first time that we have published our findings, and we hope that they can serve stakeholders throughout the region in addressing the challenges and opportunities of the digital economy for women of the Western Hemisphere.

To develop an understanding of the issue of women in the digital world and policy recommendations, our team engaged with more than thirty leaders with an interest in and a commitment to digital inclusion, including representatives from local government, civil society, multilateral institutions, and the private sector, across 15 countries of the Western Hemisphere.

We formed the Inter-American Dialogue's Women's Economic Empowerment Working Group to identify real-world solutions and best practices that advance women's digital inclusion and economic empowerment. In addition, the IAD organized two high-level events with thought leaders and subnational innovators focused on bridging the digital gender divide: a workshop titled "Women's Economic Empowerment and the Digital Transformation at the Local Level" at the inaugural Cities Summit of the Americas in Denver, Colorado on April 26, 2023,[2] and an expert panel titled "Women's Economic Empowerment: Fostering an Equitable and Inclusive Digital Economy" at the 26th Annual CAF Conference in Washington, DC on June 2, 2023.[3]

We found that the innovative policies and practices generated at the local level have advanced women's digital inclusion and should be amplified to inform policymakers at the national level. The role of subnational actors is particularly important given that gender is not a pillar of digital public policy in two-thirds of LAC countries (IDB 2022b).

Circumstances differ from country to country and across cities and towns. Nevertheless, we identified four common barriers that prevent women from fully participating in the digital economy: lack of access to the internet and devices, a shortage of digital skills, distrust of digital platforms, and a dearth of time, largely due to caregiving responsibilities. Although each obstacle is significant, as is the case with other pressing issues, subnational actors have identified actionable and innovative challenges to address them.

2. For more information on the Cities Summit workshop, see https://www.thedialogue.org/analysis/womens-economic-empowerment-the-digital-transformation-at-the-local-level/.

3. For more information on the Development Bank of Latin America and the Caribbean (CAF) panel, see https://www.thedialogue.org/analysis/womens-economic-empowerment-fostering-an-equitable-and-inclusive-digital-economy/.

Increasing Access to the Internet and Devices

The Challenge

Women in LAC are less likely than men to have access to an internet connection, a smartphone, or a computer. They are also more likely to experience financial insecurity, which hampers their ability to acquire these technologies. Working group members repeatedly cited lack of connectivity as a key hurdle preventing women from getting online. In LAC, four out of ten women lack internet access due to costs and limited connectivity infrastructure. The high cost of internet services, which can be 12–14% of an individual's monthly income, is especially burdensome for low-income households, where women are disproportionately represented (ECLAC 2023).

The connectivity challenge is especially acute in rural areas. Only 23% of rural households are connected to the internet as compared to 68% in urban areas (ECLAC 2032). The province of Morona Santiago, Ecuador, a rural province with a 62% poverty rate, demonstrates the implications of this lack of access (García-Vélez et al. 2022). A local government official shared that she has worked with women who must walk two hours for the internet access required to sell a single pair of earrings on social media.

Participants also cited the widespread lack of access to devices, primarily due to their prohibitive cost, as a significant barrier for women. Several members of the working group emphasized that women face significant challenges in accessing credit, further limiting their ability to purchase these devices. Even when they have the means, women often prioritize spending on family needs over purchasing what they may consider a personal or luxury item

but is in fact a mechanism for educational access and economic empowerment (Vaca-Trigo and Valenzuela 2022). Globally, women in low- and middle-income countries are 17% less likely than men to own a smartphone (GSMA 2023).

Potential Solutions

Among the best practices shared by working group members and panelists are for municipalities to identify target areas for intervention and understand the specific needs of different communities. City representatives and their private sector partners reported on the importance of sex-disaggregated data to measure progress in getting women online and access to devices. Surveys and research help cities identify where digital inclusion efforts are most needed. For example, cities like Long Beach, California, and Bogotá, Colombia have targeted specific neighborhoods and population groups to provide digital inclusion services where they are most needed.

Internet access is a priority for many towns and cities. Free public internet access points in shared spaces such as libraries, schools, and community centers have proved crucial for women's connectivity. Mexico City, for instance, has made significant investments in free Wi-Fi hotspots, dramatically increasing access and serving as a model by setting a Guinness World Record for the highest number of free public hotspots. Government officials of multiple cities highlighted the creation of public computer labs with support personnel in the poorest neighborhoods, targeting the most vulnerable communities.

Local stakeholders also work to remove barriers to device ownership and use. In Peñalolén, Chile, the local government concluded that connectivity alone is not enough, and the pandemic highlighted the

need for both smartphones and computers. Some cities give devices away or offer direct subsidies, such as vouchers or stipends, to help residents purchase devices. In Long Beach, micro-grants and device purchasing programs have helped people from the lowest income brackets, with many beneficiaries being women and people of color. Removing barriers to device ownership, such as easing regulatory requirements and tax burdens and encouraging the repair and reuse of devices, also makes technology more accessible.

Many of the most successful programs providing access to technology were achieved through public-private partnerships. For instance, to improve the quality of their connectivity infrastructure, some localities have facilitated private sector development of high-speed, fiber-optic internet services that can lead to a return on investment over time. Other partnerships focus on creating hubs for technology and learning. Some cities provide tax incentives to encourage investment in underserved areas.

Developing Digital Skills

The Challenge

Without the necessary skills, women and girls cannot effectively leverage connectivity or their devices. For women who have the requisite skills, Science, Technology, Engineering, and Mathematics (STEM) and Information and Communication Technology (ICT), careers and remote work opportunities offer the chance for economic empowerment. Yet across LAC, women are far less likely than men to pursue a STEM degree, to innovate in the digital space, or to use technology to advance their business.

In most of LAC, women make up less than 40% of college graduates in STEM fields, and the gap is even wider in ICT fields. For example, only 20% of ICT graduates in Costa Rica are women, and the numbers are even lower in Uruguay (18%), Brasil (15%), and Chile (13%) (ECLAC 2023). This underrepresentation puts women at a disadvantage in traditional occupations that are undergoing technological transformation as well as emerging digital entrepreneurship opportunities.

The educational disparities begin in childhood, where deep-rooted gender stereotypes and societal norms discourage girls from pursuing education in these areas. Stereotypes suggesting that men are more logical and analytical, or that boys are naturally better at math and science, contribute to not just discrimination against women and girls interested in technology, but also to a self-selection bias. Not surprisingly, women and girls often show less interest, motivation, and performance in fields where they are expected to fail (ECLAC 2023).

Potential Solutions

There is much to learn from subnational governments when it comes to education and skill-building for women and girls. Digital capacity-building was a recurrent theme amongst participants, and most of the subnational leaders, from all sectors, highlighted some form of free or low-cost digital training program for women and other marginalized communities. The courses range from basic computer skills to advanced programming, coding, and web design, including courses for women entrepreneurs on online sales, procurement, and social media marketing.

In Recife, Brasil, *Embarque Digital*, a university-accredited digital upskilling program, provides public school graduates with scholarships to pursue higher education in technology-related fields, with 50% of its vacancies reserved for Black and mixed-race individuals, prioritizing women in the selection process.

Public-private partnerships can play a vital role in bringing women into the digital economy. In Recife, with the support of the Inter-American Development Bank, the government and private sector teamed up to create *Porto Digital*, a hub for technology and innovation, that includes a focus on women's participation in STEM fields. In Bogotá, Colombia, the mayor and her team partnered with global tech companies to create digital inclusion centers, which provide access to devices and capacity-building classes for women.

Civil society along with local colleges and universities have also taken leading roles in digital education and upskilling programs specifically aimed at women. For example, Fundación Kodea, a Non-governmental organization (NGO) in Santiago, Chile, spearheads initiatives to develop digital skills and encourage innovation among school-aged children and women. One program trains teachers on how to create effective learning environments for computer sciences, with a focus on girls. Another initiative, *Emprendedoras Conectadas*, empowers women entrepreneurs by helping them digitize their operations and educating them on integrating technology into traditional business practices. In Lima, Peru, the NGO Laboratoria offers technology bootcamps for women and works with its graduates to secure technology-related employment. LEAD University in San José, Costa Rica provides an eight-week *Mujer Digital* program that bolsters women's digital skills.

Participants agreed on the need for a concerted effort to inform

residents about the resources available to them. For example, Long Beach hosted a "Digital Inclusion Week" to raise awareness of local activities and resources and established a Digital Inclusion Road Map to inform future inclusion activities. The city also implemented a free, multilingual digital inclusion hotline for residents to call with questions about the internet and digital literacy.

When it comes to combating the impact of gender stereotypes, experience at the local level demonstrates the importance of starting early in a child's education. To counter stereotypes about gender and technology, municipal programs seek to expose girls to technology from a young age, with early childhood education including technological exploration. Efforts include training educators on the skills necessary to teach STEM-related subjects.

One additional finding is that gender gaps in STEM education are pervasive and exist even in cities with higher levels of digital access, such as Montevideo, Uruguay. The city is addressing this issue by collecting data on the gap and forming partnerships with universities to develop solutions.

Participants highlighted the importance of communication campaigns that challenge existing assumptions and create support networks for women and girls interested in STEM careers. For example, Montevideo, led by a female mayor with a background in electrical engineering, publicly celebrates the unique contributions of women in municipal STEM roles. The city shares the stories of women in STEM through interviews and narratives that highlight their journey from childhood to their current careers. These low-cost initiatives make a positive impact and are accessible to communities of all sizes.

Building Trust in Digital Platforms

The Challenge

The internet is not always safe, especially for women and girls. The prevalence of predatory behavior, including online sexual violence, internet fraud, and scams, convinces many women that the digital space is not for them. The use of digital platforms to perpetrate gender-based violence increased during the pandemic, as in-person activity moved online without the creation of adequate controls and protection. Globally, 85% of women have witnessed online violence against other women. In LAC, the percentage reaches a staggering 91% (EIU 2021).

Potential Solutions

Addressing sources of distrust, including online violence, is essential for creating safe and inclusive digital spaces where women can participate fully. Several local initiatives have shown promise in addressing the issue of online violence, including the creation of streamlined procedures for reporting and investigating online crimes. Participants reported that once legislation is enacted, enforcement and victim services are essential.

Some cities have expanded their existing sexual violence response infrastructure to include digital crimes; the same is true for online scams and predatory behavior. Municipal officials and civil society representatives highlighted developing an effective communications strategy to ensure that women know where to report incidents and access support. Some cities work with the private sector to develop tools that assist women in identifying, avoiding, and reporting

digital violence, such as hotlines and resource centers.

The creation of cybercrime units to investigate cases, enforce the law, and educate the public about how to avoid becoming victims can be effective when funded adequately. These units can help protect residents from online threats by offering real-time alerts on common scams and predatory actions. Mexico City's dedicated cyber police force releases daily public alerts and provides extensive resources on identifying and responding to online violence and crime, helping to educate and protect residents. 60% of the unit's cases are reported by women, highlighting the importance of these efforts in addressing women's safety online. In addition to targeting online violence, cities must address the dangers in the physical environment. In Mexico City, public internet access points often required users to stand outside, raising concerns about women's safety. The local government responded by creating "safety corridors" equipped with lamppost panic buttons that directly connect to the police.

Several participants stressed the importance of building legitimacy for digital tools to mitigate distrust and enable women to gain a digital foothold. One concrete method is to offer public services through digital platforms, a strategy that has been used in Seattle, Washington, USA. When cities move key city services online and drive traffic to their websites, they demonstrate institutional trust in technology, enhance digital tools' legitimacy, and create a "digital on-ramp" for women who have not accessed the internet in the past. In Recife, Brasil, the online portal *Conecta Recife* offers residents a one-stop shop for interacting with various city services, including business licensing, housing, public transit, and health and vaccine services.

Cities can work with the private sector to devise creative and effective ideas for trust-building. In one example, a private company worked with the city to introduce a digital public transportation system. Another company worked with small-scale vendors in the local market to integrate QR codes and digital payment methods into their businesses.

Creating Time for Women's Participation

The Challenge

Women's disproportionate caregiving responsibilities significantly impede their participation in the digital transformation. In LAC, women are responsible for 76% of care and other unpaid domestic activities, and they are much more likely than men to be the primary caregivers for children, elderly, or disabled family members. This burden is particularly heavy for women in households with children under the age of 15, where 60% report not participating in the labor market at all (ECLAC 2023). Low-income women bear the brunt of unpaid care labor, averaging around 46 hours per week. Even those who have achieved higher earnings and professional success still perform an average of 33 hours of care labor each week (UN Women and ECLAC 2020). The pandemic has further exacerbated these trends, intensifying the demands on women's time and limiting their opportunities to engage in economic activities.

Potential Solutions

Any viable solution must address the time constraints that hold women back. Making childcare accessible is one of the most

effective ways to support women in the digital economy. High-quality, reliable, and free or low-cost public childcare programs give caregivers the time they need to learn marketable skills, such as how to start an online business. Even if this newfound time is not directly spent on digital activities, it still creates opportunities for women's economic empowerment and autonomy. In many cases, the primary barrier is not the availability of childcare but its cost. To address this, local governments and NGOs often offer vouchers or subsidies for childcare expenses, while others provide free or low-cost childcare services. Eligibility for these public programs is typically determined using metrics like income and family size.

Participants emphasized the importance of urban planning that centers on women's needs to mitigate the caregiving burden. Well-designed public transit routes that are reliable, efficient, and cost-effective—especially in low-income areas and near places frequented by caregivers, such as schools, daycare centers, grocery stores, and laundromats—can save women hours of commuting or waiting. Additionally, creating well-lit and accessible walking paths can further reduce time spent on detours to avoid unsafe routes. Some cities have enhanced support for caregivers by installing one-stop, full-service spaces where they can complete various daily tasks, access city resources, and address diverse needs in a single location.

Bogotá has devoted considerable attention to addressing the gender gap in unpaid care work, changing societal attitudes toward care labor, and establishing support for caregivers. With the support of the private sector and foundations, Bogotá's created CARE Blocks—physical centers strategically located within a 15– to 20–minute walk of schools, daycare centers, and grocery stores, which are being replicated in other cities. These centers provide a range of services,

including free or low-cost care for children and adult dependents. Beyond providing direct support, Bogotá has implemented programs to tackle stereotypes around care work. Community education programs, such as the "CARE School for Men," offer courses for men on essential household management skills.

Some municipalities are providing affordable quality childcare so that women can take courses and learn new skills. Others are centering women in their urban planning by, for example, placing urban walkways, bus routes, public hotspots, and service centers near where women already live and shop and enhancing safety along these routes.

Conclusion: Enhancing Women's Participation in the Digital World

As the world becomes increasingly digital, Women's inclusion in the digital transformation is imperative for women's broader financial inclusion. It is not just a matter of equity and autonomy but a critical way to improve the well-being of families, communities, and economies. Cities and subnational actors are often best positioned to address the challenges, as they have a deep understanding of their community's unique needs and culture. They serve as critical entry points for national and international stakeholders aiming to integrate women and marginalized populations into the digital economy.

It is imperative to deepen stakeholder engagement to solidify digital economic empowerment as an urgent international priority and mobilize the necessary resources to support it. Without significant intervention, the gender digital divide will expand, deepening existing disparities. The time to level the playing field is now before

these gaps become insurmountable. In an increasingly digital world, access to technology is about financial inclusion, economic empowerment, and autonomy.

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8.

Transparency, Accountability and Justice: Why Governments Must Share Flood Protection Planning Leadership with Frontline Communities

Paul Gallay, Amelia Ding, Hellas Lee, Victoria Sanders and Bernadette Baird-Zars

While there may be no simple solution to the growing problem of coastal flooding, research findings are clear: the most effective flood protection plans are holistic, well-informed, and restorative, and government agencies in charge of keeping communities safe from flooding must abandon traditional top-down planning methods in favor of transparent and collaborative practices built on shared leadership with frontline communities (Morris et al. 2024).[1]

Flooding poses a truly *wicked problem* for planners and

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1. An assessment of the need for a holistic approach to flood risk reduction is illustrated in comments from researchers at Rutgers, Dartmouth, Princeton, and other institutions, working together as the Megalopolitan Coastal Transformation Hub ("MACH") project, submitted to the United States Army Corps of Engineers on March 1, 2023. Archived at: https://csud.climate.columbia.edu/research-projects/resilient-coastal-communities-project.

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communities worldwide.[2] Because flooding has so many different causes, including storm surge, intense rainfall, sea level rise, erosion, and subsidence, planners need to consider a wide range of structural, non-structural, and nature-based features in order to identify the proper mix of solutions to address the different risk patterns and physical, socio-economic and demographic factors in each community (Depietri, Dahal, and McPhearson 2018). To make matters even more complex, many of the available solutions to flooding may work at cross purposes with other important community goals like maintaining waterfront access and views, protecting neighborhood character, and safeguarding natural systems and biodiversity.[3]

In the eastern United States, heavily developed states like New York and New Jersey face increasingly serious flood risks. For example, according to projections by the New York City Panel on Climate Change (2019), sea levels in the 2050s are likely to be 11 to 21 inches higher than in 2000. Heavy downpours like those seen during Hurricane Ida in 2021 and enormous storm surges like those seen during Superstorm Sandy in 2012 also are predicted to become more frequent, with the greatest impacts falling on communities already most vulnerable due to a history of redlining, disinvestment, and other inequitable land use policies.

To protect the states of New York and New Jersey from flooding, the United States Army Corps of Engineers ("US Army Corps"), along with officials from these two states and the City of New

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2. Rittel and Webber (1973) describe "wicked" problems as those with multiple potential solutions, no precedents, unclear boundaries, and porous definitions, among other characteristics. See also Incropera (2015).

3. As one straightforward example, many residents near coastlines oppose walls, e.g. Geoff Dembicki (2023). For a sophisticated perspective on the multitude of systems, symbols, and problematic understandings of "stakeholders" see Maru-Lanning (2016). For analyses of power across national and global scales, as in the cross-case examination, see more in Goh (2021).

York, have been working since 2016 on what may be the largest and most complex flood protection study in US history: the *New York-New Jersey Harbor and Tributaries Study* ("NY-NJ HATS").[4] In September 2022, the US Army Corps proposed to construct 2.2 miles of in-water barriers and 50 miles of shoreline-based walls, to safeguard communities within the NY-NJ HATS study area from storm surge-driven flooding.[5] Two years later, however, this plan remains in limbo, as the US Army Corps struggles to respond to written expressions of concern from over 2,600 local residents, community-based organizations, members of Congress, and others, including the US Army Corp's own federal, state and local agency study partners.[6] Among the most frequently expressed concerns about the 2022 plan is that it's only designed to protect the region from wind-driven storms, not from stationary, rain-driven flooding, which took at least 36 lives in New York and New Jersey during Hurricane Ida in 2021 (Calvan et al. 2021), or from sea level rise, which not only threatens communities during storms but does

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4. NY-NJ HATS is intended to protect 16 million people living along 900 miles of coastline in two of the nation's most densely populated states. The characterization of this study as being perhaps the largest study of its kind in US history was shared by Joseph Seebode, Deputy New York District Commander, United States US Army Corps of Engineers, in conversation with one of the authors of this chapter, on November 15, 2022.

5. In September 2022, the US Army Corps identified five possible approaches to flood prevention from which the Corps designated "Alternative 3B" as their tentatively selected plan. The flood protection elements in Alternative 3B are in water storm barriers at the mouths of Gowanus, Newtown, and Flushing Creeks in Brooklyn and Queens, structural shore-based barriers in Jersey City, on the lower west side of Manhattan, and in East Harlem, a combination of shore-based measures and in water barriers in from the mouth of Jamaica Bay to the Rockaway Peninsula, Lower Brooklyn, and two storm surge barriers on the mouth of the Arthur Kill and Kill van Kull tidal straits. Alternative 3B is projected to cost USD 52 billion, protect 63% of the NY-NJ HATS study area, and take 14 years to construct. See "New York-New Jersey Harbor and Tributary – Draft Feasibility Study and Environmental Impact Statement," September 2022.

6. See, for example, the following comment letters sent to the United States US Army Corps of Engineers regarding the 2022 New York-New Jersey Harbor and Tributaries Study Plan: New York State, New Jersey and New York City, March 31, 2023; New York City, March 24, 2023; National Oceanic and Atmospheric Administration, March 29, 2023; New York City Environmental Justice Alliance & Columbia Climate School, Center for Sustainable Urban Development, March 23, 2023; Bipartisan Coalition of 14 members of Congress, September 12, 2023. All letters are archived at: https://csud.climate.columbia.edu/research-projects/resilient-coastal-communities-project.

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so, increasingly, on clear, sunny days, as well (City of New York 2024). Another major concern is that the US Army Corps is failing to deliver on its promise to put frontline communities "at the front and center" of the NY-NJ HATS planning process to lift projects that address specific local needs and priorities.[7]

Fortunately, there is some hope for the introduction of new and more innovative approaches to flood reduction planning in New York and New Jersey, which could be useful in other coastal regions as well. On January 8, 2024, these two states invoked a never-before-used provision of the U.S. Water Resources Development Act of 2022 which will require NY-NJ HATS planners to address *all* major sources of flooding, including stationary downpours and sea level rise, in addition to storm surge-related flooding (Snider 2022), and to give greater consideration to natural and nature-based approaches, instead of relying solely on hardened shoreline seawalls and in-water barriers for flood protection that are the core of earlier NY-NJ HATS proposals.[8]

Calls have been made as well for fundamental changes to the relationship between the NY-NJ HATS project team and at-risk communities. On November 16, 2023, prompted by numerous

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7. Jay Shannon, "Assistant Secretary of the Army for Civil Works issues Environmental Justice Guidance to the US Army Corps of Engineers," Department of the Army, March 22, 2022, https://www.army.mil/article/254935/assistant_secretary_of_the_army_for_civil_works_issues_environmental_justice_guidance_to_the_army_corps_of_engineers, at Section 10. At the commencement of the first public meeting on the 2022 NY-NJ HATS tentatively selected plan, on December 15 of that year, Colonel Matthew W. Luzzatto, then the commander of the US Army Corps New York District, promised *meaningful dialogue, community empowerment*, and *agency accountability* through the remainder of the planning process. Colonel Luzzatto's comments to this effect may be accessed in the US Army Corps recording of the meeting (https://www.youtube.com/watch?v=KoJ4_OaOTE4&t=23s), at minute 3:20.

8. See Note 4, above.

community and academic organizations,[9] the states of New York and New Jersey and the City of New York boldly demanded that the US Army Corps adopt a vastly expanded public engagement plan to ensure that frontline communities will be meaningfully engaged in all future NY-NJ HATS planning work.[10] Subsequently, on January 24, 2024, the US Army Corps announced its intention to create a first-of-its-kind *Environmental Justice Coordination Committee* to promote transparency and accountability to frontline communities for the remainder of the NY-NJ HATS project.[11] The US Federal Government, and this article, use the term "frontline" communities

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9. For example, in May 2022, RCCP met with the US Army Corps NY-NJ HATS planning team to share the findings of its research interviews and press for a fully collaborative NY-NJ HATS process. At that meeting, the US Army Corps made a promise to convene a NY-NJ HATS environmental justice working group. New York District Commander Colonel Matthew Luzzatto and a dozen of his colleagues then visited Columbia University on November 18, 2022, for a briefing and dialogue with RCCP staff and advisory board members, at which the environmental justice working group was again discussed. RCCP again called for the establishment of the environmental justice working group in its March 23, 2023, comments on the US Army Corps tentatively selected NY-NJ HATS action plan (cited in Note 8, above). Finally, on December 11, 2023, over 20 months after the Corps' first promise of a NY-NJ HATS environmental justice working group, RCCP and 21 frontline community organizations, environmental advocacy groups, and other non-governmental stakeholders wrote to the states of New York and New Jersey to protest the US Army Corps failure to establish the environmental justice working group and appeal to those agencies for their assistance in this regard (multi-party letter to the Commissioner of the Department of Environmental Conservation of the State of New York and the Commissioner of the Department of Environmental Protection of the State of New Jersey, December 11, 2023, Archived at: https://csud.climate.columbia.edu/research-projects/resilient-coastal-communities-project).

10. Among the public consultation requirements set by the states of New York and New Jersey and the City of New York are: full responses to all public comments on the 2022 plan and continuing community dialogue on those matters; retention by the US Army Corps of a consultancy with expertise in reaching and educating affected communities, especially environmental justice and disadvantaged communities, to discuss proposed project elements and effectively obtain and appropriately act upon community guidance or critique; and, meaningful engagement in substantive discussions throughout the course of the study. Correspondence from the states of New York and New Jersey and the City of New York to the United States US Army Corps of Engineers, November 16, 2023. Archived at: https://csud.climate.columbia.edu/research-projects/resilient-coastal-communities-project.

11. US Army Corps New York District Commander Alexander M. Young committed to establishing the NY-NJ HATS Environmental Justice Coordination Committee during a January 24, 2024, meeting with the New York City Environmental Justice Alliance, El Puente, and researchers from the Columbia Climate School, including the author. Later that day, Colonel Young shared this announcement with officials from New York State, New Jersey, and the City of New York, as well as investigators from six academic research partnerships, at a planning meeting for a proposed NY-NJ HATS technical advisory workshop. However, as of September 2024, the Environmental Justice Coordination Committee has yet to launch, as the Corps continues to deliberate about it internally. See also Dalban (2024).

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to designate places that have a high risk of negative impacts from climate change due to historic patterns of injustice and exclusion.[12]

While these developments are intended to produce a more holistic, community-centered NY-NJ HATS study, many frontline community leaders remain skeptical that this will be the case, given their past experiences in resilience planning. Indeed, research involving the authors of this chapter illuminates several significant barriers to achieving truly shared leadership between government agencies responsible for flood protection planning and frontline communities, themselves. For example, leaders from ten New York-New Jersey metropolitan area community-based organizations interviewed in 2022 and 2023 by researchers from the Resilient Coastal Communities Project (RCCP), a partnership between Columbia Climate School and the New York City Environmental Justice Alliance,[13] described how perfunctory consultation and top-down government agency practice deny their communities the opportunity for meaningful participation in resilience planning. They also shared ten ideas for improved collaboration with government and academia, listed below in Figure 1, which they believe could help their communities become safer and more cohesive in the face of growing climate-related risks.

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12. Using the definition from NOAA's Climate Adaptation Partnerships program (2024): "Frontline communities are defined here as those communities who are the most vulnerable to and will be the most adversely affected by climate change and inequitable actions because of systemic and historical socioeconomic disparities, environmental injustice, or other forms of injustice."

13. New York City Environmental Justice Alliance ("NYC-EJA") is a citywide network linking grassroots organizations from low-income neighborhoods and communities of color in their struggle for environmental and climate justice. Since November 2021, RCCP has worked to develop actionable, fundable, and equitable solutions to flood risks that also deliver complementary benefits, like habitat restoration, job creation, and greater community cohesion, through a combination of iterative engaged scientific research and active support for enhanced community participation in public planning. RCCP's effort to foster new collaborations on flood risk reduction between environmental justice communities, practitioners, and researchers is also in keeping with Columbia University's 2019 commitment to adopt an institutional "Fourth Purpose," designed to leverage scholarly knowledge to create more rapid and transformational societal and global impact. Accessed at: https://president.columbia.edu/news/fourth-purpose-task-force-report-and-recommendations.

TEN COMMUNITY-BASED IDEAS FOR IMPROVING RESILIENCE PLANNING

1 **Address Environmental Injustices**
Climate justice and environmental justice are intertwined in frontline communities. Adaptation initiatives must foreground and address longstanding racialized inequities of environment, policy, and funding.

2 **Begin with a Community-Led Approach**
Inclusive community representation must commence at the very beginning of decision-making processes, so that communities can play a part in defining terms of engagement, priorities, and processes.

3 **Recognize and Incorporate Existing Community Plans**
Building on existing community plans can save time and resources which would otherwise be spent on community engagement, and can reduce risk of consultation fatigue.

4 **Reframe Resilience**
'Resilience' implies an expectation that some communities repeatedly recover from disasters, and can be reframed toward addressing community climate risk for an environmentally just future.

5 **Build True Partnership Rather Than Tokenism**
Planning processes centering investment in communities, partnership and procedural equity can assist relationship-building, power-sharing, and community leadership.

6 **Recognize Lived Experience as Knowledge and Leadership**
Lived experience and local knowledge and leadership can bring richer contextual information and more holistic perspectives to planning processes.

7 **Center Social Cohesion to Strengthen Resilience**
Social cohesion strengthens community connections, supports communication, collaboration, and inclusion, and enables mutual aid in disaster responses.

8 **Structure Reciprocal Relationships with Decision Makers**
When communities and decision makers work together for mutual benefit, opportunities arise for each party to advance shared agendas.

9 **Invest in Community Leadership Within Resilience Planning**
Communities require resources and consideration of community needs to support community capacity and capability for leadership within planning processes.

10 **Reform Structures narrowing Power and Privilege**
Problematic structures of power and privilege must be reformed to advance equitable power-sharing, resource-sharing, partnership and collaboration in planning processes.

Figure 1. Ten Community-Based Ideas for Improving Resilience Planning.

In addition to arguing for a more holistic approach to flood protection planning built on shared leadership between government planners and frontline communities, many of the community leaders RCCP interviewed called for planners to reimagine the concept of resilience, itself. They want the government to abandon

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traditional resilience planning models—which are based on the expectation that frontline communities will have to endure repeated storm events and, after each one, endeavor to *bounce back* to the same inequitable conditions, created by redlining and other discriminatory practices, that they occupied before the storm—in favor of a new approach to resilience providing front-line communities with the opportunity to proactively *bounce forward* towards a more just and restorative future.

For example, advocates argued that a truly transformative NY-NJ HATS plan would support community needs such as greater access to open space and recreational opportunities, restoration of degraded ecosystems, air and water quality, creation of sustainable jobs as part of the transition to clean, efficient energy sources, and community revitalization, especially in communities that face structural disadvantages due to legacies of environmental injustice (Gallay et al. 2022). They explained that true resilience has its foundation in strengthening social capital and community cohesion and that disaster responses and resilience planning for the future must be based on a culture of caring and community solidarity supported by the necessary resources for social cohesion and healing (Morris et al. 2024).[14]

Achieving Community Goals for Flood Protection Planning

In 2022, RCCP invited representatives of ten local environmental and climate justice organizations[15] to share their past experiences

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14. See also Bennett et al. (2016).

15. The community leaders interviewed by RCCP in 2022 included staff members from the following organizations: El Puente, GOLES, Guardians of Flushing Bay, Ironbound Community Corporation, Newtown Creek Alliance, New Jersey Environmental Justice Alliance, RISE, Staten Island Urban Center, The Point CDC, UPROSE.

in resilience planning, provide their perspectives on what a truly just and equitable planning process would look like, and explain what resources they would need to participate fully and effectively in future planning processes. RCCP provided honoraria to all in recognition of their time.

These community leaders expressed a deep willingness to help reform resiliency planning. They offered reasonable, implementable ideas for immediate action to address flood risk[16] and eliminate exclusions and gaps in resiliency planning. They also explained why narratives of place are essential to flood protection planning, given the interconnectedness of flooding risks with those linked to inadequate housing, high asthma rates, insufficient educational opportunities, and other indicators of systemic discrimination and disadvantage. Finally, they argued forcefully that community co-leadership in the planning process is just as essential to effective resilience planning as agency expertise. As Dariella Rodriguez, Director of Community Development at the Point Community Development Corporation put it: "[W]e need community members in those conversations... if we're not moving at the speed that our people need us to move in, then all the policy in the world, without that community power... we're gonna hit a wall..."[17]

RCCP interviewees highlighted problematic practices in resilience planning and shared pathways for new forms of participatory planning and community-driven just transition. For example,

16. The local organizational leaders RCCP interviewed in 2022 spoke extensively about needs like more extensive and effective floodproofing of homes and businesses, better maintenance of stormwater infrastructure, and more effective agency response in flood situations. They also pointed out that studies like NY-NJ HATS tend to focus too much on building barriers and other physical structures, rather than giving due attention to strengthening community partnerships and local response capacity, which has been shown to save lives during climate-related emergencies. See also Klinenberg (2012).

17. Interview with Dariella Rodriguez, Director of Community Development, The Point CDC, March 15, 2022.

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the need identified in Figure 1, to *Begin with a Community Led Approach* is rooted in interviewees' frustration at being asked to consult on projects where "the agenda has already been created… This table has been set and then we're being brought to the table to eat food that is being force-fed to us…"[18] Community leaders also felt that, without community-led approaches, "There's this disconnect between… what happens on the community level, which is so valuable and what actually happens in… policy, institutes, government… we're the appropriate people to bridge that gap. It can't be bridged from the top down."[19]

Additionally, the community leaders RCCP interviewed urged that the entire topic of resilience should be reframed so that it will no longer center on simply reducing risk, but, instead, focus on creating a future where "we thrive in, and that we ourselves are active leaders in really creating, and recreating, and continuing to develop…"[20] The need to reframe resilience to prioritize thriving communities is again reflected in the observation that "Climate resiliency isn't anyone's priority in everyday life, not even our government… it has to be couched in terms that are immediately relevant to folks' lives. Climate resiliency has to immediately, and visibly improve our quality of life in the moment, not at some point in the unknown future."[21]

Community leaders also want government planners to give deference to resilience plans created by frontline communities, themselves, rather than ignoring those plans because they weren't

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18. Interview with Elizabeth Yeampierre, Executive Director, UPROSE, February 17, 2022.

19. See footnote 17, above.

20. Interview with Frances Lucerna, Co-Founder, Artistic Director, & President, El Puente, March 8, 2022.

21. Interview with Melissa Miles, Executive Director, New Jersey Environmental Justice Alliance, February 24, 2022.

the product of a traditional, agency-driven process. Virtually all of the community-based organizations involved in RCCP's 2022–2023 research have prepared resilience-related plans, reflecting the high level of locally driven resiliency planning in the New York City metropolitan area, generally.[22] Community plans created by organizations RCCP interviewed, such as UPROSE's Green Resilient Industrial District and Staten Island Urban Center's Maritime, Education and Recreation Corridor, also seek to provide for restorative justice by increasing social cohesion and countering gentrification by creating jobs and strengthening community institutions based on principles of mutual support, a circular economy, and eco-industrial/environmental justice.[23] Elevating community plans in this manner would build accountability and trust and ensure that local needs and knowledge are given due consideration from the very start of project design.

Interviewees also warned that effective collaboration between agencies and communities depends on providing sufficient resources to support community participation and research needs. A final key to effective, community-centered resilience planning, according to those interviewed by RCCP, is to establish mutually supportive partnerships between agency planners and communities, based on dialogue, trust, accountability, and self-evaluation.

To summarize, frontline organization leaders want flood protection planners to make full use of the deep store of wisdom that communities possess, rather than simply defaulting to the technical

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22. NYC Climate Regional Plan Mapper, Regional Planning Association, November 2022. Accessed at: https://rpa.org/maps/resilience.html.

23. UPROSE's "Green Resilient Industrial District," in particular, provided the blueprint for the offshore wind turbine assemblage plant currently under construction in Sunset Park, Brooklyn, uniting traditional environmental justice concerns relating to health and safety with the creation of green manufacturing jobs, job training programs, and community benefits. See Gallucci (2022).

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expertise of their agency staff. Only by braiding the twin strands (Atalay 2019) local knowledge and agency expertise can fully inform, effective, and restorative flood protection plans emerge, interviewees noted. For now, this sort of co-produced resilience planning remains an unfulfilled but deeply imagined vision for the future, vividly illustrated by the following statement by the leader of the Williamsburg, Brooklyn-based organization, El Puente:

> *The deeper context and source of what we might call resiliency is our being able to imagine a future that we ourselves are not just existing but we thrive in, and that we ourselves are active leaders in really creating, and recreating, and continuing to develop.*[24]

Bringing Shared Leadership to Flood Protection Planning in New York and New Jersey

While the realization of community aspirations for a more collaborative and restorative approach to flood risk reduction planning is far from assured, those aspirations are increasingly reflected in official government policy and regulation. For example, on February 15, 2024, the US Army Corps released revised *Agency Specific Procedures To Implement the Principles, Requirements, and Guidelines for Federal Investments in Water Resources* ("Agency Specific Procedures"), explicitly directing that environmental justice considerations be incorporated into all phases of the planning and decision-making process in order to remove barriers to effective community participation, increase community access to benefits,

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24. See footnote 20, above.

and drive restorative justice.[25] The US Army Corps published an overview of these new rules demonstrates a clear intent to center community experience and promises to:

> [L]isten to the communities and ensure that they are engaged throughout the planning process. The communities themselves will likely help identify concerns and solutions to their water resources problems and opportunities as well as participate in the identification of any potential effects, mitigation measures, and benefits, including through sharing Indigenous Knowledge, as they deem appropriate.[26]

The 2024 Agency Specific Procedures also require that the US Army Corps take a more considered approach to calculating the relative value of different flood risk reduction options. While the Corp's traditional "benefit-cost" scoring system puts economic goals above all others, these new rules require equal weight to be given to economic, environmental, and social factors, thus rebalancing the scales in favor of more socially beneficial or environmentally restorative flood protection investments. The US Army Corps characterized this new benefit-cost calculation rule as follows:

> Federal investments in water resources have been mostly based on economic performance assessments [focusing] on investments that will improve national economic efficiency. This focus on national economic

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25. "Overview of Proposed Rule: Corps of Engineers Agency Specific Procedures to Implement the Principles, Requirements, and Guidelines for Federal Investments in Water Resources," Federal Register, February 15, 2024, Section 234.6(c)(1). Accessed at: https://www.federalregister.gov/documents/2024/02/15/2024-02448/corps-of-engineers-agency-specific-procedures-to-implement-the-principles-requirements-and.

26. Ibid., see also Section 234.7.

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> *gains sometimes resulted in an unduly narrow benefit-cost comparison of the monetized and quantified effects. [R]elevant environmental, social and economic effects should all be considered … This more integrated approach would allow decision-makers to view a more complete range of effects of alternative actions and lead to more socially beneficial investments.*[27]

While these new rules are intended to bring change to US Army Corps flood protection planning, they have yet to be tested in practice and their actual impact remains to be seen. Realizing this, the officer in charge of the NY-NJ HATS project, New York District Commander Alexander Young, has expressed his hope that NY-NJ HATS will serve as "the tip of the spear" for US flood risk reduction planning reform[28] and that it will help convince other agencies and communities to embrace innovation in their planning processes.

In addition to the changes required to the NY-NJ HATS under the US Army Corps 2024 Agency Specific Guidelines, the Corps is grappling with the impact of the decision by the states of New York and New Jersey, in January 2024, to invoke Section 8106 of the Water Resources Development Act of 2022 ("WRDA 2022"), which changes the fundamental scope of the NY-NJ HATS study by requiring it to address *all* major flood risks, rather than just storm surge.[29] Specifically, this means that the flood protection

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27. Ibid., see Section 234.4(c).

28. Comments by Alexander M. Young, New York District Commander, United States US Army Corps of Engineers, in conversation with members of the Rise2Resilience Coalition, March 27, 2024.

29. Water Resources Development Act of 2022, Division H, Title LXXXI of the National Defense Authorization Act for Fiscal Year 2023, Public Law 117-263, 136 STAT. 2395 (2023) at Section 8106. Also, correspondence from the states of New York and New Jersey and the City of New York to the United States US Army Corps of Engineers, November 16, 2023, and correspondence from the states of New York and New Jersey to the Assistant Secretary for Civil Affairs and Policy, United States Army, January 8, 2024.

projects in any future NY-NJ HATS proposal must be designed synergistically to:

> *Maximize the net benefits from the reduction of the comprehensive flood risks within the geographic scope of the study from isolated or compound effects of: (i) riverine flooding; (ii) coastal storms; (iii) tidally induced flooding; (iv) rainfall; (v) tides; (vi) seasonal water levels; (vii) groundwater upwelling; (viii) sea level rise; (ix) subsidence; or (x) other drivers of flood risk. (WRDA 2022)*

This is the first time that Section 8106 has been invoked since WRDA 2022 was enacted into law; it imposes daunting responsibilities on the US Army Corps, the States of New York and New Jersey, the City of New York, and other stakeholders in the NY-NJ HATS study process. They must combine the work already done by the NY-NJ HATS project team, which only addresses storm surge risk, with a new investigation into the "isolated or compound effects" of the nine other types of flooding covered by Section 8106.

Fortunately, a wide range of possible flood risk reduction measures are available to the NY-NJ HATS project team. The US Army Corps identified over forty different approaches to flood risk reduction,[30] including structural measures like seawalls, berms, and surge barriers, non-structural approaches such as expanded street-level green infrastructure programs and combined sewer overflow reduction strategies, and nature-based solutions like living shorelines, restoring wetlands, aquatic vegetation, and oyster reefs.

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30. See New York-New Jersey Harbor & Tributaries "Draft Integrated Feasibility Report and Tier 1 Environmental Impact Statement," September 2022.

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The key to success will be picking the right combination of these 40-plus interventions for each community in the 900-mile coastline covered by the NY-NJ HATS study.

The academic community has pledged support for this new, multi-hazard-focused NY-NJ HATS with applied research and consultation. Investigators from six New York and New Jersey-based research partnerships[31] are partnering with US Army Corps and state and local resilience planning officials to organize workshops to share and discuss relevant findings and proposals for further investigation on topics such as the extent of and interaction between varying flood risks, the most productive ways to deploy natural and nature-based flood risk reduction measures, and best practices for centering community expertise in flood risk reduction planning. Such efforts represent a significant opportunity for academic researchers to put their findings into service outside the university setting, gain a deeper understanding of the perspectives and experiences of communities and community-based organizations, and do more to meet the urgent need for better flood protection.

Given the complexity of flood protection planning described in the introduction to this chapter, the more thoroughly understood local conditions are in each community, the more likely it will be that effective combinations of flood safety interventions will be found for that community and the less likely planners are to propose projects

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31. These research partnerships are the Center for Policy Research and the Environment, the Consortium for Climate Risk in the Urban Northeast, the Megalopolitan Coastal Transformation Hub, the New York City Panel on Climate Change, the Resilient Coastal Communities Project and the Vulnerability, Impact and Analysis Partnership.

that miss their mark or have unintended negative consequences.[32] The US Army Corp's new mandate to share NY-NJ HATS study leadership with frontline communities can reduce the risk of such outcomes. At the same time, while more data and more holistic thinking can certainly improve planning, there is no way to tell how soon the next major storm will hit, so planners must strive to find the best balance between *planning well* and *planning quickly.*[33]

In response to advocacy to support the promised incorporation of local expertise into NY-NJ HATS planning, the US Army Corps NY Regional team agreed to create an "Environmental Justice Coordinating Committee" (EJCC). The draft EJCC guidelines, developed in partnership with the RCCP, outline the intention to bring together community leaders, experts, and stakeholders into the same conversations as the US Army Corps staff and the non-federal sponsors, and to provide the dedicated space and time needed to uplift community voices and incorporate their feedback into the plan wherever possible and practicable. If fully implemented, the EJCC would represent a huge step forward for community engagement and help transform an outdated federal process by centering the very communities the US Army Corps is

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32. For example, researchers from seven universities collaborating as the *Megalopolitan Coastal Transformation Hub* warned that the NY-NJ HATS action plan tentatively selected by the US Army Corps in 2022, which includes over fifty miles of shoreline and in water barriers designed to block storm surge, may increase the likelihood that rainfall-driven flooding will accumulate and worsen flooding in the communities on the land side of those barriers. Such concerns are also referred to as seeking to avoid "maladaptation." Letter from Researchers at Rutgers, Dartmouth, Princeton, and other institutions working together as the Megalopolitan Coastal Transformation Hub ("MACH") project, March 1, 2023. Archived at: https://csud. climate.columbia.edu/research-projects/resilient-coastal-communities-project.

33. Given the challenges described here, it's fortunate that new funding for flood risk reduction projects is provided for in recent federal legislation such as the Infrastructure Investment and Jobs Act of 2021, Pub. L. No. 117–58, 135 STAT. 429 (2021), which will pump over USD 13 billion into such efforts. See Tompkins (2021). Projects funded in this manner may also be developed more equitably than they have been in the past, under the auspices of the Biden Administration's Justice40 Initiative which establishes a policy requiring that socioeconomically disadvantaged communities receive at least 40 percent of overall flood risk reduction project benefits. See Young et al. (2021).

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tasked to serve and protect. However, despite verbal and written promises to bring the EJCC to fruition, the process has, as of late September 2024, been stalled for five months with little clarity on how to get the EJCC off the ground. The RCCP is hopeful that what currently seems like roadblocks will turn out to be more like speed bumps, in the long term, but past experience with this agency brings deep concern as to whether it will follow through on the EJCC, particularly in the spirit of which it is intended.

As encouraging as it would be for the EJCC to convene and establish a new model for community-centered flood protection planning, US Army Corps and collaborating government agency planners must be truly committed to such reforms if they are to succeed. If those planners, instead, view community consultation as *an obligation rather than an opportunity*, perhaps doubting the value of collaborating with community members who are not as highly technically trained as themselves, studies like NY-NJ HATS will remain mired in top-down thinking and fail to consider critical on-the-ground information.[34] However, if agency staff are ready to join community organizations at the table for a planning process based on transparency, accountability, and justice, those organizations say they are ready to come to that table and help design more collaborative and restorative flood protection plans.

The following section of this chapter analyzes how similar reforms have been employed during other resilience planning projects and how the lessons learned during those projects can be applied to the challenge faced by planners in current and future planning initiatives like the NY-NJ HATS.

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34. Most of the community interviewees with whom RCCP spoke in 2022 indicated that they'd rather not be at the table at all, under such circumstances, given the enormous number of other responsibilities they are balancing at any given time. See Gallay et al. (2022, 1–2) and Morris et al. (2024, Section 3.2).

Examples of Resilience Plans Reflecting Commitments to Community Engagement

The ten community-based principles for equitable and collaborative resilience planning presented in Figure 1, above, provide a ready framework for centering communities in future planning projects, as the US Army Corps has promised to do in the NY-NJ HATS study project, through both structural policy reform and actual collaborative practice. There are numerous examples of resilience planning exercises utilizing some or even all of these principles, which can help guide the NY-NJ HATS and other studies like it. RCCP examined 18 such cases and arranged them into a hierarchy of engagement and empowerment, displayed in Figure 2, below, based on the degree to which each case *fosters respect and integrates community inputs, establishes meaningful reciprocal relationships, improves accessibility, and provides local capacity for community-led solutions*, locating each case on an "engagement scale" ranging from "no engagement and empowerment" to "true partnership." While many of the broader elements reflected in these 18 cases echo the perspectives of frontline leaders from New York and New Jersey, the details of each case are what matter most, as pro forma approaches to "engagement" and "participation" can too easily worsen trust and outcomes,[35] rather than helping to ensure that local voices will be respected and heeded in project planning.

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35. See, for example, the summary by Innes and Booher (2004).

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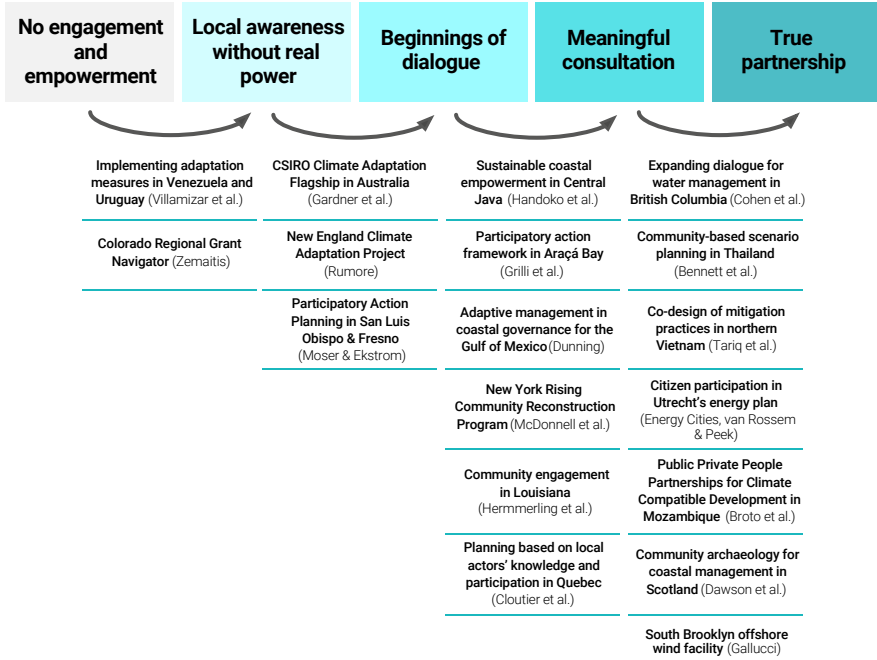
Figure 2. A Hierarchy of Engagement and Empowerment Drawn from 18 Resilience Planning Cases.

The cases listed in Figure 2 have also been placed into four levels of achievement, based on how close each one comes to creating the conditions necessary for community leadership that is recognized as true partners alongside agencies, as follows: Level 1 – *building climate awareness;* Level 2 – *creating platforms for dialogue;* Level 3 – *providing for meaningful community input and consultation;* and, Level 4 – *establishing true partnerships for lasting impact.* Levels 1–3 are neither sufficient nor satisfactory, per our examination, but each level contains elements that can be valuable components to support true partnerships. By examining and categorizing the extent and quality of community engagement reflected in these case studies in this manner, we hope to illustrate

the results produced in each case more fully and help government agencies improve their engagements with frontline communities in future resilience planning processes. Discussions of key cases from each grouping follow.

Level 1 – Participatory Beginnings: Building climate awareness

Raising climate risk awareness and effectively engaging frontline communities can be extremely difficult, especially when there is a history of injustice and top-down planning. "Informing" communities often take a one-way, top-down flavor, which is then harmful and tokenistic.[36] In this regard, related coastal community-based adaptation plans in Venezuela and Uruguay are informative, as they focus on expanding the use of early warning systems relating to climate risk and offer findings on how to use expanded communication channels as a resilience strategy. The recommended communication strategies were the culmination of a project that included monitoring and characterization of risks at the local level and a growing consciousness of how residential development affected risk, as well as a growing call for management and ownership of risk information at the local level.[37] In the last phase of the project, community members were trained in risk management utilizing community flood risk maps, flood gauges, and preventive education materials (Villamizar et al. 2016). Similarly, in Colorado, the *Regional Grant Navigator* program educated local municipalities about potential sources of funding to expand climate risk notification systems and guided them through the associated

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36. See Arnstein's (1969) classic ladder; for more recent works, see more on Fitzgerald (2022), as well as reviews that note that much of the literature on climate risk communication and community engagement continues to fail to engage power imbalances, e.g. Hügel and Davies (2020).

37. See literature on participatory mapping or modeling, e.g. Landström et al. (2011).

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application processes, to help build climate awareness and enhance risk communication (Zemaitis 2024). These cases offer lessons like the role of education on climate knowledge as well as resources available for initiatives on how to build frontline community capacity and awareness about climate risks, which is a critical pillar of effective community-centered planning.

Level 2 – Climate in Conversation: Improved platforms for dialogue

To empower communities facing climate risk, it is crucial to facilitate two-way dialogue between stakeholders as a way to ensure meaningful engagement. Stakeholder dialogues that are led by agencies, however, have a spotty track record.[38] To make them better, cases point to consistency, stability, and careful co-design of the dialogue platforms from the outset. For example, the *New England Climate Adaptation Project* used participatory research to build local capacity, translate climate projections into Summary Risk Assessments, and conduct interviews to learn more about stakeholder engagement (Rumore 2014). In *San Luis Obispo and Fresno, California*, Moser & Ekstrom conducted workshops with local decision-makers featuring beginning with presentations, facilitated small-group, sector-focused discussions, and short prioritizing exercises, before moving into public workshops designed to kickstart collaborative climate adaptation planning attuned to the local political climate and spark ongoing dialogue and partnerships (Moser and Ekstrom 2011). Similarly, the *Climate Knowledge Exchange (CKE)* in New York City, launched by the Mayor's Office of Climate and Environmental Justice, focused

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38. See Arnstein's framing again, as well as the many contemporary cases, e.g. Satizábal et al. (2022).

on improving engagement processes and community capacity through sustained communication, improved access to critical information, and collaborative partnerships. By hosting workshops and intentional follow-ups that facilitate and create sustained engagement efforts between various stakeholders around the New York metropolitan area, the CKE has maintained consistent communication with stakeholders on how it is working to advance goals decided in prior CKEs to sustain funding, increase information accessibility, create and maintain partnerships, establish multi-way exchanges, and foster fair and accountable spaces to empower communities.[39] CKE's long-term success will, as in other cases, depend on how well it sustains this platform over administrations and prioritizes community leadership in decisions over traditional top-down bureaucratic prerogative.

Level 3 – Inclusive decision-making: Better community input and consultation

Innovative approaches to the challenge of integrating community knowledge and concerns into resilience planning were employed by Grilli et al.'s catalytic mobilization exercise in *Araçá Bay, Brasil,* which demonstrated ways to move from merely listening to community members to acting on their inputs and priorities. This process sought to mobilize stakeholders, strengthen local power, and enhance risk management at the local level through innovative approaches such as the formation of an "Araçá Guardians" working group tasked with creating a self-sufficiency-focused sustainable development plan. However, while the formation of

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39. "Climate Knowledge Exchange." 2024. NYC Mayor's Office of Climate and Environmental Justice, August 16. Accessed at: https://climate.cityofnewyork.us/initiatives/climate-knowledge-exchange/.

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the Araçá Guardians did increase community participation and help inform subsequent development plans, community members expressed concern that they were not able to share decision-making power or co-produce plans themselves, highlighting the need for more thorough and effective approaches to the challenge of enfranchising disempowered communities (Grilli et al. 2021). This finding parallels the observations of frontline leaders in New York and New Jersey, as well as the broader literature: inclusion of community priorities in plans is a first step but will often be weak in implementation without true partnerships from the beginning.

Level 4 – United efforts: True partnerships for lasting impact

Long-term partnerships between communities and institutions are crucial to creating and maintaining effective resilience planning, ensuring active participation, and accountability. For example, in Bennett et al.'s *community-based scenario planning initiative* in Thailand, workshops, created by researchers, involved a unique collection of activities like drawing, storytelling, and facilitated discussions in which community members broke into groups to identify problems, explore changes, and propose adaptation measures representing their needs and values. These workshops led to actionable community-level adaptation suggestions such as implementing environmental education and mangrove planting programs, creating a mangrove walkway for tourism, installing toilets in schools to facilitate attendance, and looking for government funds to improve community tap water (Bennett et al. 2016). In the *Okanagan Basin of British Columbia*, planners initiated a multi-year effort of homogenous and heterogenous focus group dialogues, which included activities such as presentations

and evaluations of efforts by other communities to integrate climate concerns into local planning. The community participants' full autonomy in decision-making and ease of collaborating in these activities helped them collaborate meaningfully in long-term development planning, wield greater authority in decision-making, and work to ensure that development plans addressed their adaptation needs (Cohen 2006). Similarly, in Scotland, the *ShoreDIG* project successfully centered local knowledge in coastal heritage management by establishing a citizen-science monitoring platform, allowing stakeholders to use their lived experiences to help create local-scale adaptation plans and facilitate discussions amongst all stakeholders (Dawson et al. 2017). The elements of success are often in the micro-details of the structure of processes, but one thing that all these projects share is a sustained, multi-year approach that respects community knowledge.

Key Principles for Empowering Community Engagement

The cases discussed above, like the rest of those listed in Figure 2, suggest useful strategies for developing actionable solutions to local climate adaptation challenges based on more effective community engagement practices. Many of these strategies are rooted in intra- and inter-sectional workshops, where the most effective activities center community priorities and actively involve individuals' participation (Moser and Ekstrom 2011). These approaches also resemble practices that the frontline leaders interviewed actively practice among their communities in New York and New Jersey; unsurprisingly they foreground the role of community-based organizations. On an individual level, participatory mapping and interactive evaluations about the controllability and feasibility

of adaptation measures, as used in Thailand, effectively illustrate possible avenues for engaging community members (Bennett et al. 2016). Integrating purposeful engagement is most empowering during the early stages of the project, where community members can contribute toward building an overall vision for community resilience and establish long-term partnerships for development.

Purposeful engagement during specific planning exercises can also help develop and maintain meaningful and lasting reciprocal relationships between professional planners and communities. This resonates with requests by frontline leaders in New York and New Jersey for agencies to be transparent about the actual space for action and their input. For example, some project leaders engaged with community members outside of project work, through community-led events, post-engagement mechanisms, and other efforts to maintain contact and get feedback (Gardner et al. 2009). Specific tactics included online feedback platforms and the establishment of citizen science monitoring programs, as seen in New England (Rumore 2014) and Scotland (Dawson et al. 2017), which allowed community members to share their first-hand experiences in a way that was easily interpreted and processed by other stakeholders, spurring wider discussions and creating opportunities to address community needs more holistically.

Lastly, in terms of increasing accessibility and local capacity, significant barriers addressed were related to funding and inter-sectoral knowledge gaps. Ensuring that the resources available to community members are audience-specific and easily accessible is essential to encourage participation and show respect for their positionality. Frontline groups in New York and New Jersey, similarly, often observe how they hold deep expertise in developing

and communicating with residents and could be valuable partners for agencies—with recognition and funding. Helping to pursue external funding, such as through federal grants, or curating summaries of climate risk information, as was done by the *New England Climate Adaptation Project*, can help planners meet residents and community organizations where they are, without expecting free labor.

In sum, the case studies described above underscore the critical importance of early and continuous community engagement in resilience planning and demonstrate that meaningful, inclusive participation not only strengthens community bonds but also enhances the effectiveness of adaptation strategies. Here are seven recommended practices for future resilience planning projects, derived from these case studies:

1. Engage community members early, before plans are set, to ensure resilience planning starts with a community-led approach.

2. Engage broadly and continuously: start before the commencement of planning, provide education as to the issues, engage consistently during planning, and maintain engagement during plan follow-up and evaluation.

3. Expand community outreach to ensure a full range of stakeholders are being engaged, rather than just solely relying on pre-existing community contacts.

4. Present background information in an audience-specific manner, providing tailored and translated summaries of risk assessments and stakeholder opinions to enhance understanding and engagement.

5. Participate in local community activities to strengthen relationships outside formal engagement processes.

6. During engagement, include interactive exercises such as discussing personal climate event experiences, participatory mapping, modeling, and scenario planning.

7. Incorporate integrated compartment models (ICMs), integrated biophysical models (IBMs), and scenario simulators to inform and engage community members.

For the resilience-focused community, further research should explore how the practices listed above can be scaled and adapted across diverse contexts, to ensure that community-led approaches are increasingly at the forefront of climate resilience efforts worldwide. Key questions for planners and researchers to keep in mind are:

- How can multi-stakeholder dialogue and agency accountability become foundational elements of public resilience planning?

- How can agency planners increase the degree to which public planning incorporates community-generated ideas and plans?

- How can public decision-making processes be structured to ensure reciprocal relationships, shared power, and continuous engagement with communities?

- How can resilience plans not only protect frontline communities from climate disruption but also improve community cohesion and quality of life more broadly?

Conclusion

There is no simple answer to the question "What does success look like," when it comes to coastal flood risk reduction. Because flooding has so many different causes, including storm surge, erosion, subsidence, intense rainfall, and sea level rise, planners need to consider a wide range of structural, non-structural, and nature-based features in order to identify the proper mix of solutions to address the different risk patterns and physical, socio-economic and demographic factors in each community under study. Given the complexity of flood protection planning, it's clear that the more thoroughly understood the conditions in local communities, the more likely it will be that effective combinations of flood safety interventions will be found for each community and the less likely planners are to propose projects that miss their mark or have unintended negative consequences.

As illustrated above, frontline communities also need flood protection plans to provide for restorative justice to redress long-standing inequities rooted in segregation, housing discrimination, and unequal enforcement of environmental permitting regimes.[40] Climate justice advocates thus seek to ensure that planners work with frontline community-based organizations to develop redress and accountability mechanisms for communities most impacted by climate change (Donoghoe and Perry 2023). Utilization of the ten community-based ideas presented in the introductory section of this chapter can help assure the success of these efforts, through tactical approaches such as the HATS Environmental Justice

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40. In 2022, New York directly acknowledged that, due to "the inequitable pattern in the siting of environmental facilities, minority and economically distressed communities bear a greater environmental health burden due to the cumulative pollution exposure from multiple facilities." Preamble to "Environmental Justice in Permitting Act." New Jersey passed similar legislation in 2020. See also Loh, Coes, and Buthe (2020).

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Coordination Committee. However, delays in convening the EJCC call into question the capacity or even the underlying commitment of the US Army Corps in these areas.[41]

This chapter has attempted to illustrate the benefits of co-produced, holistic, and restorative flood protection planning in addressing the growing risk of climate-related disruption and repairing the associated damage inflicted on frontline communities by systemic underrepresentation and disadvantages. In the eastern United States, the invocation of Section 8106 of the Water Resources Development Act of 2022, which will require the NY-NJ HATS to take a comprehensive, "multi-hazard" approach to flood risk reduction, along with the US Army Corps promise to create an Environmental Justice Coordinating Committee for the NY-NJ HATS study, could help establish a model for just and restorative flood risk reduction planning and provide 16 million residents of New York and New Jersey (and potentially, millions more in other coastal communities) with better protection from flooding and more equitable, vibrant, connected, and ecologically sound communities, as well.

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41. The EJCC was first discussed by members of the Army Corps HATS project team and the RCCP in May 2022. It was publicly committed to by the Army Corps in January 2024, which then invited members of the RCCP project team to co-create a committee charter and invitation list, which were completed in April 2024. As of September 10, 2024, the Army Corps has yet to constitute or convene the EJCC, while professing its continued intention to do so. Cite the May 2022 meeting, statement by Colonel Young in January 2024 and September 10, 2024, an email communication from Clifford Jones to Victoria Sanders.

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9.

Policy Implications for Climate Adaptation in the Context of Nonlinear Impacts and Catastrophic Risks

Amy Campbell and Jeff Schlegelmilch

While climate adaptation has taken a greater role in the discourse and policy discussions about the climate crisis, integration of risk is generally based on obsolete, linear notions of impact (e.g. twice the change is twice as bad). The latest understanding of climate risk identifies that not only is risk non-linear but there are also tipping points or thresholds that will cause cascading runaway impacts. Once crossed, the full impacts are hard to predict and harder to reverse. But by pairing a more robust understanding of risk into our climate adaptation policies, we can help to avoid these catastrophic outcomes and provide more time for climate mitigation efforts to help reduce the overall threats from climate change.

Non-linear risk can be understood in two ways here: warming, with continued warming beyond 1.5°C accelerating us towards tipping points, and secondly the cascading risk to so many other facets

of society (financial crises, displacement, etc). Rapid warming is *compounded* by "risk cascades" (Benton et al. 2023, 37) as other factors (movement of goods, money, fuel, etc)—overarchingly, we face a collective polycrisis. Timothy Clack et al. argue "attention in politics is often afforded to the urgent at the expense of the important" (2023, 1). We argue that this urgency is now here and that we need immediate as well as long-term solutions from policymakers and civil society actors alike to help reduce the worst impacts of climate change that are already unfolding.

Nonlinear Climate Risk, and Why We Are Out of Time

Non-linearity and cascading effects expand the bounds of adaptation policy, which must now be far more systemic. However, risk is dangerously undercalculated in climate policy. The world is on track to warm by 2.5-2.9°C above pre-industrial levels by 2100 with current policy commitments (UNEP 2023) and we have seared through the 1.5 degree Celsius Paris Agreement temperature goal. We are already seeing the impacts of climate change through increased frequency of extreme weather events. Some are easier to link to climate change than others, but events like prolonged and more severe heat waves, increases in wildfires, outbreaks of severe storms, extreme flooding events, and the severity of tropical cyclones are all exemplative of the types of extreme events that we are expecting to see more of as a result of uncontained climate change.

The costs of these disasters are also continuing to grow: climate-related disasters caused over $4 trillion in economic losses from 1970–2021 with a sharp increase in the past two decades (Climate Policy Initiative 2023). Global insured losses from catastrophes

reached $120 billion in 2022 (CPI 2023). This is particularly devastating for the Least Developed Countries (LDCs) and Small Island Developing States (SIDS) where climate disasters have caused economic losses equating to more than 5% of their gross domestic product (GDP) (UN 2023). In more severe instances, climate disasters have induced losses exceeding 10–30% of developing countries' GDP (WMO 2023).

Oftentimes these increases in disasters are presented in graphics with normalized data, and gradual increases year over year, represented by a bumpy line with an upward slope. This gives us the impression that these changes are linear. However, those involved in climate research know that this picture does not tell the whole story. We have been overly attentive to notions of linear climate risk— focusing on high-probability and usually lower-impact (although still devastating) outcomes (OECD 2022). But these increases in averages are being driven in part by disproportionately more *severe* events. These types of high-impact and "low-probability" outcomes are often discarded—considered outliers or are otherwise left out of the policy calculus. But these events demonstrate non-linear impacts, and hint at the dangers of climate tipping points.

Tipping points, according to the Intergovernmental Panel on Climate Change (IPCC), are irreversible levels of change and do "not return to the initial state even if the drivers of the change are abated" (IPCC 2022). A tipping element is a component of the Earth system that is susceptible to a tipping point—the most cited example is the Arctic ice sheet melt. Once melted past a certain point, not only will it likely never recover, but ocean currents, atmospheric circulation, and shifts in weather patterns can be permanently altered. This would lead to significant sea level rise,

as well as: low-latitude coral reef die-off, boreal permafrost abrupt thaw, global ocean current disruption including severe cooling in Europe, mass displacement in South Asia, Africa, and Southeast Asia, more intense storms, and disruptions to marine ecosystem. There are two important threads here: irreversibility, and further cascading risk across the earth system once this happens.

The 2023 Global Tipping Points report (McKay et al. 2023) details tangible and imminent climate tipping points: the die-off of warm-water coral reefs; the runaway melting of Greenland and West Antarctic ice sheets; the collapse of the North Atlantic subpolar gyre's circulation. There is now emerging evidence that the oceanic tipping points in the Atlantic Meridional Overturning Circulation (AMOC), the North Atlantic Subpolar Gyre (SPG), and the Antarctic Overturning Circulation are likely to have "far-reaching consequences for the rest of the climate system" and could lead to "strong impacts on human societies and the biosphere" (Ritchie et al. 2023).

We do not need to be climate scientists to appreciate the weight of this reality: once breached, cascading impacts and compound risk mean unpredictable and dangerous acceleration of impacts in the world's most vulnerable regions.

As a recent example of the challenges of integrating risk into climate adaptation and disaster resilience, the unprecedented flooding in Rio Grande do Sul, Brasil, displaced 580,000 people and impacted over 1.5 million people. This flooding was predicted, but the risk and vulnerability were not sufficiently communicated to officials. Ninety percent of the 497 municipalities in Rio Grande do Sul were impacted by the rain and flooding (Sader 2024). In August 2023 in the United States, wildfires devastated Maui in Hawaii,

causing $5.5 billion in damage. These wildfires were predicted by climate scientists for years and yet it was the United States' deadliest wildfire in the last 100 years (Partyka and Erdman 2023). In May 2023, flooding and landslides caused devastation in Rwanda—the scale of the flooding was unexpected, but the flooding itself was not unexpected (Braun 2023). The year 2023 was a year of constant climate disaster, with equally constant amnesia towards these disasters hitting our headlines, and the damage from all of these disasters could have been significantly lessened by integrating risk into adaptation policy development.

Of course, climate mitigation, or reducing emissions, is the most effective way to avoid tipping points. And these tipping points make climate adaptation and disaster management much harder. But it will also make climate mitigation more difficult. Some climate tipping points would reduce the "remaining carbon budget for reaching temperature objectives" (OECD 2022, 60). Once tipping points are crossed, many would further amplify surface temperatures somewhat unpredictably and uncontrollably. As such, emissions reductions would need to be even larger and will be far more expensive than previously thought to meet stated temperature targets. Emissions from permafrost have already lowered the carbon budgets for achieving 1.5°C and 2°C (Canadell et al. 2021). If the vast majority of the G20 and developed countries in the United Nations Framework Convention on Climate Change (UNFCCC) are struggling to hit Net Zero by mid-century now, consistently missing and altering Net Zero targets year on year, carbon budgets will be inordinately more strained once climate tipping points accelerate. This reinforces the case for urgent and more effective *adaptation* policy—tipping points and cascading impacts require adaptation policy to withstand far wider extremes than currently

planned for. This means the economic costs of the climate crisis have been underestimated, mitigation and adaptation policies are ill-equipped, and cascading climate risks will far outstrip the technological, diplomatic, and financial levers we have available.

However, it is important to accept that some of these cascading impacts are already locked into the system. Even if decarbonization efforts pick up pace, the system is irrevocably and irreversibly changed. The AR6 technical summary makes clear that equilibrium climate sensitivity has a "very likely" range of 2°C to 5°C (IPCC 2021). The AR6 working group also makes clear that the risk associated with crossing tipping points remains moderate, with high confidence, at ~1.1°C—which we have already surpassed (IPCC 2021; United Nations 2023). The current warming of ~1.1°C *already lies within* tipping point uncertainty ranges (McKay et al. 2022). The bottom line is that we are too late to prevent all risk through climate mitigation efforts alone. We concurrently need to adapt to the impacts that cannot be avoided. As climate adaptation is increasingly the center of attention in the climate crisis discussion, at the UNFCCC Conference of Parties (COP) through the Global Goal on Adaptation indicator development, Loss and Damage Fund, and New Collective Quantified Goal negotiations coming to a head, non-linearities in climate systems must be incorporated in the earliest stages of climate adaptation policy as climate systems are *inherently non-linear* (Horton et al. 2016).

Now as these tipping points are breached, cascading impacts and compound risk will cause impacts to fast accelerate. Inertia means there will be impacts from the emissions we have already released until this very moment and continue to release as we debate climate mitigation policy approaches. The strict bounds that

politicians and senior policymakers currently require—specificity of frequency, financing, scope—will become more impossible to meet in developing policy under pressure.

Key questions policymakers should be grappling with include:

- How do we incorporate sudden, large-scale, and irreversible transformations in climate into climate adaptation and disaster resilience strategies within national and international governance?

- How do we embed an understanding of non-linear climate risk in national governments with limited capacity, funding, and time to design policy?

- How can we incentivize expensive and uncomfortable climate decisions under hazard conditions that are inherently imprecise, although generally clear within wider confidence intervals, in their predictions of risk?

The Case for a More Just Adaptation

As with many aspects of climate change, the burden is not shared equally, nor are the resources for supporting adaptation and building resilience distributed equitably. At the Conference of Parties, the vast majority of UNFCCC developing nations will be calling for more concessional climate finance and loss and damage compensation. There is only so much adaptation finance physically available. Funds available in Overseas Development Assistance are severely limited, competitive, and painfully slow to get approval. And our understanding of risk, and what that means in a global framework and a backdrop of climate justice, is still a work in

progress. But we do have enough information to do better with the resources that are becoming available.

While talking about risk, we also need to recognize that risk is about more than just Hazard. Utilizing the United Nations Office for Disaster Risk Reduction (UNDRR) equation for risk, Risk = (Hazard x Vulnerability) / Capacity to Cope (UNDRR 2020). This means that risk is only one set of variables. The underlying vulnerability of critical infrastructure, as well as social, health, and economic vulnerability, are all critical contributors to risk. And the ability to garner resources to support climate adaptation, disaster response, and recovery are central to risk, yet are inequitably distributed throughout the world. Even if we were all exposed to the same hazards (which we are not), our risk would still be disproportionately distributed in a manner that makes the most vulnerable even more vulnerable and at higher risk in the face of disasters.

Climate risk is also inherently geopolitical. There is a growing chorus of nations focusing on national security implications and moving in the direction of climate security. Securitizing climate risk inherently moves attention toward protectionism and appeasing domestic and national political tensions. Climate security as a field is currently neglecting to prioritize vulnerability; this approach leaves a swathe of unrecognized value in multilateralism, geopolitics, and meeting adaptive capacity needs. But vulnerability is also an inherently transnational issue.

There are numerous frameworks for understanding how climate risk is distributed globally—through trade, migration, and financial systems (Hedland et al. 2018). Viewing the urgent re-framing of vulnerability through a transnational and geopolitical lens. This

is why *vulnerability* should gain just as much traction as national security issues when confronting climate risk. Uncomfortable trade-offs will need to be confronted in designing climate vulnerability metrics to address risk, need, local circumstances, and historical responsibility. At any one time, there will be an urgent competing need for accessible, high-quality, and transparent climate finance, particularly for small island developing states and vulnerable countries in South-East Asia (i.e. Bangladesh), and Sub-Saharan Africa. As an example, if we ignore the contributors to a mega famine in the Horn of Africa, this could lead to as many as 100 million climate migrants seeking new homes (Red Cross 2024), putting new pressures on economies and governments around the world that no nation is prepared to deal with, politically or logistically. This would be another immediate crisis-taking focus that is also needed for long-term and more gradually emerging crises in need of attention before other tipping points are reached.

In attempting to capture this complexity in a digestible and actionable manner, there are a myriad of indices and categorization schemas being developed to simplify this approach. However, no matter how you calculate risk and financial need, you may miss something in developing climate vulnerability indices. Current climate vulnerability metrics such as the Climate Vulnerability Index (CV), Livelihood Vulnerability Index (LVI), and the Notre Dame Global Adaptation Initiative (ND-GAIN) Index have taken great strides in these directions, but do not yet sufficiently capture layers of climate risk and need. There are methodological limitations within indices, and the search for a simplified quantification of risk as well. Looking at an average across multiple hazards will favor countries with larger geographic coverage, while diminishing risk to smaller countries with one or few catastrophic risks, but low risk

for other hazards. Focusing on only the top hazard(s) will ignore the complexity and cost of adapting to numerous categories of hazards. Financial indicators often look at GDP/Capita, but this does not capture access to capital to finance adaptation, which can be driven by debt burden, access to financial markets, and other factors. And low population countries will never compete with the raw economics of large countries in terms of calculated losses.

The sheer complexity of layered climate impacts adds challenge in capturing all dimensions of vulnerability, which also defies consolidating into a single number or ranking of risk. Highlighting factors like *catastrophic* risk in addition to risk across multiple hazards is a step-change in ensuring we are not losing urgent and historically systemic vulnerabilities. Indebtedness, governance, and inequality must all be considered within indices as they relate directly to the capacity to cope, and thus the overall risk. Improving the dimensions of vulnerability we consider when allocating financial resources could shift the dial closer to a new convention or framework for climate-induced movements once displacement fast accelerates.

For data to be integrated, it also needs the legal and governance frameworks in which to implement more robust risk management approaches. The notion of governance and legal frameworks warrants its own space for dedicated discussion. One example of this complexity and importance includes the long-standing legal debate in expanding the 1951 Geneva Refugee Convention to include climate change, as a means to protect those subjects to climate-induced migration. A convention similar to the Kampala Convention, recognizing climate as the *cause* of displacement could progress this conversation (Afzal 2024).

This also does not need to be thought of as a humanitarian gesture or a moral obligation, although both of these lenses are true and appropriate. There are also outsized benefits in the return on investment in more robust climate adaptation and disaster resilience initiatives. This comes from the catastrophic losses averted, as well as an opportunity to use these investments as a stimulus towards a more just resilience into the future. There are competitive advantages in fostering resilient and stable business environments and reducing the risk of shocks from disasters and other disruptions. Recognizing and integrating historically disadvantaged and imbalanced power structures that lead to increased vulnerability, decreased capacities to cope, and thus, increased risk are all components for building stronger and more resilient economies.

Re-envisioning climate risk as a tangible benefit to the bottom line as well as the overall human condition can help to re-frame this almost intractable ask of the global financial landscape. *Avoiding catastrophic risk* is in the interest of every investor, insurer, and philanthropic organization. Climate vulnerability metrics that build in non-linear climate risk, a holistic assessment of socio-economic factors, and financial need will enable adaptation finance and will most effectively distribute funds to the most vulnerable regions.

Recommendations for International Climate Policy

In the context of global warming, the solutions are also inherently global. In this climate disaster age, we cannot abandon multilateralism. There is no singularly national solution when the context of our economies, our security, and our personal and professional relationships are global. There is also an acute need

for international governance on tipping points. Whether through the UNFCCC or the UN Security Council, multilateral fora must upskill all nations on the dangers of tipping points to inform national policy accordingly. Some steps that can be taken by nations and multilateral institutions alike include:

1) **Inclusion of the growing scientific evidence:** Non-linearity should be incorporated at risk-assessment change as part of a range of 1-3 degree Celsius warming pathways. High-impact outcomes cannot be discarded simply for being "low-probability." If a risk has the potential to cause irreversible system change, this must be escalated to politicians. While specificity may be elusive, there is more than enough evidence to inform more robust policy and investments in climate adaptation and disaster resilience in the context of catastrophic risk and tipping points

2) **Establish better frameworks for integrating uncertainty:** Specificity continues to be elusive, but clear patterns and predictability within confidence intervals provide enough certainty to invest in adaptation and resilience with a particular emphasis on averting tipping point events. Frameworks for managing uncertainty should be adapted to apply to climate adaptation and resilience policy to better support immediate and sustained action to address these growing risks.

3) **Incentivize investment where it is needed most:** Risk should be framed clearly around the impact on remaining carbon budgets, potential food in security, infrastructure damage and displacement, and overall net cost. Advice to politicians should include "positive tipping points" as

an incentive for investment. This should include multi-dimensional factors such as current and forecasted risk to catastrophic impacts, as well as the ability to pay for critical adaptation measures. This will include looking at risk across multiple dimensions, as well as looking at the ability to pay beyond measures like GDP/per capita, and will need to take into consideration indebtedness, cash reserves, access to financial markets, and other tangible barriers to adaptation and resilience investments.

4) Resist the *status quo* for political decision-making: Policy succumbs to a common facet that is seen across many decision types; we are better incentivized to be reactive rather than proactive. The Catch-22 of "it isn't here yet, so I won't pay for it" from politicians and senior policymakers has to be overcome. The case for disaster preparedness is viscerally clear: cascading risk is locked in. Tipping points are imminent and will be extortionately expensive to fiscal budgets. Cutting aid to the most vulnerable regions puts the wider geopolitical landscape at risk. We know that every dollar spent on disaster preparedness can save up to nine dollars in the future.

The G20 has a particular opportunity as well as a responsibility to address these challenges. The G20 represents 85% of global GDP, 75% of international trade, and nearly two-thirds of the world's population. The affluence of the G20 is codependent on the sustainability of global systems, and a more just adaptation and resilience paradigm will further strengthen these systems. Conversely, these global systems are at great risk with the disruption caused by catastrophic tipping points that will cascade across all

nations. Those most vulnerable will be the first to fall, but none will ultimately be spared the severity of the impacts of the ripple effects of major disasters. There is both a fundamental moral and practical responsibility to rapidly re-frame how climate risk is considered and to re-adjust international climate adaptation efforts in this age of disaster, and while the window for investments in climate adaptation and catastrophic disaster resilience is closing, there is still time, but it is running out.

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10.

Shaping Sustainable Urban Mobility: How Current Narratives Drive Change

Clarisse Cunha Linke

Climate change is a confirmed reality, and global, national, and local agendas focus on cities as the locus of the problem and action. The urban mobility debate is at the heart of the discussion about the future. However, public and private investments for decarbonizing mobility continuously emphasize private vehicles, going in the opposite direction of the Sustainable Development Goals (SDGs), the United Nations New Urban Agenda, and the Paris Agreement. The transition to a comprehensive mobility system based on zero-emissions public transport, walking, and cycling is critical in Brasil, as an integrated mitigation and adaptation strategy, that has the potential to deliver a transformational and just transition.

This article argues that the existing narratives about the future of mobility are outdated and potentially dangerous, leading to a deficient, exclusionary, and environmentally harmful mobility system. Addressing these challenges requires a fundamental change

in the narrative that guides policies, community engagement, and investments—one that prioritizes the movement of people over vehicles, integrates land use with transport planning and aligns with the broader goals of climate justice and social equity.

The Context of Urban Mobility in Brasil

Urban mobility has become a central issue in the discussions about the future of cities, particularly in the context of climate change. Cities are responsible for 75% of global greenhouse gas (GHG) emissions and consume nearly 80% of the world's energy (Burdett 2011); the transition to zero emissions and resilient mobility systems has gained increasing importance, with significant public and private investments.

The importance of urban mobility is evidenced in the three main global agendas on sustainable development. Mobility appears in seven of the 17 Sustainable Development Goals. The 2016 United Nations New Urban Agenda emphasizes the need for walking, cycling, and public transportation as essential components of more inclusive cities. Additionally, the adoption of intermodal transport systems and energy-efficient vehicle technologies appears as part of the mitigation strategies in the 2015 Paris Agreement, to which Brasil is a signatory.

The transport sector is responsible for 52.6% of energy-related emissions in Brasil and has, over the past few decades, shown a worrying upward trend, driven by the country's heavy reliance on road transport and the use of fossil fuels (SEEG 2024). In 1990, the sector accounted for around 40% of emissions, and this share has grown significantly due to the expansion of the vehicle fleet,

accelerated urbanization coupled with urban sprawl, and insufficient investment in public transportation. Brasil's motorization rate, now at 471 vehicles per thousand inhabitants, has steadily increased since 2001. Between 2010 and 2020, the rate grew by 50% across all state capitals, except for Boa Vista (MobiliDADOS 2024). In addition to the climate emergency, there are other externalities linked to the current system, such as air pollution and traffic-related deaths.

Air pollution kills more than seven million people worldwide yearly, with over 44,000 deaths in Brasil alone in 2016 (Ministério da Saúde 2019). Exposure to particulate matter, nitrogen dioxide, and sulfur dioxide can trigger serious health problems. Associated problems range from headaches and eye irritation to lung cancer and cardiovascular diseases. It also impacts the central nervous system and the reproductive system. The list of associated risks is long and alarming.

The public health challenges associated with urban mobility in Brasil extend beyond air pollution. Traffic-related deaths and injuries also play a significant role in this bleak scenario. Between 2010 and 2019, there was a 13.5% rise in traffic-related fatalities compared to the previous decade, resulting in more than 40,000 deaths annually, with one-third of deaths of people up to 15 years old. Deaths due to run-overs account for most deaths involving people over 70 years old. Motorcycle accidents account for about 44% of deaths in the 15 to 29 age group—these incidents cost the country over 50 billion Reais per year (Carvalho and Guedes 2023).

Moreover, Brasil has seen a dramatic increase in natural disasters over the past few decades, further complicating the urban mobility challenge. The country had a record number of natural disasters, such as heavy rains, floods, and landslides, in 2023, when the global

average temperature was 1.45°C above pre-industrial levels (MCTI 2024). We have also experienced a rise in the average temperatures of cities and an increase in the number of days with heat waves. These climatic events directly affect urban systems, such as the mobility one, making urban life increasingly difficult, especially for the most vulnerable groups, and pose additional challenges to the population's livelihood strategies.

The National Urban Mobility Policy, Law No. 12,587, established in January 2012, defined the principles, guidelines, and objectives that should guide the planning, implementation, and monitoring of urban mobility policies and investments in Brazilian cities. After 17 years of debate, adopting the Policy represented an essential advance in the sustainable urban development agenda, as it is aligned with the broader environmental agenda, inverting the pyramid of priorities with preference given to active and public transport modes to the detriment of individual motorized modes. The Policy was strengthened in 2015 when mobility became a right in Article 6 of the Federal Constitution. The main implication of this Law is to give cities the authority to manage transport, set prices for access to transport services, and use revenues to invest in public transport and infrastructure for walking and cycling. The Law also establishes that cities with more than 20,000 inhabitants must develop municipal mobility plans aligned with their Cities Masterplans.

However, the existence of the Policy for over a decade has not minimized what appears to be a collapse in the main metropolitan regions of the country. Individual motorized mobility still dominates the planning paradigm and, therefore, the investments on the ground. Coupled with governments' need for more technical and institutional capacity to plan and finance sustainable urban mobility, the result is a

deficient, exclusionary, and environmentally damaging system.

The Need for a Paradigm Shift in Current Narratives

Urban mobility solutions remain predominantly car-centric, with the automobile industry-leading investments in technological changes that preserve its existing business model. Clean vehicle technology is a crucial solution to the environmental impacts of the industry. Still, the emphasis on individual ownership of vehicles is rooted in a 20th-century vision of the future—one that is both outdated and potentially hazardous. Research indicates that prioritizing clean vehicles while maintaining individual travel patterns could increase trips, perpetuating the business-as-usual scenario (Fulton et al. 2017).

Likewise, the rapid adoption of new technologies, such as ride-hailing apps, has coincided with a rise in kilometers traveled by vehicles (Henao and Marshall 2019), further exacerbating congestion and extending commute times. Six of the ten most congested cities in South America are in Brasil (TomTom 2023). Transitioning from internal combustion engines to electric vehicles will certainly reduce emissions. Still, the continuing narrative romanticizing private vehicle ownership and the lack of investment in other mobility solutions take passengers away from public transport, intensify congestion, and increase travel time. Commuting time lost daily harms mental health and overall quality of life.

We urgently needed a paradigm shift that focuses on the movement of people instead of the movement of vehicles. Reducing the number of vehicles circulating is essential. The famous Lisbon-

Study, conducted by researchers from the International Transport Forum in 2015, demonstrated that it is possible to reduce by 10% the number of vehicles in the city by securing the same number of trips with different configurations of vehicles with higher occupancy, cutting CO2 emissions by one third, eliminating congestion and the need for on-street parking space, which in turn frees up public land for other uses, contributing to more livable urban environments.

Promoting low-carbon and inclusive cities requires expanding access to the city's opportunities, with clean mobility systems that have greater coverage and reach, and that consume less space. While there are many strategies already identified aligned with these principles, the current imagination—dominated by visions of technologically advanced future cities—risks exacerbating disparities among different population groups.

The Concepts Behind the Right Narrative

Narratives about the future of mobility play a significant role in shaping policy decisions, guiding investment, influencing public opinion, and technological developments. How we approach different concepts can help drive or hinder a shift towards a more sustainable future. Four pivotal themes underpin a comprehensive approach:

- The Avoid-Shift-Improve (ASI) framework.
- The combination of electrification with compact and dense cities.
- The urgent need for adaptation alongside mitigation.
- The principle of a just transition.

Avoid-Shift-Improve

The Avoid-Shift-Improve (ASI) framework discusses the transport sector's contribution to the 2°C scenario. Developed in the 2000s by German development agencies and international experts, it addresses environmental and social challenges in rapidly urbanizing regions. Since its introduction, global organizations, governments, and urban planners have widely adopted the approach to foster sustainable mobility. It focuses on three core pillars: Avoid, Shift, and Improve (Bongardt et al. 2019).

Avoid aims to reduce the overall need for travel, especially by private vehicles, by integrating urban planning and transport policies to promote compact, dense, and mixed-use cities, and includes incentives like congestion pricing and low-emission zones. The Transit-Oriented Development (TOD) concept is fully aligned with this strategy by creating walkable communities around transit hubs, reducing the need for automobile travel.

Shift—or maintain, in most Global South regions—focuses on moving travel from private vehicles, as the most consuming and polluting mode, to sustainable modes such as public transport, walking, and cycling. It requires expanding and improving public transit systems, enhancing walking and cycling infrastructure, and promoting shared mobility to decrease low-occupancy trips.

Finally, Improve seeks to enhance vehicle technology and fuel efficiency. This is led mostly by the industry, particularly when there are supply-side regulations and incentives in place. Prioritizing bus-based systems is crucial for minimizing environmental impact while ensuring equitable goals.

The ASI approach works synergistically, with each pillar reinforcing

the others. By avoiding unnecessary travel (smart land use policies), shifting to sustainable modes (public transport, walking and cycling), and improving efficiency (in particular bus-based systems), cities can significantly enhance quality of life. This can lead to reduced congestion, better air quality, and more livable environments, offering a promising future for urban mobility.

Compact and Elecrified Cities

Since conceptualizing the ASI approach, the main advances have been in vehicular technology and energy efficiency, especially for private vehicles. However, while electrification is often seen as a silver bullet for reducing GHG emissions, it alone falls short of the necessary reductions. Extensive vehicle electrification only lowers emissions by a portion of what is needed.

Research including a study by the Institute for Transportation and Development Policy (ITDP) and the University of California, Davis Institute for Transportation Studies (2021), underscores the effectiveness of combining vehicle electrification with dense, walkable cities and robust public transport systems. This integrated approach cuts emissions more effectively and accelerates the shift away from car dependency. The potential impact is significant. This combined strategy could cut urban passenger transport emissions by 59 gigatons (Gt) CO2-equivalent by 2050. For Brasil, a tailored roadmap shows that this approach could reduce emissions by 2.1 gigatons (Gt) CO2-equivalent by 2050 (ITDP 2024).

Key policies to achieve these goals include implementing supply- and demand-side regulation and incentives, particularly to accelerate the country's production of electric buses, setting

stringent fuel economy and tailpipe GHG emission standards' and promoting battery reuse and recycling. Equitable deployment of public charging points, expanding the electric grid, and establishing low-emission zones will drive both mode shift and vehicle electrification. Additionally, reallocating transport budgets to prioritize walking, cycling, and public transport and redesigning streets to favor pedestrian and cycling space will enhance urban livability and reduce reliance on private cars.

Adaptation: Going Beyond Mitigation

The recent tragedy in Rio Grande do Sul highlighted the urgent need to adapt Brazilian cities to climate change. Discussions have expanded to focus on mitigation measures and immediate adaptation strategies for urban systems. Adaptation involves adjusting processes and structures to enhance resilience against climate impacts and benefit from opportunities that emerge in this new scenario.

One key adaptation strategy is rethinking urban mobility. Over 80% of Brazilians live in urban areas, with 58% in metropolitan regions, where long commutes are common due to sprawling, inefficient city layouts, with centers that concentrate opportunities for work and study and peripheries where most people live. Residents face congested roads and inadequate transport systems, particularly in low-income areas (Linke et al. 2018). This lack of access to quality public transport exacerbates social inequality and segregation, disproportionately affecting those further from job opportunities. Adapting urban mobility can address these inequities, aligning with principles of climate justice to reduce the disproportionate impacts on vulnerable populations.

Another crucial aspect of adaptation is the integration of nature-based solutions with mobility interventions. It includes, for example, expanding cycling networks, enhancing pedestrian spaces, implementing green corridors, and adopting new materials for infrastructure to build system resilience to extreme weather events. This approach not only allows for the design and investment in infrastructure with a future-thinking effect but also increases the adaptative capacity of the systems and the population.

Just Transition

Social inequalities and spatial injustices exacerbated by the ecological crisis are critical concerns. By 2050, over 140 million people are projected to face climate stress globally (Rigaud et al. 2018), reflecting what Archbishop Desmond Tutu termed "climate apartheid"—a stark scenario where extreme inequality persists despite global economic growth and unprecedented production and consumption. In response, the concept of a just transition to a low-carbon economy has emerged, emphasizing the need for inclusive change that does not leave anyone behind.

To achieve this, we must reassess our planning approach and recognize that mobility patterns are influenced by gender, race, income, and age. Access to urban opportunities—such as economic, health, education, and leisure facilities—is often inequitable. This disparity is exacerbated when viewed through the intersectional perspective, revealing deep-rooted inequalities in infrastructure and service quality. Daily commutes between the outskirts and city centers disproportionately affect marginalized groups, including black women, who are often primary caregivers in the Brazilian context. This occurs due to the cost and quality

of infrastructure and services offered in different areas of the city and begins with a planning process that prioritizes productive travel—home-work trips during peak hours instead of mobility of care (Linke and Tavares 2024). These systemic issues limit mobility for those who need it most, underscoring the urgency for planning that addresses these inequalities and ensures a just transition for all.

The concepts behind the narratives about the future of mobility matter. We need to embrace ideas that shift away from private vehicles, integrate land use and transport, leverage electrification to elevate the role of public transport, and promote fewer vehicles to free up space for cycling and walking infrastructure. This is the way forward to adapt cities. The result is a new paradigm with a narrative committed to addressing the pressing challenges posed by climate change and social inequalities.

Moving the Narrative into Action

Turning the narrative into tangible outcomes requires a strategic blend of policy and investment. This effort demands a shared vision, with broad public engagement, targeted effective investments, and, above all, a sense of urgency.

Achieving a vision for a sustainable, resilient, and just transition requires a unified approach, bringing together multisectoral and interdisciplinary players to work toward common and achievable goals. This collective vision must have clear outcomes and foster collaboration among government, the private sector, academia, and, most importantly, community-based movements and organizations. A unified strategy can guide efforts to reduce travel demand, shift

to sustainable modes, and improve transportation efficiency, addressing environmental and social challenges effectively.

In 2023, Brasil updated its Nationally Determined Contributions (NDC), committing to a 48% reduction in emissions by 2025 and a 53% reduction by 2030. In August 2024, the Climate Observatory proposed a more ambitious 92% reduction by 2035. This target, deemed feasible and scalable, reflects the Brazilian potential to lead in global climate action while aligning with the goal of limiting global warming to 1.5°C (Observatório do Clima 2024). The Observatory, a coalition of civil society organizations, research institutions, and experts, has been developing these proposals since 2015 to democratize climate discussions and set a higher, evidence-based benchmark for Brasil's contributions.

Achieving this target requires a substantial overhaul of Brasil's passenger mobility infrastructure. This includes constructing 4,000 kilometers of dedicated BRT lanes (as in "Bus Rapid Transit and System") and expanding cycle paths by 95,000 kilometers beyond 2015 levels. Such measures aim to limit the growth of private vehicle usage to 15% while more than doubling urban bus travel. Transitioning to electric buses is also critical, with a goal to convert at least 57% of the bus fleet—about 60,000 buses—to clean vehicles by 2035. These upgrades are vital for reducing emissions and meeting Brasil's climate commitments.

Society's engagement is essential for turning awareness into behavior change. The narratives we craft about the future of mobility can influence public attitudes and behaviors. Public transportation's social value is often overlooked, reduced to a profit-driven service rather than an essential public good. However, as the COVID-19 pandemic showed us, it is a service that is essential for the cities'

resiliency, a significant job creation sector, and it serves most of the lower-income population. Yet, it is frequently sidelined in future urban visions. Elevating the importance of public transport, along with cycling and walking, is an urgent task. Simultaneously, we need to make the negative externalities of car-centric cities visible. Most externalities are either invisible—for the sake of not being publicized—or are normalized by society.

Finally, a significant change in urban mobility requires not just policy shifts but also improved funding and financing for the infrastructure adequate for the city of the future. As urbanization accelerates, the demand for efficient, accessible, and environmentally friendly mobility will grow, particularly in developing countries with limited resources. Leveraging innovative financing mechanisms and fostering international collaboration are crucial to overcoming these challenges. Events like the G20 in Brasil or the COP30 in Belém offer critical opportunities to highlight sustainable mobility on the global stage, attract investment, and engage the public in socio-environmental issues. The narratives we promote about the future of mobility can drive positive change, creating more livable, inclusive, and resilient cities for future generations. The time to act is now, and the world cannot afford to wait.

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11.

Climate, Equity and Health Problems in Road Transport: Closing the Popular Transportation Gap

Jacqueline M. Klopp

Introduction

Despite the profound importance of ubiquitous popular or informal transportation in the Global South, these critical modes–and the people who use and run them–remain largely marginalized and outside of planning, investment and decision-making at local up to global levels. This is a remarkable and problematic gap in global and local policy, funding, governance, and action in the road transport sector, with important implications for cities; it is also an ongoing injustice. Stigmatized and largely unsubsidized, these forms of highly used, shared transport modes–from motorcycle taxis to rickshaws and minibuses–tend to emerge from long standing government failure to invest, enough and equitably, in public transport and related non-motorized infrastructure and services. These services are linked to

other constraints in cities, such as historically narrow streets and complex, spatially segregated built environments.

To fill the public sector vacuum, self-help and indigenous entrepreneurship have emerged to supply diverse mobility service businesses that provide critical access to cities, their opportunities and services. These businesses also employ large numbers of people, both directly and indirectly (Spooner 2019; Spooner et al. 2023) and also enable other livelihoods–for example, by providing travel and micro-freight support to vendors in markets. Increasingly, the sector is also adopting digital tools from payment systems to ride-hailing and tracking and, hence, are innovating and participating in digital economies (Schalekamp and Klopp 2018; Klopp et al. 2019). Indeed, most people across Asia, Africa, and Latin America and the Caribbean rely on these varied, privately provided shared mobility businesses, and the labor that run them, to access opportunities, jobs and vital services, including education and health care. Thus, popular transportation facilitates and is a key determinant of public health and sustainable and equitable development (Behrens et al. 2019; Campbell et al. 2019; Fried et al. 2020; Hosking et al. 2022).

This essay is designed to facilitate conversations about the popular transport gap: the great gulf between the importance of these modes and their recognition and status in planning, policy and decision-making. The focus is on how to close this gap and why it is important to do so for improving mobility as well as addressing climate, public health, the Sustainable Development Goals (SDGs), and questions of social, environmental, and climate justice. After a brief overview of popular or "informal" transport, we explore some potential, different ways that addressing popular transport and working with the sector, mainstreaming it into plans, strategies,

and investments, can create opportunities for accelerating needed changes in the road transport sector.

Brief Overview

Ranging from bicycles, motorcycle taxis or rickshaws that accommodate one to three passengers to shared car taxis, mini and large buses, and in some cases boats, popular transport is provided by local entrepreneurs, small businesses or cooperatives, and range widely in size, operations capacity and also across regions (Tun et al. 2020; Behrens et al. 2021). Shared basic data is very poor about many aspects of popular transport services (a serious gap), but estimates suggest that they provide the bulk of the motorized mode share for many, if not most, of the rapidly growing cities of the Global South (Behrens et al. 2016; Klopp et al. 2019; UITP 2024).

Popular transport is often called para-transit (instead of transit), or "informal", because of the diverse informalities associated with the sector–in their labor relations, service provision operations, and business models. Less recognized is what causes these diverse informalities as well as the benefits of these systems. First, where public transport exists, popular transport fills gaps in this service and also provides critical last mile connectivity for institutionally supported public transport transit systems. This service is provided at little to zero cost while enhancing ridership. Thus, these modes work as an essential part of the functioning of multi-modal public transport systems (UITP 2024). In many places, particularly in African cities, they are the main, and in some cases, only form of public service (Behrens et al. 2016). Second, these forms of shared mobility provide a great deal of livelihood and job support

in communities with high youth unemployment (Mutongi 2017; Hart 2016; Sopranzetti 2018). Third, widely used because of speed, availability and/or cost, these businesses also often pay for formal licenses and fees creating government revenue and supporting access and transport services with usually no government budget or investment.

The question of how informalities work in popular transport are often poorly understood and recognized. Different kinds of informalities that emerge in relation to these systems often stem from government failure and complex interactions and overlaps between government officials and popular transport (Klopp and Mitullah 2015; Sopranzetti 2018). For example, without planning or investment in public transport infrastructure and services by the government in certain areas, people who are unable to afford private means need mobility services. This creates demand for services which is filled by popular transport operators. These operators, then, also have to create their own infrastructures, for example, a bus stop, as well as do their own planning, including of routes. They then negotiate with state actors to attain various degrees of recognition and regulation. As popular transport businesses fill critical mobility needs in this context, they may become the target of police extraction and, to continue to provide service and employment, the businesses or those who work in them may choose to pay a police bribe–another form of informality that involves state actors abusing their office.

These kinds of informal transactions, as well as the involvement of government employees in the sector, in turn, may undermine enforcement of safety rules, creating many problems (Klopp and Mitullah 2015). Informal labor contracts also often generate

mistrust between owners and drivers, as well as incentivize speeding and violation of other traffic rules, contributing to an epidemic of crashes (Kelley at al. 2024). Hence, while these popular transport systems are often deeply rooted in communities (Mutongi 2017; Hart 2016) and provide important benefits, the way they are governed and engaged by the state generate some serious concerns that impact public health, climate, and equity. As part of some key problems, however, they must then also be a key part of finding solutions.

Air Pollution, Climate Change, Public Health

While providing access and opportunities to many people, popular shared transport modes are linked to key public health and emissions problems. These include high numbers of crashes and emissions. Their regular use means large numbers of passengers and workers are exposed to high levels of pollution with serious health impacts, including cardiovascular and respiratory illnesses (Ngo et al. 2015; Guzman et al. 2023). For example, two-stroke motorcycles and auto rickshaws, which are popular because of their accessibility and ability to circumvent traffic, can emit more pollution per mile than passenger cars. Minibus systems, widely used in most cities, often rely on modified fuels and old, poorly maintained vehicles, part of a used vehicles recycling economy that can shift serious emissions from North America and Europe to Asia or Africa, undermining climate goals (Boateng and Klopp 2022; UNEP 2020). Given that lower income urban residents tend to use these modes, improving these systems for safety and health–which includes reducing disease-causing emissions–is an important, unrecognized justice issue in the Global South, one

that has parallels with the environmental justice issues facing under-served communities in the United States and elsewhere (Klopp and Boateng forthcoming).

While likely to be worse polluters than many private vehicles, on a per capita basis, many of these popular modes, especially the minibuses, still tend to generate less emissions per capita than private vehicles–which are also often highly polluting used vehicles carrying fewer people. However, we have not adequately researched emissions from popular modes, and a great deal of data is missing, most likely meaning current transport contributions to emissions inventories[1] for many, if not most, metropolitan areas in the Global South are rough estimates–if they exist at all (Mbandi et al. 2023; Kustar et al. 2023). While some existing efforts to quantify popular transport emissions exist, these emissions are not always disaggregated carefully to allow us to isolate the total contribution from popular or "informal" transport even though this is critical for policy purposes (Kustar et al. 2023). To address the complex set of issues around popular transport emissions, it is necessary to properly gather data on fuels, vehicle miles traveled, and the number of vehicles by model and age, data that is conspicuously absent. With more techniques, we can measure pollutants from these modes and understand their specific contributing share to national and local greenhouse gasses (GHG) inventories and the health and equity impacts of this pollution, which the few existing studies suggest is substantial (e.g., Ngo et al. 2015; Guzman et al. 2023).

Another key future area of research and action is to understand not only the contributions to climate change of these popular transport

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1. An emissions inventory is a database of the amount of air pollutants by source discharged into the atmosphere during a year or other time period for a particular place.

emissions but also the impacts of climate change on these systems. Increasing heat and extreme heat days make passengers using these modes, as well as workers, suffer health and income impacts since they typically do not have means to cool air. Increased likelihood and severity of flooding and flash floods are leading to dangerous conditions and losses as well as disruption of services. One innovative and rare study looked at transport and access disruptions of flooding in Kinshasa and estimates US\$ 1.2 million worth of losses a day (He et al. 2021). These are climate injustices and the impacts, as well as the connection to growing "loss and damages" conversations, are aspects we are just beginning to explore. This situation in turn plays into our global struggle to reduce emissions to address both climate crisis and public health concerns.

Popular Transport, the Road Sector, and Transformation

Road transport emissions contribute substantially to GHG and, hence, climate change.[2] Climate change, in a vicious circle, has serious impacts on road transport and health (Hosking et al. 2022). It is clear that large reductions in GHGs are needed to meet global targets to stay within 2°C to avoid catastrophic implications, and this must include the transport sector. Instead, emissions from transport are stubbornly and rapidly climbing with growing contributions from transport related to rapid urbanization in the Global South[3] (Creutzig et al. 2015; Jaramillo et al. 2022, SLOCAT 2023).

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2. In 2019, direct greenhouse gas (GHG) emissions from the transport sector accounted for 23% of global energy-related CO_2 emissions with 70% from road vehicles (16% of global emissions). It is also unclear how well these emissions figures include popular transport emissions.

3. SLOCAT notes that it is the "combustion sector with the fastest CO_2 emissions growth from 2010 to 2019: 18% growth" (SLOCAT 2023).

Road transport is also a major source of ambient air pollution linked to over 4 million premature deaths annually (WHO 2024). This pollution comes from both tailpipe exhaust (incomplete fossil fuel combustion), and tires and brakes which release particles including microplastics (Wang et al. 2023). Adding to this already terrible toll, traffic crashes remain the number one killer of 5-29 year-olds worldwide (WHO 2024). Overall, the environmental and public health costs of our road transport as it currently operates are devastating, and in the Global South popular transport modes and how they operate and are governed are one critically important piece of this global public health and climate problem.

The burdens and costs associated with the road transport sector are also distributed unevenly at all levels, disproportionately affecting vulnerable populations, communities, and countries in the Global South (Hosking et al. 2022; Klopp and Boateng forthcoming). In the last two decades, deaths from air and toxic chemical pollution have increased, with 90% of these deaths in lower income regions, threatening health and economic wellbeing (Fuller et al. 2022). Further, while Global South countries have contributed the least to historical GHG emissions (including in the road transport sector) and hence climate change, many are experiencing severe and growing impacts, and this includes their transport systems, making this a climate justice issue. To add onto this formidable set of challenges, as we have noted, the forms of road transport most used by vulnerable groups and communities in the Global South are often simply ignored in climate, transport and health investments. Overall, this makes the transformation of road transport a serious public health and social, environmental, and climate justice issue that demands urgent attention. The good news is that by drawing in the popular transport sector as an ally and providing smart

investments and improved governance, we can potentially accelerate needed transformations to address this problem, and there are growing efforts and experimentation in this direction from which to draw an evidence base for action and scale up.

Untapped Potential from Integrating and Improving Popular Transport

The best framework for addressing current problems in the road transport sector remains the Partnership on Sustainable, Low Carbon Transport (SLOCAT) framework. This Avoid, Shift and Improve framework involves several challenging but clear steps to take: 1) *create* denser more mixed land-use and other interventions to avoid motorized trips; 2) *shift* to low carbon and more efficient shared modes with multi-modal public transport systems at the core of this effort; and 3) *improve*, including by decarbonizing and rendering resilient[4] all transport modes.

Interestingly, lower income communities, typically living in denser and mixed use neighborhoods and using shared mobility, already roughly follow this framework by necessity but, until recently, popular transport has often been neglected within action around this framework (Kustar et al. 2023). Yet, large opportunities may exist to work with the sector to improve these shared modes of transport to both enhance public transport (a necessary condition for modal shift or stemming automobility), reduce emissions and, in the process, achieve global goals for the transport sector, equity, climate justice and the SDGs. Indeed, one model by the

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4. The recent report NASAC and IAP (2024), *Decarbonization of Transport in Africa: Opportunities, Challenges and Policy Options*, has added "Resilience" as a fourth step in this framework.

International Transport Forum[5] suggests that by applying similar improvements to informal transport as to formal bus systems, we could see carbon dioxide emissions decline by an additional 12% by 2050 (ITF-OECD n.p.). Similarly, emissions reductions in popular transport through improved vehicles, operation and infrastructural improvements, and electrification, could have substantial public health and equity benefits (Khreis et al, 2024). However, we need more holistic benefits/cost analysis across transport (including livelihoods and access), environment, and public health, with an equity lens that is inclusive of popular transport.

Even without this analysis, evidence has accrued around the many benefits of popular transport recognition, engagement, improvements and integration. Many of these efforts are occurring at the city level, from electrification by auto-rickshaw operators in India (Harding and Kandlikar 2017; Saxena et al. 2024; UITP 2022) to the efforts by South African cities to improve minibus operational improvements (Schalekamp and Behrens 2010; Schalekamp and Klopp 2018; Saddier, McLachlan and Dass 2019) and Mexico City to help provide finance and capacity for upgrading popular transport (Ciudad de México 2024).

Recognizing the importance of popular transport in the road sector and including its actors in key decision-making and policy arenas, planning and investment plans can help turn mistrust into needed collaboration. Currently, efforts fall into roughly a number of categories and all these actions can be scaled up:

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5. The modeling uses projections of transport activity from analyzing the drivers of demand. It then models how changes in mobility patterns affect CO2 emissions. The Schmidt-Sciences' Climate Institute is working on exploring improvements in modeling decarbonization pathways that include Global South conditions.

1. Creating access to concessional finance for vehicle and other technological upgrades, including electrification with catalytic philanthropic support (Saxena et al. 2024; UITP 2022).

2. Working with passengers and the sector on operational improvements to upgrade services (scheduling, digital technology application, capacity building) (Schalekamp and Klopp 2018; Ciudad de México 2024. See also: digitaltransport4africa.org).

3. Supporting infrastructural re-design and investments– including popular transport in public transport improvements, from dedicated lanes to signal prioritization, improved road design, bus stops and terminals, and NMT connectivity (increasingly important as part of climate adaptation and also for seamless multi-modal public transport integration and last mile connectivity) (Schalekamp and Klopp 2018; SLOCAT 2023; Liotta et al. 2023).

4. Supporting workers who are ultimately at the forefront of transformation with better conditions (less hours, better wages, stronger training, more respect). New work suggests better worker conditions in the minibus sector in African cities are associated with higher passenger satisfaction and may reduce crashes (Behrens et al. 2023; Kelley et al. 2024).

5. Investing in adequate, collaborative, and shared crosscutting data collection and research that focuses on improvements and measurements of real multidimensional and holistic impacts of these kinds of changes. This will help support smart integration of specific measures and investments in popular transport within sustainable transport, climate

and public health planning and investments. This includes improvements in air pollution and public health, and hence cost savings on health budgets; and carbon reduction, and hence inclusion in transport decarbonization pathways and also Nationally Determined Contributions (NDCs) (Kustar et al. 2023; GIZ et al. 2024).

We are at the cusp of a new paradigm, one that aims to overcome the popular transport policy gap and the injustices, costs, and human suffering around its neglect. This is by no means easy as we continue to also struggle to implement the Avoid, Shift and Improve framework in our cities (SLOCAT 2023). However, by recognizing, including and supporting popular transport users, workers and operators, and engaging them in these efforts, we gain critical allies in our ongoing and ever more significant inter-twined struggles for sustainable cities, justice and planetary health.

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12.

Sustainable Cities in the Gulf Cooperation Countries

Mohamed Abdelraouf

Nowadays, more and more people are moving to cities. Experts predict that the world's urban population will double by 2050. The Arabian Gulf region is experiencing tremendous change and challenges over the past 30 years, especially in its urbanization sector. Gulf cities are growing rapidly with many rural residents either migrating to or working in the cities. The region is known for its massive projects and the subsequent over-the-top carbon footprint they leave behind. To address this, there has been a growing interest in sustainable cities in the region.

As the Gulf region becomes more urban, city development needs to adapt to handling the challenges that come along with it, including meeting citizens' needs and aspirations for an improved quality of life, reduced pollutants, increased efficiency, better services, employment, and affordable cost of living. As climate change becomes a growing universal concern, countries have initiated and formulated policies to protect the environment and promote

a greener planet. Sustainable cities are a crucial way to achieve this goal without compromising urban development, as they address social, economic, and environmental impacts through urban planning and city management. A sustainable city incorporates eco-friendly alternatives into urban infrastructure.

The importance of these so-called smart cities is further underlined by the fact that the universal agenda for the United Nations (UN) Sustainable Development Goals (SDGs), specifically SDG 11, calls on making "cities and human settlements inclusive, safe, resilient and sustainable" (UN 2015). There is a clear recognition by the international community that sustainable cities in our modern world play a crucial role in achieving sustainable development and realizing many other SDGs on energy, water, climate change, employment, etc. There can be little doubt that a sustainable city possesses numerous advantages for emerging countries to consider, for instance, reducing costs, providing a cleaner and more vibrant environment, embracing biodiversity, enhancing water management and food production, and contributing to overall public health.

This paper covers different concepts of sustainable cities, provides some insights about the Arabization of SDG 11 along with examples of sustainable cities in the Gulf Cooperation Countries (GCC), as well as the importance of transforming GCC's cities into sustainable ones, and, finally, draws some conclusions.

The Concept of a "Sustainable City"

Recently, many terminologies around cities have emerged in literature to identify sustainable, smart, future city concepts.

These include, for instance: Green Cities, Zero Carbon Cities, Ecological/Clean Cities, and Intelligent/Knowledge Cities. In fact, all these different terms boil down to the same idea: "Smart and sustainable" cities.

A "smart city" is a developed urban area that supports sustainable economic development and a high quality of life by focusing on multiple key areas: economy, mobility, environment, people, living, and government. Excellence in these key areas can be achieved through strong human capital, social capital, and Information and Communications Technology (ICT) infrastructure.

A smart city is a unified urban entity with three critical layers, all planned, developed, and managed as integral parts (Abdoullaev 2011). The first layer incorporates the digital and technological aspects, through things like multi-play telecom networks, ICT spaces, sensor networks, etc.

The second layer covers the environmental sustainability dimension where the key focus is on green and environmentally friendly spaces. This would be achieved through natural capital and things like increasing natural urban zones and eco-friendly buildings. The third layer covers the knowledge aspect, which includes learning, innovation, and incorporating sustainability into the social sphere, especially through human interactions.

An example of an existing smart city is Singapore, where the city functions on fully smart alternatives such as cameras monitoring the cleanliness of public spaces, crowd density, and movement of vehicles, ensuring the safety of senior citizens, and monitoring energy use, water, and waste management.

Another concept is the "Happy City" as outlined in the book *Happy*

City: Transforming Our Lives Through Urban Design published in 2013 by Charles Montgomery. He makes his case by explaining how the manner in which we build our cities alters the way we feel, think, and behave as individuals and as a society. Montgomery argues that the "Happy City," the "Green City," and the "Low-Carbon City" are the same place, and we can all help build it.

At the same time, it needs to be understood that the dynamic concept of a "Happy City" differs from one place to another depending on the environment, culture, and socioeconomic conditions, among other factors. The beauty of this is that it allows for diverse cities with diverse interpretations of happiness and how to achieve sustainability. It also differs through time because it should respond to people's evolving needs that change over time, for many reasons, but largely according to economic conditions. Then, the first step is to establish and identify the basic and different needs of each city.

About the "Sustainable City"

There are many definitions for the term "sustainable city," for this paper, we will refer to the following:

> *A Sustainable City enables all its citizens to meet their own needs and to enhance their well-being, without degrading the natural world or the lives of other people, now or in the future. (Brebbia, Tiezzi 2006)*
>
> *Sustainable Cities are environmentally safe, socially inclusive, and economically productive. (Lian, Gunawansa, Bhullar 2013)*

Sustainable cities should act as a self-sufficient and sustainable body

that provides investment in economic opportunities, employment, basic services, recreational and cultural activities, health, education, and housing. It will help contribute to Gross Domestic Product (GDP), solidarity, social cohesion, social harmony, and the integration of ecological principles.

The term adopted in this paper is "sustainable city," as this is the term adopted in SDG goal number 11. The paper specifically focuses on the principles of living within the context of the environment. Besides, being sustainable means that the city excels socially and in various other aspects such as mobility, IT, knowledge, etc. A sustainable city is a key mechanism for achieving SDGs. It guarantees the welfare of citizens, a healthy environment, and economic prosperity at the same time.

The discussion of sustainable cities and their relations with sustainable development started in the 1990s. "Sustainable cities should meet their inhabitants' developmental needs, without imposing unsustainable demands on local or global natural resources and systems" (Satterthwaite 1992, 3; United Nations 2013). The term "Sustainable City" was included in the "Agenda 21" outcomes of the United Nations Conference on Environment and Development (UNCED) in 1992, which discussed how the environmental, social, and economic factors should be part of the sustainable city's framework. The concept of a sustainable city emphasizes the importance of environmental policies and good governance in order to create green sustainable cities (Lian, Gunawansa, Bhullar 2013).

A sustainable city requires urban planning and city management designed to address social, environmental, and economic impacts. Sustainable cities provide eco-friendly alternatives to urban lifestyles

and sustainable initiatives to promote environmental protection. According to ecocity builders, it is the "human settlement based on the self-sustaining resilient structure and function of natural ecosystems." A sustainable city meets the needs of its residents without allowing for the consumption of more renewable resources than it produces. Ultimately, as cities become sustainable, they create a more attractive and beneficial place for people to live, work, and invest, which in turn enhances the potential for job creation, inward investment, and economic growth.

The ecological impact of the inhabitants of a sustainable city mirrors supportive planetary lifestyles and the "social order" reflects the "fundamental principles of fairness, justice, and reasonable equity." An example of this is in Copenhagen, Denmark, as the country offers eco-friendly alternatives and limits greenhouse emissions. For instance, local hotels offer bicycles for guests, only 29% of households own a car, and there is widespread encouragement of organic eating.

Several existing cities have already implemented the criteria of sustainable living, including Vancouver, in Canada, Amsterdam, in the Netherlands, and Curitiba, in Brasil. These cities followed the main elements to being sustainable; building pedestrian-friendly infrastructure making their city more walkable thereby reducing reliance on vehicles, accessible public transportation to reduce emissions and traffic congestion, green spaces and parks, and sustainable buildings that should limit and significantly reduce energy consumption, a combination of residential, commercial and retail areas to reduce the need for long commutes, and the use of smart technology to enhance efficiency and sustainability of urban spaces.

SDG 11 (UN 2015) focuses on improving cities and urban areas and

making them more sustainable by offering affordable housing and sustainable public transportation thus reducing their environmental impact. Moreover, SDG 11 is intersected with all other SDGs and improving any one of the other goals will help in achieving this goal as well. Transforming cities into more sustainable ones is integrating a holistic plan into governmental actions and policies. It demands strong management among different sectors, such as transportation, public finance, energy, and infrastructure. This is challenging and will take a long period of time to achieve. Furthermore, SDG 11's specific targets need to be evaluated by using specific standards and multi-scale instruments such as national urban development plans that incorporate SDG 11 values (ICSU and ISSC 2015).

Cities, like people, face their own goals and challenges. In other words, on an individual level, residents of a city have their own dreams of how they want to live. These are hindered by certain challenges that are faced in any city, at any time or place, just as one is faced with worries about obstacles that might stop them from meeting goals. This idea is conceptualized in the below figure which shows how SDGs can reconcile the "dreams" of a city with its "worries."
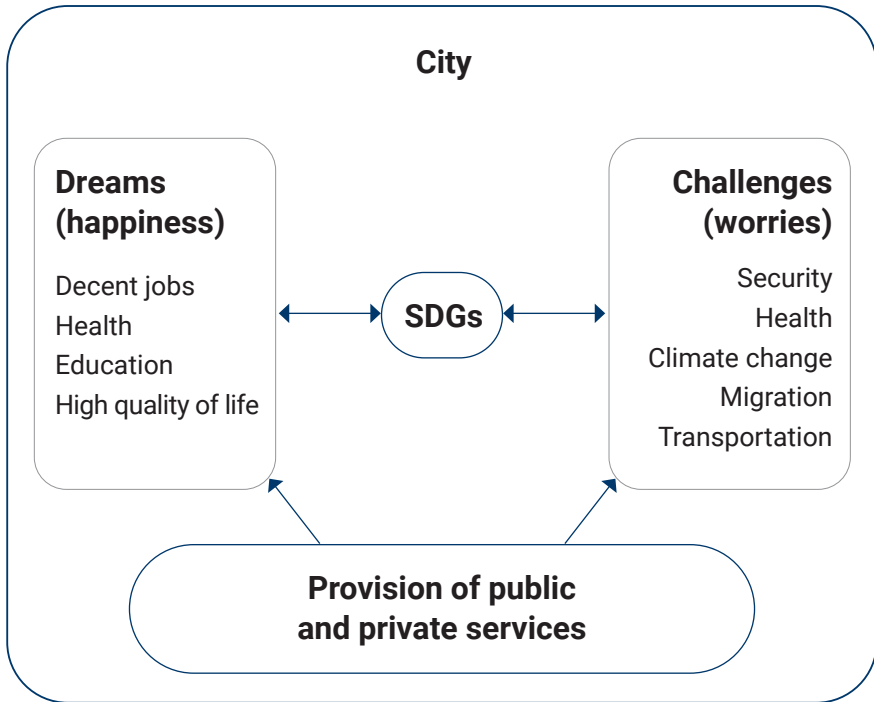
Figure 1. SDGs and the Local Context of Any City.
Source: Author's elaboration.

The Arabization of SDG 11

By developing this idea, we can state that the designs and concepts behind the Gulf cities were affected by three main factors:

1. The culture, design, and structure of the Islamic city (Madinah, Saudi Arabia) as seen in the cities of Baghdad, Damascus, Cairo, Tunis, Amman, old parts of Jeddah, Dubai, and Muscat, among others. The Islamic culture is the cornerstone for urban design and development in all

its political, economic, social, and architectural details. Cities across the Arab World feature a masjid (mosque), the medan (square), the souq (the traditional market), and an interior courtyard characteristic of residences in the region. Unfortunately, after colonization, this traditional style has changed dramatically and only parts of these cities still have the traditional touch.

2. The climatic and geographic conditions in the region are arid, with frequent sandstorms, low vegetation, and non-arable lands, thus the major urban areas across the Arab World are either desert cities like Riyadh, coastal cities like Dubai, Casablanca, and Alexandria, or river cities like Cairo, Baghdad, and Damascus.

3. The colonization period introduced modern Western style into the design, planning, and construction of cities, in addition to modern techniques in mobility, cooling, etc. These, coupled with population expansion have resulted in a change in cities across the region, making them similar to Western cities (UN-HABITAT 2012).

It is worth mentioning that in the Arab and Gulf regions there is a unique difference between a city and a village where the village inhabitants have a common profession, such as a fishing village or a tourism village, regardless of its size. On the other hand, a city is composed of diverse values, professions, and issues, which is the case in the majority of modern cities regionally and globally.

Sustainability in Traditional Cities in the Gulf Region

There are many sustainability aspects, whether in construction, lighting, mobility, etc., already embedded in the design and structure of the old traditional cities in the region. These sustainability aspects were mainly based upon some of the Islamic principles such as "avoidance of harm, [damage], or loss having priority over... profits or benefits." A few examples of sustainability in traditional cities regions are:

- Only hand-made and traditional crafts were allowed in the old traditional cities, whereas polluting industries were left out of the city in order to protect inhabitants and improve the quality of life in the city.

- Extension of horizontal construction and limiting vertical construction to ensure that the highest building was always the Masjid. This horizontal expansion guaranteed that the different quarters of the cities would not be overcrowded, and public services would be most efficient.

- Considering climatic conditions (such as weather trends) in the planning and design of urban development. These conscious responses to the environmental conditions began by choosing the city location according to the best climatic and geographic conditions.

- Homes were designed with an inner courtyard, allowing for better ventilation, shade, and a reduction in the impact of wind and dust storms. This space also allowed for a tranquil space in the home, conducive to a better quality of living.

- In addition, climatic conditions were taken into consideration

when planning the city streets, i.e. the direction of the streets from north to south allowed for the movement of the pleasant northern winds through streets to reduce the hot temperatures.

- Further shading the streets and controlling the high temperatures were relatively high buildings on both sides of the streets. Moreover, the first-floor balconies usually extend out and above the street to help further shade the street. In some cases, like the traditional souqs, streets are fully shaded to protect the public from the sun and heat. One can still see this style in many traditional markets around the region.

- Examples of effective conventional methods for keeping, storing, and delivering water include the falaj system in the Kingdom of Saudi Arabia, the United Arab Emirates (UAE), and Oman, the khettara in Morocco, and foggaras in Algeria. These are excellent, more primitive methods of water management and irrigation in cities that allow water access for households, agriculture, and other needs.

- Harmful industries that produce smoke, malodor, or intrusive noise like lime, tannery, and pottery industries, were built on the outskirts, away from the housing blocks.

- Uninterrupted traffic flow contributes to the organic unity of urban fabric in traditional cities. Roads were typically narrow, shadowed, and winding alleyways, perfect for wind movement and pleasant for pedestrians. It left them eager to see what was around the corner because of the streets' blind curves. Even today, it is very difficult for cars to move around most of the streets in traditional cities and this in turn

has resulted in low pollution and less CO2 emissions. Only traditional transportation, like donkey carts and bikes, can move freely on these streets.

From this one can argue that the principles of sustainable development in architecture and city planning in the Arab World have played a role from the very outset of the development of these cities, long before the Sustainable Development Agenda. People back in those times were living a healthy, happy life in harmony with nature.

Sustainable Living and the Gulf Cooperation Countries (GCC)

Subject to the tremendous growth that has occurred in the Gulf region and given that sustainable cities are crucial for developing society, Gulf Cooperation Countries (GCC) have begun to initiate several innovative plans to create a more sustainable environment in the region. Globally over the years, cities have become more and more congested. It has been estimated that urbanization will increase by 600 million people by 2030 and more than 5.6 billion are expected to constitute the urban population by 2050.

In the Gulf region, the urban population is expected to increase by 30% between 2020 and 2030 and 90% by 2050. It has been predicted that the Saudi urban population will increase from 83% to 90% between 2023 and 2030. Similarly, other countries in the region follow suit, as Dubai and Abu Dhabi have already emerged as megacities in the UAE, and the largest city in Qatar, Doha, makes up almost the whole population of the country, amounting to 2.38 million people in Doha, out of 3.11 million people, as of 2022 (Sons 2024).

On that note, Gulf Cooperation Countries need to implement a sustainable criterion to alleviate the damages that come as a result of this development. Creating a sustainable city would first require addressing existing issues in the region. For instance, the consequence of rapid urbanization impacting climate change, insufficient public transportation, as well as equitable and inclusive health urbanism and air and water pollution are all significant challenges to sustainable development in the GCC. With this, emerging sustainable cities should be taken as a priority within the region's development agenda. Fortunately, the Gulf countries have taken the initiative to promote sustainable living and follow the sustainable city checkbook.

The Gulf Cooperation Countries are aware of the importance of sustainable cities. Each member country places sustainable development and greener initiatives as part of their national visions and agendas and cooperates with international organizations to achieve this goal. The drive for sustainable cities emerged in the transition from developing to smart civilizations, with technological innovations such as artificial intelligence, cloud computing, and big data. Throughout recent years, GCCs, predominantly Saudi Arabia and the UAE, have integrated the concept of smart cities and projects into sustainable development. These cities include Masdar City, Abu Dhabi (UAE), Neom (Saudi), Lusail City (Qatar), Saad Al-Abdullah City (Kuwait), and The Sustainable City Yiti (Oman).

The following table displays key information on current and future urban demographics in the Gulf Cooperation Countries.

UAE	
Current Population (as of August 2024)*	Current Urban Population (2022)**
11,027,129	**8,265,048**
Future Initiatives	

The UAE aims to achieve Net Zero emissions by 2050. The 2050 initiative aligns with the Paris Agreement which calls on countries to establish long-term strategies aimed at reducing greenhouse gas emissions and limiting the rise in global temperatures. The country is already moving steadily towards the 2050 vision. Stakeholders in key sectors such as energy, economy, industry, infrastructure, transport, waste, agriculture, and the environment have been regularly updating relevant plans, strategies, and policies and initiating projects to achieve the goal of net zero. The country has invested over $40 billion in renewable energy to date. Current trends predict the production capacity of clean energy to reach 14 Gigawatt (GW) by 2030.

Saudi Arabia	
Current Population (as of August 2024)*	Current Urban Population (2022)**
37,473,929	**30,380,961**
Future Initiatives	

The Saudi & Middle East Green Initiatives programs are working towards the reduction of emissions as part of the national Vision 2030. Efforts across the Kingdom have begun: 2.8 GW renewable energy capacity, 520,000 homes could be powered by installed renewables, 3.3 GW renewable energy capacity are under development, 7 new renewable energy projects tendered in 2023, and 8.4 GW renewable energy capacity under construction. Saudi Arabia expects to achieve net zero by 2060.

Qatar

Current Population (as of August 2024)*	Current Urban Population (2022)**
3,058,661	**2,676,741**

Future Initiatives

Qatar's Ministry of Transport has created the Transportation Master Plan for Qatar-2050 to initiate a roadmap for investing in land transportation infrastructure in a way that ensures their integration with land uses, urban development, population growth, and meeting future demands for transportation while maintaining sustainability as a core aspect of the Master Plan.

Kuwait

Current Population (as of August 2024)*	Current Urban Population (2022)**
4,934,507	**4,268,873**

Future Initiatives

Kuwait pursues goals to preserve the environment, reduce damaging emissions, and transition to renewable energy and clean fuels following the Paris Agreement on Climate Change and Carbon Neutrality by 2050. As an incentive, Kuwait Oil Company collaborated with U.S. technology solutions company KBR to produce 17 GW of renewables and 25 GW of green hydrogen by 2050.

Oman

Current Population (as of August 2024)*	Current Urban Population (2022)**
5,313,027	**4,051,701**

Future Initiatives

Oman has also committed to achieving net zero emissions and to decarbonize by 2050. The Ministry of Energy and Minerals has developed an ambitious green hydrogen strategy and redefined the structure of the green hydrogen sector. It will provide a strategic opportunity for Omani and international companies to partake and cooperate in energy security, economic diversification, and climate change mitigation. Oman established HYDROM, which is a fully owned autonomous subsidiary of Energy Development Oman SAOC as one of the key projects to work towards the goal.

Bahrain	
Current Population (as of August 2024)*	Current Urban Population (2022)**
1,612,049	**1,321,226**
Future Initiatives	
The Bahrain Natural Strategic Plan for 2050 emphasizes renewable energy adoption, water preservation, and sustainable waste management to promote a more environmentally sustainable country. Bahrain has already seen significant progress towards their strategic plan: the Industrial Sector Strategy (2022–2026) and the Strategic Projects Plan profited an investment of $30 billion in Bahrain's national infrastructure, and as of May 2023, 80% of the country's GDP is generated from non-oil sectors.	

* Source: https://www.worldometers.info/population/
** Source: https://www.macrotrends.net/global-metrics/countries/topic-overview

Examples of Sustainable Cities in the GCC

Masdar City

Located in Abu Dhabi, Masdar City is an innovative and sustainable community committed to evolving research and development and setting a standard for urban communities. The advanced city possesses a strong ambition to achieve a sustainable environment, which was passed down through the generations, making sustainability a long-lasting priority in the UAE.

Masdar City's multi-institutional projects are working towards eco-friendly transportation development. As the city designs an interconnected sustainable mobility system, it is hosting the Smart and Autonomous Vehicle Industries (SAVI) in Abu Dhabi. This initiative brings significant opportunities for the country, including investors and stakeholders, advanced technology, Research and

development (R&D) labs, and a pedestrian-friendly design. By creating eco-friendly modes of transportation, such as the Personal Rapid Transit System (PRT), the NAYVA autonomous shuttle, and the Eco Bus, the city is committed to elevating the regulatory framework for air, land, and sea transportation.

Research on enhancing healthcare with specialized companies is another element in Masdar City's initiatives. The city is the home of pioneering companies such as Insilico Medicine, XLife Science AG, CellSave Arabia, Oxford Nanopore Technologies, Prepare Labs, and more, which have been shaping the future of healthcare and R&D. As of late, Masdar City has been appointed as Middle East Headquarters for global organization Attentive Science, as part of their global expansion. This makes the sustainable city a hub for research services in biotech, pharmaceutical, and animal health industries.

Exploring the space technology domain for enriching data storage and computing services is also a part of Masdar City's goals. As part of their goals, Masdar and the UAE Space Agency initiated a business incubation and acceleration package for start-ups in the space sector. This means an increasing number of funds and investments for the city to advance its expertise in the astronomical domain, as an opportunity to enhance innovative and advanced technology, which contributes to the goal of sustainable living.

NEOM

NEOM is a Saudi renowned global hub for businesses, with the aim to build an eco-centric future and sustainable economy, creating opportunities for potential talents and enterprises. According to

NEOM's model, it aims to preserve, protect, and regenerate nature and planetary systems. What makes NEOM a sustainable city is the drive to reimagine city life into one that is nature and people-friendly, putting the well-being and development of society first. As part of achieving these ambitions, NEOM has initiated a project called "The Line" which is a cognitive city that upon completion, will stretch across 170 kilometers, towering 500 meters above sea level, and a land-saving 200 meters wide.

The Line will not possess transportation methods like roads or cars, eliminating their related emissions, but will operate on 100% renewable energy and 95% of its land will be preserved for nature. In turn, this would achieve a significantly reduced infrastructure footprint, as the health and well-being of people will be prioritized over transportation and infrastructure development, breaking the status quo of traditional cities.

In terms of socio-economic innovation, NEOM targets to create over 100,000 new jobs, with investments in education, healthcare, and living conditions opportunities to promote socio-economic innovation by 2030. The NEOM project attracts the young ambitious community, as they partake in the opportunity to transform the Kingdom's economy and global presence. The project also aims to diversify Saudi Arabia's economy, away from oil, attract foreign investment, and inaugurate the country as a pivotal player in commerce and technology.

This has the potential to create increased employment demand and opportunity for the future. Another socio-economic opportunity the project would provide is increased tourism. According to NEOM's Social Responsibility Report for 2023, it has been revealed that 50,000 people in local communities have already benefited

from the NEOM social responsibility programs over the course of a year. A demonstration of this is NEOM's initiative to award 26 projects to Tabuk companies, securing employment opportunities for 583 people from NEOM and Tabuk.

This aligns with one of NEOM's primary development goals, which is to create more job opportunities, which would result in a more secure and innovative society. Moreover, NEOM's incorporation and introduction of The Line aligns with the features of a sustainable city including green buildings and architecture, renewable energy, and nature preservation.

Lusail City

Qatar's second-largest city after Doha, Lusail City extends 38 square kilometers (km), housing four exclusive islands and 19 multi-purpose districts expanding from residential, entertainment, and commercial spaces. While being the hub for prime entertainment, sports, and more, Lusail City aims to preserve greenery and reduce the carbon footprint by creating walkways, sports fields, and bicycle lanes, etc. These also contribute to sustainable living and promote the health and well-being of the public.

Lusail City's strategy is to protect on-site natural habitats and promote biodiversity through expansive landscaping. Around 40% of the total vegetation will be plant species native to the region. This is aimed at committing to green landscapes across the 38 square km area, allowing inhabitants to live in harmony and preserve greenery and sustainability. For instance, Lusail City's goal to limit water consumption is displayed through the Wadi Conservation Park, which utilizes an open space system to present the natural

functioning of original Wadi systems to recycle rainwater. Moreover, with more than 33 parks in the city of Lusail, in just one of its areas, the Fox Hills district, we witness the promotion of biodiversity and life in harmony with other biodiverse habitats.

South Saad Al-Abdullah City

South Saad Al-Abdullah City is a project located in Kuwait and is the home of 22,000 residential units. These housing units meet the needs of over 150,000 people and feature sustainable and digital innovations such as centralized rainwater management, integrated sewage treatment, solar lighting, and intelligent monitoring and construction systems that target improvements in local infrastructure and living conditions.

As the project is in the process of development, external companies, even from fellow GCCs have signed agreements and investments to further the development of the city. This includes Saudi's HanmiGlobal and Bahrain's Al Amari Group.

Yiti Sustainability City

Designed by the Oman Tourism Development Company (Omran) and Diamond Developers, Yiti is a project aimed at meeting the highest standards of social, environmental, and economic sustainability. The city utilizes clean energy, water and waste management, food production, clean mobility, and enhanced air quality as a target for achieving net zero energy in Oman.

The Sustainable City Yiti received awards for "Best Sustainable Project" and "Best Sustainable Development" at the Dossier

Construction Awards and Summit in November 2022 for being the largest sustainable community. Since the project aims to meet the highest standards in development and sustainability, Yiti has committed to the features of a sustainable city through recycling, vertical farming, and the adoption of sustainable transportation.

Challenges Facing GCC's Sustainable Cities

Nonetheless, it is acknowledged that GCC's cities have many challenges such as expanding urbanization, traffic congestion, water issues, electricity, garbage disposal, and land use issues. Below is a breakdown of each challenge.

Water Issues

Urban water system challenges are huge across the region, given the limited availability of freshwater in the region. This has for decades presented a significant challenge to the local people and governments. Scarce rainfall together with a high rate of evaporation and consumption, leads to deficits in the water budgets of the countries of the region.

The increased pressure on water resources in Gulf Cooperation Countries has come because of population growth, changes in lifestyle, industrialization, urbanization, and climate change. All of these have compounded the already arid climate, leading to water scarcity and increased competition for water supply for agriculture, industry, and households throughout the rapidly growing cities in the region.

The region falls below the water poverty line, meaning that the

average water availability per capita is lower than the critical amount of 1,000 cubic meters per year per capita. The lack of water availability in the region forces GCCs to rely on non-conventional water resources such as desalination technology, which is expensive and produces by-products that are harmful to the environment. However, one must say that desalination costs technological improvements, process optimizations, standardized designs, and renewable hybrid configurations, meaning that the price tag for desalinated water is expected to drop considerably over the next 10 to 20 years. Industry projections estimate overall desalination costs will decrease by upwards of 50% by the year 2030.

Energy Security

Energy security plays a crucial role in supporting the Gulf Cooperation Countries to advance their cities into more sustainable cities. Smart and Sustainable cities depend completely on the electrification of almost everything. GCCs are rich in traditional energy sources such as oil and gas and are also fortunate to have an abundance of clean renewable energy sources in their countries, such as solar and wind energy.

In addition, the energy sector is directly connected with other sectors in these countries, such as food security, water security, and transportation. Therefore, advancing and developing the energy sector sustainably will allow GCC's cities to improve the other related sectors in their countries. In the meantime, GCCs are mostly reliant on fossil fuel and seawater desalination to generate electricity. The overuse of fossil fuel in GCC's cities, in the long run, will create a major problem if no shift to clean renewable energy is made by using more sustainable resources.

However, GCCs have recently pursued ambitious programs of energy transition towards more clean and green energy sources such as wind, solar, and hydrogen which is a must for a sustainable city's future in the region.

Green Policies

There is a crucial demand for changing GCC's cities, lifestyles, and ways of thinking to achieve sustainable development for Gulf Cooperation Countries' cities. The most important element needed is having suitable green policies that will guide us to build sustainable cities. The UAE has set a perfect example of green policies to reduce their greenhouse gas (GHG) emissions and get financial benefits from their new strategy. The UAE has also adopted the green building approach and green policies in the last few years, such as a sustainable transport policy, diversification of sources of energy policy, cleaner production policy, and efficient use of natural resources policy.

Adopting these policies has helped in energy and water cost reduction. These policies helped in creating a strong strategy that shifted the national economy to a green economy. On the other hand, there is a lack of financial and non-financial incentive programs that could support suitable policies to change unsustainable behaviors.

Waste and Waste Management

The increased waste in the GCC's cities is one of the biggest challenges that demands integrated waste management in a sustainable manner. However, one must say that each GCC has a very good municipal system to deal with waste. The biggest challenge is the changing nature of waste types in GCC's cities

which evolves every few years. This is due to the reliance heavily on expats working in the region and every few years new experts and workers come from other countries, thus bringing their habits and their types of waste. So GCC sustainable systems need not only laws and regulations to deal with this issue but also a smart system that can adapt to these changing types of waste every few years.

In short, the Gulf Cooperation Countries face many challenges in order to achieve sustainability in their cities. Transferring cities in GCCs is a big challenge that requires collaboration among different stakeholders and different sectors.

Sustainable cities are a result of a collaborative long-term strategy that tackles many challenges in different economic, social, and environmental aspects. Cities recognize the need for a sustainability strategy that can cope with the change in the demand of the increasing population. When the number of people increases, so does their demand for food, water, and natural resources. Transferring cities into more sustainable cities will have positive impacts on the people, economy, and the environment. It will increase job opportunities and drive GDP growth.

Another important point is that environmental awareness will increase in societies. Services such as health and education will be affordable and accessible. The city's authority will gain the knowledge to reserve energy, use natural resources and innovations to develop the country (Ericsson 2013).

There is another benefit of achieving Sustainable Cities in the Arab world, this means that the electricity and energy consumption per capita will decline and save about $73 billion annually (Abu Megly 2013). According to Galal (2013), Sustainable Cities will allow

citizens to get more information about their city through an open updated portal for each city. It also encourages the private sector to find solutions. Sustainable cities are designed to support and help everyone; elderly, children, pedestrians, and public transportation, in order to make our lives easier. In this sense, designing a Sustainable City means offering the best services and high-quality education (Galal 2013).

Conclusions and Recommendations

Across the region, cities and municipalities are facing a wide range of challenges as businesses and citizens demand better, more efficient, and more flexible services. For the region's cities to be sustainable they have to start with the users and then understand the consumers' needs. Hence, sustainable cities are defined by their innovation and their ability to solve problems and that is the only way to avoid citizens' discontent.

As a way to solve problems sustainably, the complete use of modern technology is not recommended. This is very true, particularly in the GCC's cities, where it is very important to understand and respect local conditions, cultures, and traditions. In fact, traditional knowledge and practices, in old urban districts, buildings, transportation, and irrigation systems, can often deliver faster, more reliable, cheaper, and more environment-friendly services for citizens.

However, the author believes that in modern cities, like most cities in the GCCs, municipalities have to adopt a mix of both traditional and modern technological innovations. For instance, in some areas of the city, especially old ones, traditional, smart mobility

methods could be more favorable, consumer-friendly, cheap, and sustainable and even act as a tourist attraction. In new quarters of the cities, authorities can depend on new, smart, and clean means of transportation.

Unlike many researchers, the author believes that there is no "one size fits all" model for sustainable cities. Each city has its own socioeconomic and geo-political condition that imposes different sustainability solutions. This implies that integrated urban planning is a key to sustainable cities, i.e. including a strategy and plan for the renewal of old and large cities instead of building sustainable cities from scratch.

Sustainable Cities should adopt and implement urban policies and programs that are consistent with the green economic strategy of the country. In other words, a starting point for sustainable cities is the development of a green economic strategy, as in the case of the UAE. A sustainable city must have enough free space around it that serves it environmentally and economically for its future expansions and services since one cannot achieve sustainable cities without the development of sustainable energy. Energy is the key for all other sectors and affects all life aspects in the city.

In this regard, it is also relevant to note that citizen participation is very important to provide innovative and creative strategies or policies that would promote sustainability in their countries. A wise sustainable city authority will inform citizens of the current projects and invite them to give feedback. Seoul, for instance, represents a perfect example of developing an online policy system that allows its citizens to share and discuss their ideas with the city's authority regarding suitable policies for a specific issue (Monitor Deloitte 2014).

This model of sustainable development needs to take into account local specificities. The traditional character of the city in the GCC regions must be maintained, considering the needs of the present and future growth. Therefore, here are some recommendations for the progress of these cities in the Gulf region:

- Encouraging the trend to revive the traditional use of a Masjid (Mosque), not only as a place of worship but also as a center of educational and social change.

- The Souqs (traditional markets) are well-fitted according to their status and design to play an important role in the trading style of the modern city. Its maintenance and preservation are the key to maintaining its role and beauty. These markets present an excellent model for the design of modern shopping centers.

- The establishment of new industries must be outside the cities to mitigate environmental impacts on cities.

- Cooperation is only effective when it responds to the city's local priorities, strategies, and objectives set by an open dialogue between all parties involved.

- Recognizing the importance of knowledge exchange and learning together with other cities in the region and globally.

- Pillars of good governance are perhaps the most important factor in shifting towards a sustainable city in the Middle East and North Africa region.

- The "Top-Bottom" or "Bottom-Up" approach goes in parallel with sustainable city practices.

- There is a need to work on new cities as well as greening current cities, which is a bigger challenge for the cities in the region.

- Experience has shown that specific environmental problems such as water problems are usually addressed by employing a "policy mix" consisting of:

  › Various Command and Control Instruments (CAC) such as penalties and fines.

  › Economic Instruments or Market-Based Instruments (MBI) such as incentives.

  › Awareness and educational programs also known as Persuasive Measures.

The sustainable cities of the GCCs have set ambitious goals for a sustainable and smart future. Following this analysis, it can be argued that each city has the aim to set sustainable measures according to the sustainable city guidelines while integrating smart technology to protect the environment. Numerous initiatives and programs were introduced in each sustainable city. They all share the priority of renewable energy and the well-being of citizens. However, some of the cities mentioned, including South Saad Al-Abdullah City and Lusail City, are still undergoing developments, then, the cities rely on external investment and funding before commencing with water, waste, transportation, and energy management strategies.

On the other hand, cities like Masdar, NEOM, and Yiti are experiencing progressive growth and development, facing growing numbers of public recognition and creating specific programs for

each sustainability issue. Nevertheless, much still needs to be done before achieving fully sustainable cities to be lived in, as facts and figures on the progress of these programs are yet to be released.

All in all, Gulf Cooperation Countries aim to meet the United Nations Sustainable Development Goals and prioritize the protection of future generations, as they progressively embrace sustainability as a fundamental aspect, resulting in a societal modification toward environmental consciousness.

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13.

China's Urban Green Infrastructure Construction

Xin Dong and Li Zhuang

The mid-term review year for implementing the United Nations (UN) *Transforming our World: the 2030 Agenda for Sustainable Development* was 2023. *The Sustainable Development Goals Report 2023: Special Edition,* released by the UN, indicates that against the backdrop of the pandemic and geopolitical conflicts, progress in most areas of global sustainable development has been slow, and some have even experienced setbacks. According to the Report on *Big Earth Data in Support of Sustainable Development Goals* (2023), referring to the Sustainable Development Goals (SDGs), by 2022 more than half of China's environmental SDGs indicators have achieved the 2030 target ahead of schedule, and the ecological restoration effect is significant. China has made significant progress in various indicators of SDG 11 (Sustainable Cities and Communities), and the ecological greening of urban construction land in China has achieved remarkable results. China has contributed 28% of the globally significant greening areas in urban regions,

despite only accounting for 19% of global urban built-up areas. Around 310 million people worldwide have directly benefited from urban greening, with China's population accounting for about 47% of the global beneficiaries. The achievements of sustainable development in Chinese cities are hard-won. This article summarizes and analyzes the construction experience of green infrastructure in Chinese cities, in order to contribute to the achievement of sustainable goals in China and even globally in the future.

Definition of Green Infrastructure

The idea of green infrastructure was first proposed in the 1990s. In 1999, the U.S. President's Council on Sustainable Development defined green infrastructure as the network of open space, airsheds, watersheds, woodlands, wildlife habitats, parks, and other natural areas that provides many vital services that sustain life and enrich the quality of life, in its report *Towards a Sustainable America: Advancing Prosperity, Opportunity, and a Healthy Environment for the 21st Century* (PCSD 1999, 64). Since then, various scholars and organizations have offered different definitions of green infrastructure, which can be broadly categorized into narrow and broad definitions. Green infrastructure in the narrow sense, as opposed to gray infrastructure such as roads and utility corridors, refers to a green spatial network composed of natural and semi-natural areas that provide ecosystem services for humans and other organisms (Li 2009, 88; Chatzimentor et al. 2020, 1; Nieuwenhuijsen 2021, 317; Huang et al. 2023, 40). The broad definition includes green infrastructure in the narrow sense and greening improvements to gray infrastructure (Wu and Fu 2009,

68). In contrast to the narrower definition, which is mostly limited to the perspective of gardens and green spaces, the broader concept is more in line with the increasingly rich content and role of green infrastructure. Therefore, this article adopts the broad concept.

Urban green infrastructure is based on cities and aims at sustainable development. It includes not only narrow-sense green infrastructure such as urban parks and green belts but also greening improvements to gray infrastructure. Green infrastructure plays an important role in urban sustainable development as a spatial implementation pathway for ecosystem services, including adapting to climate change, mitigating floods, reducing the heat island effect, improving air quality, reducing environmental noise, protecting biodiversity, and so on (Gill et al. 2007; Nieuwenhuijsen 2021, 320–21; Hu and Zhou 2023; Zhao et al. 2024, 464). Green infrastructure also plays an important role in improving the physical health of residents, regulating psychological states, inheriting historical and cultural heritage, shaping urban image, and other aspects of urban socio-economic development (Qiu 2010, 2; Zhao et al. 2024, 464).

According to United Nations data, the global urbanization rate has exceeded 50% since 2007 and continues to rise. It is expected to reach over 60% by 2030. The role of urban green infrastructure in promoting global sustainable development will become increasingly prominent.

The History and Current Status of Urban Green Infrastructure Construction in China

Since the reform and opening-up in 1978, China's urbanization level has been steadily increasing. From 1978 to 2023, the permanent

urban population in China increased from 172 million to 933 million, and the urbanization rate rose from 17.9% to 66.2%.[1] China has completed the urbanization journey that developed countries took hundreds of years to traverse in just a few decades, which determines that China needs to embark on a sustainable urbanization path that is in line with its national conditions. This is also an inevitable choice for China to move towards the era of ecological civilization. Building and improving urban green infrastructure is a crucial guarantee for sustainable urbanization, an important component of ecological civilization construction, and a key manifestation of improving people's livelihoods (Qiu 2010, 5).

At this rare pace of urbanization in the world, China's green infrastructure construction has made remarkable achievements: the area of urban green space in China increased from 82000 hectares in 1978 to 3.586 million hectares in 2022; the per capita area of public recreational green space in cities has increased from 1.5 square meters in 1981 to 15.3 square meters in 2022, an increase of approximately tenfold; the green covered area as percentage of completed area has increased from 16.9% in 1986 to 43.0% in 2022.[2] Since 2022, China's total population has entered a negative growth stage, but the urban population still maintains a growth trend. In 2023, China's urban population increased by 11.96 million people compared to 2022, and the urbanization rate rose by 0.9 percentage points. Both the increase in urban population and the improvement in urbanization rate indicate that sustainable urban

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1. Unless otherwise specified, the data in this paper are sourced from the official website of the National Bureau of Statistics of China. Population-related data only include the population of 31 provinces, autonomous regions, municipalities directly under the Central Government and active servicemen in Chinese Mainland, excluding residents of Hong Kong, Macao and Taiwan, as well as foreigners living in 31 provinces, autonomous regions, and municipalities directly under the Central Government.

2. The data is sourced from the annual *China Statistical Yearbook* and *China Urban Construction Statistical Yearbook*.

development will play a more prominent role in the sustainable development of China and even the world.

Before the reform and opening-up in 1978, due to the social and economic conditions at that time, the institutional framework for green infrastructure in China had not yet begun. The issue of greening has received the attention of national leaders, for example, in 1955, Chairman Mao Zedong issued a call to the people of the whole country to "green the motherland" and "implement land gardening." In 1956, China started its first "12 Year Greening Movement." In 1958, Chairman Mao further pointed out that "we must see forestry and afforestation as one of the fundamental issues for our future" (SFA 2008). However, the construction of relevant systems had not yet started, so the process of building green infrastructure in Chinese cities can be traced back to the era of reform and opening-up in 1978.

Institutional Start-Up Period (1978–2000)

The construction of green infrastructure-related systems was launched, and the urban greening work was mainly focused on protection.

In 1978, the National Urban Work Conference was held in China, and the *Opinions on Strengthening Urban Construction Work* were issued, which put forward the requirements and implementation opinions on improving the work of landscaping and greening, marking a new era for China's urban landscaping industry. In parallel, the construction of relevant systems for green infrastructure was gradually launched. In 1979, China introduced its first environmental protection law, the *Environmental*

Protection Law of the People's Republic of China. In 1982, the State Council announced the first batch of 44 national-level scenic spots, which can be regarded as the beginning of China's national park management system (Qiu 2010, 2–3). In the same year, the former Ministry of Urban and Rural Construction and Environmental Protection formulated and issued the *Interim Regulations on Urban Landscape and Greening Management.* In 1984, the *Forestry Law of the People's Republic of China* was promulgated. In 1992, the State Council formulated and promulgated the *Regulations on Urban Greening*, which is the first regulation on urban landscaping in China (UCDMC 1994, 4), marking important progress in the legal construction of urban green infrastructure.

The idea for the construction of a green infrastructure system in this stage is to prioritize protection and punish behaviors that damage urban greenery. For example, in 1982, the *Measures of the State Council for the Implementation of the National Voluntary Tree Planting Campaign* proposed that "cities should give priority to greening public places such as scenic spots, historical sites, and main streets," and emphasized that "urban green spaces should be strictly protected and not encroached upon or destroyed. Violators should face economic penalties or legal sanctions." The *Regulations on Urban Greening,* promulgated by the State Council in 1992, required that "no unit or individual shall damage urban trees, flowers, plants, and green facilities" and "urban green space management units shall establish and improve management systems to maintain lush trees, flowers, plants, and green facilities in good condition." Several penalty provisions were put forward for acts of damaging urban greening.

After the reform and opening up, China's urbanization began to

accelerate and, while large-scale urban construction was carried out, urban landscaping and greening also made significant progress. In 1978, the urban green space area in China was 82000 hectares, and by 2000, it had reached 865,000 hectares, with an average annual growth rate of 43.4%. The per capita area of public recreational green space in cities increased from 1.5 square meters in 1981 to 3.7 square meters in 2000, representing a 146.7% increase.

System Construction Period (2001–2016)

Clarified the infrastructure attributes of urban greening, established a basic urban green infrastructure system, and focused on planning and coordinated construction as the primary approach.

In 2001, a national conference on urban greening work was held and the *Notice of the State Council on Strengthening Urban Greening Construction* was issued, which clearly stated that "urban greening is an important infrastructure of the city," marking the real starting point of urban green infrastructure construction. In 2007, the former Ministry of Construction issued the *Opinions on Building Conservation-Oriented Urban Landscape Greening*, which once again emphasized that "urban landscape greening is an important infrastructure of the city." *The Guiding Opinions of the Ministry of Housing and Urban-Rural Development on Promoting the Healthy Development of Urban Landscape and Greening* (hereinafter referred to as "Guiding Opinions") issued in 2012 reiterated the infrastructural attribute of urban greening—"Urban landscape and greening are the only living urban infrastructure." While clarifying its status, the construction of the urban green infrastructure system has been continually improved. In 2006, the State Council promulgated the *Regulations on Scenic and Historic Areas*; in 2010,

the former Ministry of Housing and Urban-Rural Development and the General Administration of Quality Supervision, Inspection and Quarantine jointly issued the *Evaluation Standards for Urban Landscape and Greening*; in 2014, the *Environmental Protection Law* was revised. As a result, China's urban green infrastructure system began to take shape.

The emphasis on protection from the previous stage shifted and, from 2001 to 2016, the initiatives on urban green infrastructure focused on systematic planning and construction. The *Notice of the State Council on Strengthening Urban Greening Construction* issued in 2001 required all regions to formulate and strictly implement the *Urban Green Space System Plan*; residential area greening, unit greening, and supporting greening of various construction projects had to meet the standards outlined in the *Regulations on Urban Greening Planning and Construction Indicators*. The "Guiding Opinions" issued in 2012 required that "urban landscaping and greening are inseparable from urban buildings, structures, and various municipal infrastructure, and must be unified planning, coordinated construction, and comprehensive management."

During the system construction period of urban green infrastructure, various indicators of China's urban green infrastructure construction were further improved. From 2001 to 2016, the growth rate of urban green space areas in China declined compared to the previous stage, but still maintained a relatively fast growth rate, increasing from 947,000 hectares in 2001 to 2.786 million hectares in 2016, nearly doubling, with an average annual growth rate of 12.9%. The per capita area of public recreational green space in cities increased from 4.6 square meters in 2001 to 13.7 square meters in 2016, an increase of 200.4%, with an average

annual growth rate of 13.4%, which is faster than in the previous stage. The green-covered area as percentage of the completed area increased from 28.4% in 2001 to 40.3% in 2016. The increases in per capita area of public recreational green space and the green covered area as percentage of the completed area reflect a significant improvement in the urban living environment.

Development and improvement Period (2017–Present)

Large-scale promotion of land greening actions, improvement of urban green infrastructure system through legal construction and connotation extension, combined with urban renewal as a new idea.

The year 2017 marked another milestone for the construction of urban green infrastructure. In 2017, the report at the 19th National Congress of the Communist Party of China (CPC) proposed "carrying out land greening action," marking that China's urban green infrastructure construction had entered a period of development and improvement. In 2018, the National Afforestation Commission and the National Forestry and Grassland Administration issued the *Opinions on Actively Promoting Large-scale Land Greening Actions*, proposing that by 2035 a national ecological security framework will be formed, and the goal of building a beautiful China will be achieved. The *Forestry Law of the People's Republic of China*, as amended in 2019, clarifies the content of large-scale land greening in a legal form, "The state coordinates urban and rural afforestation and greening, carries out large-scale land greening actions, beautifies urban and rural areas, promotes forest city construction, promotes rural revitalization, and builds a beautiful homeland."

At this stage, the urban green infrastructure system has been developed and improved through legal construction and connotation expansion. In terms of legal construction, the establishment and revision of a series of laws and regulations have made the institutional system of urban green infrastructure more perfect. In 2017, the *Regulations on Urban Greening* were revised, as were the *Implementation Regulations of the Forestry Law of the People's Republic of China* in 2018, and the *Forestry Law of the People's Republic of China* in 2019. In 2021, the *Wetland Protection Law of the People's Republic of China* was first promulgated. At the same time, it can be seen from the successive policy documents that the concept and connotation of urban green infrastructure are constantly expanding, which is conducive to further improving the urban green infrastructure system.

In 2021, the General Office of the CPC Central Committee and the General Office of the State Council issued the *Opinions on Promoting Green Development of Urban and Rural Construction*, proposing to "strengthen the construction of urban parks and green spaces, promote three-dimensional greening, and build a continuous and complete ecological infrastructure system." In 2021, the *Guiding Opinions on Accelerating the Establishment and Improvement of a Green, Low-Carbon and Circular Development Economic System* issued by the State Council proposed to "accelerate the green upgrading of infrastructure." In 2022, the General Office of the Ministry of Housing and Urban-Rural Development (MOHURD) issued the *Notice on the Pilot Work for Urban Landscaping Waste Treatment and Resource Utilization*, which requires that "the collection, transportation, and treatment facilities of landscaping waste should be regarded as an important component of urban infrastructure." The *National Adaptation to Climate Change Strategy*

2035, released in 2022, requires "promoting the construction of new urban infrastructure, ensuring systematic, intelligent, green construction and safe and stable operation of infrastructure."

With the development of China's urbanization, the demand for urban renewal has become increasingly prominent. The Central Economic Work Conference at the end of 2019 mentioned "urban renewal," and the *Outline of the 14th Five-Year Plan (2021–2025) for National Economic and Social Development and Long-Range Objectives Through the Year 2035 of the People's Republic of China*, released in 2021, clearly proposed "implementing urban renewal actions, promoting the optimization of urban spatial structure and quality improvement." The problem of aging and upgrading of infrastructure, including urban green infrastructure, is gradually becoming apparent. The notice from the General Office of the MOHURD on organizing the application for the Science and Technology Plan projects in 2020 lists the requirements for "upgrading technology for urban green infrastructure renewal." In 2021, the *Guiding Opinions of the General Office of the State Council on Scientific Greening* proposed to "combine urban renewal, adopt methods such as demolishing illegal buildings, and increase urban green space." The *Notice on Solidly and Orderly Promoting Urban Renewal Work* issued by the MOHURD in 2023 requires the coordinated promotion of urban renewal work, including the renovation of existing buildings, the renovation of old urban communities, urban ecological restoration, and infrastructure renewal and renovation. All these reflect a new approach that combines urban renewal with the development and improvement of urban green infrastructure.

Since 2017, urban green infrastructure has been further developed

and improved, and the living environment has continued to improve. From 2017 to 2022, the area of urban green space in China increased from 2.921 million hectares in 2017 to 3.586 million hectares in 2022, an increase of 22.8%, with an average annual growth rate of 4.6%. Although the growth rate has slowed compared to previous years, urban green infrastructure is still improving. From 2017 to 2022, the green space and square land area in urban construction land increased by 8.9%, which is 1.1 percentage points higher than the 7.8% increase in the total urban construction land area during the same period. The per capita area of public recreational green space increased from 14.0 square meters in 2017 to 15.3 square meters in 2022, an increase of 9.2%, with an average annual growth rate of 1.8%. The green-covered area as percentage of the completed area increased from 40.9% in 2017 to 43.0% in 2022.

Experience of Green Infrastructure Construction in Chinese Cities

Since the reform and opening up in 1978, China has experienced over 40 years of rapid urbanization, achieving remarkable advancements in urban construction. The green area has continued to expand, the number of parks has increased, urban green infrastructure has improved, and the overall living environment has enhanced. The experience can be summarized in three key aspects: systematic planning, continuous investment, and adapting to local conditions.

Systematic Planning

One of the core features of green infrastructure is connectivity,

and the role of planning in achieving it cannot be ignored. Under the unprecedented pace of urbanization in the world, China's achievements in green infrastructure construction cannot be separated from systematic planning. China implements a compact urbanization development model, with a population density of over 10000 people per square kilometer in built-up areas. Under this premise, the green covered area as percentage of the completed area increased from 16.9% in 1986 to 43.0% in 2022, an increase of 26 percentage points; the per capita area of public recreational green space increased from 1.5 square meters in 1981 to 15.3 square meters in 2022, representing about a tenfold increase.

The systematic planning of urban green infrastructure includes relevant laws, regulations, and rules, such as the *Urban and Rural Planning Law of the People's Republic of China*, the *Environmental Protection Law of the People's Republic of China*, the *Forestry Law of the People's Republic of China*, the *Land Administration Law of the People's Republic of China*, the *Interim Regulations on the Management of Scenic and Historic Areas*, and the *Urban Greening Regulations*, among others. It also includes relevant technical standards and specifications, such as the *Classification Standards for Urban Green Spaces*, the *Regulations on Urban Greening Planning and Construction Indicators*, the *Garden City Indicators*, the *Park Design Specifications*, and the *Urban Road Greening Planning and Design Specifications*. It also encompasses relevant policy measures of government departments, such as the *Notice of the State Council on Strengthening Urban Greening Construction*, the *Guiding Opinions of the Ministry of Housing and Urban-Rural Development on Promoting the Healthy Development of Urban Landscape and Greening*, and the *Guiding Opinions of the General Office of the State Council on Scientific Greening*.

Continuous Investment

As the broad definition of green infrastructure includes both the green spatial network composed of natural and semi-natural areas, as well as the green improvement of gray infrastructure, continuous financial investment is required from planning and design to construction and implementation, maintenance, and even renovation. Since the clarification of the infrastructure attributes of urban greening in 2001, China's investment in urban green infrastructure has continued to increase. The investment in urban environmental infrastructure and urban landscaping alone has reached an average of 1.0% of Gross domestic product (GDP) per year. Since 2002, China has invested over 100 billion yuan each year in urban environmental infrastructure and urban landscaping and has continued to increase investment. From 2001 to 2016, the average annual investment in urban environmental infrastructure and urban landscaping construction in China was 433.031 billion yuan; from 2017 to 2022, it surged to 840.002 billion yuan.

Acting According to Local Conditions

The construction of urban green infrastructure must be tailored to local conditions, and China embraces this demand. For example, the *Notice of the State Council on Strengthening Urban Greening Construction* requires that "landscape greening should mainly focus on local plants and actively introduce garden plants suitable for growth and development in the local area". Different cities in different regions implement differentiated requirements for green infrastructure construction, for example, the *National Adaptation to Climate Change Strategy 2035* proposes that cities in central China focus on implementing three-dimensional green coverage,

improving residential insulation, ventilation, and shading; The focus of urban green space construction in the Guangdong-Hong Kong-Macao Greater Bay Area is to increase urban wetlands, green spaces, and water bodies to mitigate the heat island effect, optimize the networked spatial pattern of efficient connections between cities, and create a vibrant world-class climate adaptive urban agglomeration.

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14.

A Conversation with Policymakers, Mayors, and Urban Specialists: An African Perspective on Sustainable Urban Development and the G20

Arkebe Oqubay

A Dialogue on Sustainable Urban Development

Sustainable urban development is vital for Africa, offering opportunities for a better future that requires political commitment and a collective response to global challenges. A shared perspective and productive debate on Africa's challenges and future are essential to enhance economic transformation, urban sustainability, and the transition to a carbon-neutral economy. This commentary presents a compelling conversation among African policymakers, leaders, practitioners, and specialists on this pressing theme conducted in September 2024.

The conversation was based on a semi-structured qualitative survey featuring a qualitative format, targeted at a spectrum of African mayors, national policymakers, leaders of continental organizations,

and development practitioners—urban specialists. The respondents play a critical role in shaping public policy and practice and include Prime Ministers and the African Union Commission Chairperson, offering a snapshot of their perspectives and concerns. Of the fifty invited participants, nearly 50% completed the survey, including eight ministers, seven officials of continental organizations, five development and urban experts, and the mayors of Rabat, Freetown, Windhoek, and Cape Town.

Cities are vital in attaining the United Nations 17 Sustainable Development Goals (SDGs) and the net-zero goals endorsed in 2015 under the Paris Agreement. The questionnaire comprised questions underpinned by cities' contributions as innovation and economic growth engines, as well as Africa's commitment to the common aspiration of the global community. African countries made a significant stride by unanimously adopting Agenda 2063, a 50-year road map with a theme of "Africa We Want," which places sustainable urban development at its core. Most recently, in September 2024, the African Union Commission successfully organized an African Urban Forum in Addis Ababa. This pivotal forum delved into African urbanization and the challenges of financing to achieve sustainable and resilient urban development.

The survey focused on a few selected core issues, namely perspectives on sustainable and productive cities, challenges of cities, and the role of G20 in addressing the challenges, crafted into 8 specific questions:

1. How do you understand sustainable/green cities and sustainable urban development?

2. What examples do you present of sustainable and productive

cities (economic contribution) in your country's context?

3. What should cities do to create jobs and attract productive investment?

4. What are the three primary challenges of building sustainable and productive cities in developing and emerging economies?

5. What governance reforms are essential in cities?

6. What is the role of G20 and the global community in achieving sustainable urban development?

7. How can the G20 and global partnerships assist in addressing the financial constraints of cities?

8. Any other reflections and opinions?

In the survey, former Ethiopian Prime Minister Hailemariam Desalegn underscored the scale of urban transformation and the depth of the challenge:

> *In the next three decades, African cities and towns will be developed, and how they are built will significantly impact the continent's future and global sustainability. Establishing new multi-level governance arrangements and continent-wide programs to leverage urbanization for economic diversification, cost-effective service delivery, and climate-resilient development is crucial. Africans need to participate in reshaping this process within the G20 framework as one critical platform. Reforming African urban development should be a key priority within the G20 agenda. We need to seek support from the G20 to address this issue.*

The following section summarizes the diverse respondents' views on the challenges and strategies for productive and sustainable cities. The final section presented the selected case that illustrates the journey of African cities.

Perspectives on Productive and Sustainable Cities

On Productive Cities

There is a common consensus on the perspectives of African policymakers and leadership at continental, national governments, and city levels. Regarding perspectives on sustainable cities, respondents emphasize the need for a comprehensive approach, including environmental, economic, and social dimensions, and a focus on renewable energy, efficient urban infrastructure, and inclusive growth. However, respondents show their concerns that African cities are not sustainable in the true sense of the concept, and a lot needs to be done if cities are to cope with a bulging population and rapid urbanization. However, a few cities have been mentioned as prioritizing urban development sustainability, such as Cape Town, Rabat, and Addis Ababa. In terms of perspectives on productive cities, the responses emphasized the need for cities to focus on economic growth, expand infrastructure and affordable housing, promote productive investment, improve the business environment and employment creation, and expand industrial ecosystems.

However, the responses were less bold and broad than those on sustainable cities. This implies that more discussions are essential to show how sustainable and productive cities can go hand in hand, as highlighted in the other chapter of the same authorship

in this publication. More conversations and dialogue are crucial to enable key players to shape the direction of Africa's sustainable urban development path. Dr. Nkosazana Dlamini Zuma, former Chairperson of the African Union Commission, stressed the productive role of cities: "Cities should have programs that support jobs and entrepreneurial opportunities in the city's primary economic sectors. Space must be created for people to work, learn, and start their businesses."

Productive cities are the foundation for sustainability and require strategic focus, and Prime Minister Hailemariam further highlights:

> *What steps should cities take to create jobs and attract productive investment? African cities should focus on creating employment opportunities, primarily through rapid and inclusive industrialization. This requires well-planned industrial development policies for urban centers. Our experience in Ethiopia has shown that addressing housing shortages is crucial for successful industrialization in developing countries since it takes time for industrialization to take hold in cities. Housing shortages lead to increased living costs for city dwellers. Infrastructure and effective governance are also essential for efficient urban industrialization. Poor governance in African cities is obstructing development and deterring investment. Therefore, attracting more investment to African cities across the continent is essential.*

The South African minister, Ebrahim Patel, emphasizes the prioritization and targeting support for the green transition and focus on new industries. Andrew Dabalen, World Bank's Africa

Region Chief Economist, underscores concrete actions related to urban land policy, "provision of cheap, abundant and reliable infrastructure," and "mechanisms for supporting firms" in response to urban planning challenges, infrastructure constraints, and weak municipal governance to stimulate productive investment. Tishilidzi Marwala, the Rector of the United Nations University and the former Vice Chancellor of the University of Johannesburg, highlights the importance of technology in building productive cities:

> *In this era, what is required is a modernized city that prioritizes the injection of technology into city planning. This is not to say that cities with a longer road to becoming "smart" are not poised to create jobs or attract productive investment, but there has to be a certain way of thinking and approach. We are looking at the emergence of economic hubs.*

On Sustainable Cities

The most frequent terms mentioned in this survey were sustainable cities, renewable energy, and infrastructure. Moderately mentioned terms were productive cities, green space, and urban development. The understanding of sustainable cities is not uniform among respondents. KY Amoako, Former United Nations Economic Commission for Africa (UNECA) Executive Secretary and United Nations Undersecretary highlights that "Sustainable or green cities are urban settlements that rely on renewable energy, manage waste to produce energy, promote sustainable transport, maintain green spaces and air quality, and manage and use their natural resources efficiently." Amoako adds that it is done

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*through urban planning and management, which
address the social, environmental, and economic impacts
of population growth in the urban setting. Green cities
have specific characteristics regarding public transport,
buildings, water conservation, public spaces, and citizens'
participation. There are no examples of green cities in
Ghana. Cape Town could be considered an example of
a green city.*

Professor Evan Turok, an urban specialist, argues the concept is

*conventionally defined mainly by environmental
objectives like lower carbon emissions, less pollution and
other forms of environmental degradation. But I don't
think we can ignore fundamental social and economic
objectives, like poverty reduction, more and better jobs/
livelihoods, and greater social inclusion and spatial
integration.*

Andrew Dabalen also highlighted the need to differentiate
"sustainable" as a broader socio-economic concept from "green"
cities that focus on transitioning to green energy. He suggests
that a green/sustainable city is characterized by using renewable
energy, sustainable mobility, sustainable buildings and households,
and an economy resilient to economic and climate shocks. He
acknowledges that "there are no obvious examples right now of
sustainable, productive cities." Marwala further notes:

*The lack of access and inclusivity, urbanization, and
funding are the key challenges of African cities. I will
use the example of Johannesburg, where I previously*

> *lived. While there has been investment in strategic infrastructure, the vestiges of apartheid still present spatial challenges. As a result, access to this infrastructure does not encompass the entire city despite its rapid rate of urbanization.*

As these conversations vividly show, there is recognition that inclusivity is vital to ensuring sustainable urban development.

Challenges of African Cities

Respondents highlight that the binding constraints of African cities are primarily growing unemployment, financial constraints, rapid urbanization and inadequate response, inadequate infrastructure and housing finance, and pressures from climate adaptation needs. There is a consensus that these challenges are directly linked to urban governance. Respondents emphasized that cities should be responsible for economic growth, financial autonomy, decentralization of decision-making to cities, and public engagement. Cities also lack city administration capacity, and city plans are not executed. Addressing the urban governance issues calls for a political commitment by national governments to ensure synergy between national, provincial, and city levels to maximize cities' contribution. Secondary cities and the polycentric urban policy approach are essential to ensure that several growth poles drive growth.

The challenges of African cities are compounded and multifaceted. Yvonne Aki-Sawyer, the Mayor of Freetown, maintains that:

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> *Investments in clean technology and clean cooking are a significant issue for us in Freetown, where 82% of cooking fuel is wood-based, which increases pressure on deforestation. In governance, our biggest challenge in Freetown is land use planning and building permits. If we want a better response to the climate crisis, then cities must be given more opportunities and powers because they are the closest to the people, the closest to the issues, and at the front line. Developing secondary cities will reduce the massive population pressure on the capital city.*

Mayors and other respondents have highlighted the lack of financial resources and the inability to develop urban infrastructure, housing, and services. This is coupled with a lack of decentralization of power to cities to boost economic growth and generate revenue. African Union Commissioner Albert Muchanga underscored that "central governments may need to reconsider the roles of mayors, to make them responsible for economic growth and not limited to service delivery."

Former Minister of Finance of Ethiopia, Sufian Ahmed noted that city planning and urban administration, the influx from rural areas to cities, financing infrastructure, and the lack of autonomy (power) to raise taxes are critical challenges to sustainable cities. He recommended that governments decentralize city services and be empowered to boost revenues and property taxes. Still, the G20 must also share the financial responsibility for supporting African cities and display solid political commitment.

While many African countries have the primacy of capital cities, we

observe economic growth generated by several urban hubs, such as in Morocco (Rabat, Tangier, Casablanca, Marrakech) and South Africa (Cape Town, Johannesburg, Pretoria, Durban). An important observation was provided from the South African context that city plans and land use should enhance mixed settlement rather than the apartheid and colonial legacy of segregation and discrimination in many African cities.

Chairperson of the African Union, Dr. Nkosazana Dlamini Zuma stated that:

> *Some of the biggest challenges include the rapid migration of citizens into the cities and the inability of many cities to expand infrastructure and economic opportunities to meet the citizens' demands. Limited resources are available for developing sustainably, particularly in the developing world. However, the lack of political will in allocating resources towards sustainable development is a significant hurdle that needs to be addressed.*

Most respondents highlight the enormous pressure of rapid urbanization, which burdens cities significantly. Amoako maintained that:

> *Rapid urban development has occurred due to a high rate of rural-urban migration, leading to air and water pollution, depletion of cultivated land, and urban sprawl. Urban planning and infrastructure development have yet to keep up with these population movements. Building sustainable and productive African cities presents many challenges, but my top three are environmental quality, transport, and housing.*

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Cities like Windhoek have invested in waste management as a priority. Windhoek Mayor Queen Kamati highlighted: "For the past decade, Windhoek has been investing in waste management programs and recently launched its first solid waste buy-back center to reduce waste to the landfills by monetizing waste and making it a source of income."

Respondents emphasized that urban governance remains a critical challenge. Amoako highlighted the depth of governance challenges and reform priorities:

> *There is a need for integrated and holistic city planning. In most cities, the approach is top-down. Decisions are made without significant stakeholder consultations and very little community participation. Outdated legislation exists in several cities. The Town and Country Planning Acts must be reviewed to align with modern trends. In some cases, legislation exists, but there are little or no implementation and enforcement mechanisms. There is often a lack of resources for enforcement and monitoring. City administrations often mirror national administrations and are subject to similar governance challenges, such as corruption and mismanagement of public financial resources. Codes of good governance are needed to address these issues and improve public financial management. Reforms are also required to enhance and maintain the revenue and tax base.*

Mayors' Perspective and Sustainable Urban Development Practices

In this section, we highlight the inner voice of mayors by presenting cases to illustrate efforts being made by African cities. The mayors of Rabat, Freetown, and Windhoek, the capital cities of Morocco, Sierra Leone, and Namibia, respectively, and South Africa's Cape Town provide a diverse but exciting live experience on the roles and challenges of African cities. Several insights can be drawn from these cases. In addition, the role of the national government is vital for developing sustainable and productive cities. Mrs. Lelise Neme, the Director General of the Ethiopian Investment Authority, underscores "maximizing collaboration between cities and countries to address common challenges."

First, it shows that African cities are putting in effort despite the huge constraints in their peculiar context and enormous challenges. All mayors highlighted the importance of fostering their roles as engines of the economy and sustainability.

Second, the mayors showed the importance of mediating between historical and cultural roles, inclusiveness and segregation, the constraints on not delegating cities to play prominent economic roles, and the urgency for focusing on secondary cities. The mayors described how their cities promote sustainable solutions, such as renewable energy, improving land use and afforestation, and reducing pollution. The Mayor of Freetown underlined the necessity of reducing the pressure of urbanization on capital cities and that secondary cities play a vital role in sustainable urban development, as many of the challenges of urban development are also governance issues.

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Third, national-level development strategies (such as green economy, industrial, and urban development policies) and policies are critical for attaining sustainable urban development. The coordination and synergy at the national, provincial, and city levels condition the level of success.

Finally, the mayors highlighted the role of G20, primarily in addressing financial resources and knowledge sharing. We hope the story of Rabat, Freetown, and Cape Town will inspire policymakers, mayors, and experts to be committed to shaping the future of African cities. However, a realistic expectation of the G20's role is in order, and a more profound emphasis is critical on how cities and national governments can mobilize domestic resources and put them in highly targeted manners.

The Case of Rabat as a Sustainable City

By Dr. Fathallah Oualalou, Former Mayor of Rabat and former Minister of Finance and Economy of Morocco:

I belong to a city that has been evolving positively for 20 years. Rabat has one of the world's highest rates of green space per square meter per capita. This focus on sustainability is linked to the city's heritage and geographical position. A forest surrounds the city, the world's largest natural cork oak forest, which is a significant asset.

Greening cities through urban green spaces is critical, and Rabat has one of the world's highest rates of green spaces. This has been a long tradition since the early 20th century, but it has been strengthened recently, especially with the "Rabat, City of Light, Cultural Capital" vision. Here in Rabat, there is a dialectical link between interest in history, culture, and the environment.

The environment concerns both the past and the future. Still, if we connect it to culture and root it, it gives a kind of essential legitimacy to any pro-environmental policy.

Rabat has an environmental and historical dimension, and as a capital, it promotes partnerships with other cities. Since its designation as a United Nations Educational, Scientific and Cultural Organization (UNESCO) Heritage Site in 2012, Rabat has had a dual obligation: to safeguard its cultural heritage—Roman, Almohad, Marinid, and Alawite—and to preserve its space. Rabat has always tried to create a dialogue between the heritage of the past and the spatial determinants between geography and history.

In the Moroccan context, like other cities in developing economies, the big issue is that cities lack financial resources. Therefore, the state needs to transfer financial resources to cities. Still, it is also important to have tax reforms that provide local authorities with the resources they currently lack to introduce the sustainability factor. There needs to be mediation between state financing and city financing; otherwise, cities will remain in a state of dependence, waiting for state support for their budgetary policies.

The first challenge is that poor and developing countries do not have the means to adapt to the risks of climate change. Therefore, developed countries must transfer resources to developing countries to help them participate in the sustainability of the economy, especially since these countries are not responsible for pollution or environmental degradation. There has been an international commitment on this issue since 2015.

Additionally, the issue of slums is crucial. In a city like ours, there are two types of pollution: pollution from development

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(industrialization, transport, etc.) and pollution from poverty, which comes from slums and marginalized neighborhoods. Addressing sustainability means tackling both types of pollution.

The Case of Cape Town as a Thriving City

By Geordin Hill-Lewis, Mayor of Cape Town:

Sustainable urban development integrates green infrastructure, renewable energy, water efficiency, and public spaces while encouraging responsible consumption and waste management. Cape Town embodies this vision through its infrastructural investment in essential services such as water, energy, and housing, which ensures that urban development caters to low-income communities and minimizes environmental strain. Cape Town is procuring renewable energy through independent power provider schemes (IPPs) to diversify the supply and nature of energy production, attract new skills and capital into the industry, and provide competitive performance and energy pricing. These efforts contribute to Cape Town's broader goal of creating a resilient and sustainable city.

Cape Town is taking action to attract investors and create jobs by making it easier for businesses to operate. Cape Town's R39.5 billion infrastructure budget over the next three years is a clear example of how targeted investment in housing, water, and energy can stimulate job creation while improving the quality of life for residents. Cities can create long-term, high-quality jobs by strengthening industries such as tourism, manufacturing, and green energy. In Cape Town, the tourism industry is a vital job creator with its wide-reaching multiplier effect. Cities must also invest in

green initiatives, like renewable energy projects, that contribute to sustainability and create jobs in growing industries, such as green energy and manufacturing.

However, like other South African cities, Cape Town faces various challenges. Urban inequality is a primary challenge. Rapid urbanization often results in socio-economic inequality, where lower-income residents do not benefit equally from urban development. Providing affordable housing and essential services to all citizens, as demonstrated in Cape Town's land release program for 4,200 affordable housing units and 75% of its capital budget being spent in low-income areas, is a critical challenge. Developing economies often lack the financial resources required to invest in sustainable infrastructure, which can hinder the adoption of renewable energy, waste management systems, and water-saving technologies.

Through international cooperation, the G20 can support creating and promoting green bonds or climate finance mechanisms that help African cities fund sustainable infrastructure projects. The G20 can also play a pivotal role in helping cities adopt cutting-edge technology for urban planning and smart city initiatives, significantly enhancing their efficiency, resilience, and sustainability.

The Role of G20 and Global Community

The survey found that financing, know-how transfer, and political commitment were the most frequently mentioned terms related to the G20's role. However, there is a lack of clarity on how the group plays its role in financial resources. There is a solid consensus that the G20 and developed countries share a common but differentiated responsibility to support urban centers in developing countries,

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notably African cities, which lack the resources—financial, technology, and know-how. Respondents highlighted that G20 should show solid political commitment if progress is to be made and international inequality is to be narrowed. The urgency and necessity of financial resources for urban development was a key point of emphasis. Respondents focused on the role of G20, which was to provide financial resources, including access to concessional loans, grants, and guarantees to stimulate private investment. Respondents also emphasized the need for innovative financing, as highlighted by the Secretary General of the African Continental Free Trade Area (AfCFTA and the Chairman of Afreximbank. In addition, the need for a global compact to promote sustainable infrastructure development and clean energy was highlighted. Respondents highlighted the urgency of facilitating technology transfer and providing assistance in capacity building.

President Oramah, the Chairman of Afrieximbank, highlights financial constraints, institutional weakness, and low technical capacity as critical challenges and recommends that G20's priority should be on "knowledge exchange, mobilize resources, promoting collaboration including concessional financing and grants, develop tools like green bond and blended finance mechanisms to attract private sector financing, support risk mitigation through guarantee." Wamkele Neme, the Secretary General of AfCFTA emphasizes financial resource constraints and G20's role:

> *Many cities grapple with the scarcity of financial resources necessary to fund large-scale urban infrastructure projects such as public transportation and waste management systems. By influencing multilateral development banks and financial institutions, the G20*

can ensure that targeted grants and concessional loans are allocated to critical urban infrastructure projects.

South African former Minister Rob Davies underscores the responsibility of G20 in realizing the net zero goals, "I think adaptation is the major challenge facing African cities," underlining that "funding available in total is way below what is required and in the wrong form." He highlights AfCFTA's contribution in "working through AfCFTA, a single market, to build economies of scale and regional value chain." He adds that "the G20 should seriously consider the impact of discriminatory policies such as the EU's Carbon Border Adjustment Mechanism (CBAM) on Africa and other developing countries."

Minister Patel underlines the need to compensate "countries that forgo unsustainable industries and natural resource opportunity" and the priority for the G20 and global community to contain geopolitical tensions and conflict that further complicate the green transition and slow down African transformation.

On the G20's role in African sustainable cities, Dabalen highlights a different dimension: "Personally, I am not confident there is much of a role for the G20 or the global community. This is primarily a domestic or a country-led issue." Nonetheless, he highlights that G20 and global partnership could make a huge difference in addressing cities' financial constraints by reducing or restructuring debt for African countries and reforming the international financial system in financing green energy, sustainable infrastructure, and green industrialization. They can also provide platforms for cities' financing. Dabalen adds that urban governance should focus on "localizing decision-making that gives more autonomy to mayors and municipal councils, reforming land and city plans, and financial reforms."

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Conclusions

A total of 24 respondents—policymakers, mayors, and development experts—participated in the semi-structured qualitative survey. Respondents highlighted the challenges of sustainable and productive cities, climate change, population explosion, rapid urbanization, lack of finance and investments, and pressures on cities' infrastructure. On urban governance challenges, respondents highlighted a lack of decentralization and capacity, a lack of good city governance, low human capital and skills, and poor planning and implementation. Regarding perspectives on sustainable cities, most respondents highlighted various dimensions (socio-economic-environmental), and some focused merely on environmental aspects.

Five key recommendations on the role of the G20 were highlighted, with a primary focus on mobilizing low-cost financing or investments. In addition, political commitments to development, promoting international cooperation, promoting technology transfers, setting standards, and sharing knowledge were highlighted. The importance of national strategy and policies was also emphasized. Former Minister Mekonen Manyazewal highlights:

> *Ethiopia has prioritized renewable energy for over two decades achieving nearly 100 percent, national green legacy afforestation, promoting sustainable mobility through incentives for electric vehicles and bans on fossil fuel-driven passenger vehicles, and promoting secondary cities and corridor development in Addis Ababa.*

Several views and recommendations were highlighted on the roles of cities: the lack of employment, attracting finance and investments, provision of infrastructure, and supporting industries were most emphasized. In addition, applying smart technologies, improved waste management, using city plans, and housing development were highlighted. In governance, improved leadership and institutions and decentralization of responsibilities to cities were highlighted.

The commentary provides a snapshot of perspectives and diverse views on sustainable urban development, the challenges of productive and sustainable cities, and the roles of G20, which is one way of understanding African perspectives. However, it should be noted that this is not a comprehensive review and falls short of the basis for action. It also illustrates the potential for new research to understand cities' perspectives and challenges.

Acknowledgments

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Zaouli (Policy Centre for the New South), Dr. Pedro Vormittag (CEBRI), Dr. Uduak Akpan, Dr Ayalew Mamo, and Dr Nigisty Gebrechristos (SOAS University of London), as well as Binyam Arkebe and Samuel Arkebe Oqubay, for their invaluable input and comments. Any errors or oversights are entirely my own, and I apologize for any unintentional mistakes.

List of Survey Respondents

The respondents in the survey are not listed in alphabetical order. The first 25 respondents (numbers 1-25) participated in the survey or interviews; respondents 1-8 represent continental organizations; respondents 9-16 are national government leaders and officials; 17-20 are African mayors; and 21-25 are development experts and urban specialists. Unfortunately, the remaining 20 individuals (numbers 26-45) could not participate due to time constraints and other commitments. Additionally, invitations were sent to 15 more individuals who did not respond to the survey.

	Name	Title	Origin
1	Nkosazana Dlamini-Zuma, Dr.	Former Chair of AU Commission, Former Minister of the Republic of South Africa	South Africa
2	K Y Amoako, Dr.	Former UN Under Secretary and Executive Director, United National Economic Commission for Africa (UNECA)	Ghana
3	Albert Muchanga, Ambassador	Commissioner, African Union Commission	Zambia
4	Victor Harison, Professor	Former Commissioner, African Union Commission	Madagascar
5	Wamkele Mene	Secretary General, African Continental Free Trade of Area (AfCFTA)	South Africa
6	Tshilidzi Marwala, Professor	Under Secretary UN and Rector of the United Nations University and former Vice Chancellor of the University of Johannesburg	South Africa
7	Benedict Oramah, Professor	President and Chairman of Board, African Export-Import Bank (Afreximbank)	Nigeria
8	Hailemariam Desalegn	Former Prime Minister, Democratic Republic of Ethiopia	Ethiopia
9	Sufian Ahmed	Former Minister of Finance and Economic Development, Ethiopia	Ethiopia
10	Mohamed L. Doubouya, Dr.	Former Minister of Finance, the Republic of Guinea	Guinea
11	Mekonen Manyazewal	Former Minister of Industry and Trade, Ethiopia	Ethiopia
12	Rob Davis, Dr.	Former Minister, Department of Trade and Industry, Republic of South Africa	South Africa
13	Lelise Neme, Eng.	Director General Environmental Authority, Former Commissioner of the Ethiopian Investment Commission	Ethiopia
14	Ebrahim Patel	Former Minister, Department of Trade and Industry, Republic of South Africa	South Africa
15	Okey Enelamah	Former Minister of Industry, Trade, and Investment, Federal Government of Nigeria	Nigeria
16	Fathallah Oualou	Former Mayor of Rabat and Minister of Finance of the Kingdom of Morocco	Morocco

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	Name	Title	Origin
17	Yvonne Aki-Sawyer	Mayor of Freetown, Sierra Leone	Sierra Leone
18	Mayor Geordin Hill-Lewis	Mayor of Cape Town, South Africa	South Africa
19	Councillor Queen Kamati	Mayor of Windhoek, Namibia	Namibia
20	Amare Asgedom	Former Deputy CEO, Industrial Parks Development Corporation, Urban development specialist	Ethiopia
21	Ivan Turok, Dr.	Executive Director, South African Human Sciences Research Council, and Research Chair in City-Region Economies	South Africa
22	Andrew Dabalen, Dr.	Chief Economist Africa Region, World Bank	Kenya
23	Frannie Leautier, Dr.	CEO of South Bridge Investment, Former Executive Director of African Capacity Building Foundation	Tanzania
24	Edlam Abera, Dr.	Director, UN-Habitat, Urban development specialist	Ethiopia
25	Edgar Pieterse, Dr.	Director of the African Centre for Cities, University of Cape Town	South Africa
26	Kesetebirhan Admasu, Dr.	Former Minister of Health of Ethiopia and CEO of Big Win Philanthropy	Ethiopia
27	Adanech Abebe	Mayor of Addis Ababa and Former Minister of Revenue	Ethiopia
28	Ahmed Shidie	Minister of Finance and Economic Cooperation, Ethiopia	Ethiopia
29	Haddis Tadesse, Dr.	Bill and Melinda Gates Foundation	Ethiopia
30	Lia Tadesse, Dr.	Former Minister of Health of Ethiopia	Ethiopia
31	Lantosoa Rakotomalala	Former Industry & Trade Minister of Madagascar	Madagascar
32	Tesfachew Taffere, Dr.	Former Director of UNCTAD	Ethiopia
33	Patrick Achi	Former Prime Minister of Côte d'Ivoire	Côte d'Ivoire

	Name	Title	Origin
34	Tadese Haile	Former State Minister of Industry and Trade, Ethiopia	Ethiopia
35	Barbara Creecy	Minister of Transport, Former Minister of Environment	South Africa
36	Pravin Gordhan	Former Minister of Public Enterprises	South Africa
37	President Jakaya Kikwete	Former President, Tanzania	Tanzania
38	Mukhisa Kituyi	Former Secretary General of UNCTAD	Kenya
39	Mahmoud Mohammed	Mayor of Zanzibar, Tanzania	Tanzania
40	Sakaja Johnson	Governor of Nairobi, Kenya	Kenya
41	Aminata Touré, Dr.	Former Prime Minister of Senegal	Senegal
42	Anna Tibajuka, Dr.	Former UN Under-Secretary and Executive Secretary, UN-Habitat	Tanzania
43	Ibrahim Mayaki, Dr.	African Union Special Envoy for Food Systems and Former Prime Minister of Niger	Niger
44	Admassu Tadesse	Group President and Managing Director, Trade Development Bank, TDP Group	Ethiopia

15.

Integrating Climate Disaster Risk within an Interdisciplinary Urban Agenda: Lessons Drawn from the Brazilian Experience

Andrew J. Kruczkiewicz, Camila Pontual, Jessica Weinberg, Isabella Pereira and Walter Baethgen

In the city of Rio de Janeiro, there is a rich tradition in assessing, understanding, and managing climate risks, including hydrometeorological. In recent years, and as climate and socioeconomic change has led to an evolution of both individual and compound risks, there is a growing need to develop structured, yet sufficiently flexible, disaster resilience programming. There have been significant gains in recent years to support this evolution. As an example, the Rio de Janeiro Operations Center (COR), which coordinates and integrates responses to manage risk and respond to disasters, has created an impact scale to understand when, where and to what extent climate and weather extremes have led to damage across Rio de Janeiro (Muse et al. 2020, Nunes et al. 2020). Research and

engagement across academia and the private sector have also grown significantly. However, guidelines and standards intended to foster strong and sustainable partnerships should evolve further to reflect current trends, such as those present in data availability and accessibility, early warning and anticipatory action, and questions related to the legality of owning and dissemination climate and impact today, particularly when it can be potentially useful for saving lives and protecting livelihoods.

From a global perspective, there are significant gaps in understanding the relationship between socioeconomic and governance factors, along with the climate elements of these disasters (Marchezini and Wisner 2017; Kruczkiewicz et al. 2021). Without standard approaches connecting these factors to the impact of disasters, it can lead to a misrepresentation of the relationship between developing policy and standard operating procedures for risk reduction, extreme event early warning, anticipatory action, and, more broadly, across adaptation strategies. With over 40% of the total loss and damage from disasters in Rio de Janeiro being absorbed by sectors that are directly related to the livelihoods and health of the most vulnerable communities, there is an urgent need to improve our understanding of the connectivity of these spaces and to ensure that policy and decision-making standards are informed appropriately (Turetta and Neto 2022). The impact of disasters is increasing, leading to both direct and indirect stressors through a variety of mechanisms, including agriculture, infrastructure, transportation, and nutrition.

Gaps remain in strategies for risk reduction and resilience when the focus is on supporting the most underserved and socioeconomically vulnerable populations, who are not represented in historical data

(Tuholske et al. 2021). As risks become more dynamic in scope and scale, while leading to a growing disproportionate impact on the most vulnerable and lowest income populations (Interlenghi et al. 2015; Palmeria et al. 2019), there is a rapidly growing need to describe and assess:

1. The extent to which current disaster risk reduction strategies are effective, within the context of the city of Rio de Janeiro and across the whole of an interconnected urban area.

2. Which disaster risk reduction strategies lead to decreasing disproportionate impact when a hydrometeorological or climate-driven disaster does occur?

3. Methods to increase adaptation efforts to enhance preparedness for disasters in the future, in ways that are specific to compound and multiform disasters.

Further, as a cross-cutting element across each of the above three, the extent to which climate and environmental justice should be central must be a key consideration. However, justice elements could also be considered as an independent priority.

Case Study: Rio de Janeiro

In the unique and complex socioeconomic and natural hazard environment within Rio de Janeiro, there is added importance in developing a revised urban agenda that is not limited to extreme events. It should also center on the communities facing growing impacts from increasingly interrelated climate, environmental, and socioeconomic shocks and stressors. Rio de Janeiro's informal

settlements are particularly vulnerable to climate impacts like flooding, landslides, and heat waves due to inadequate infrastructure. While attention is increasingly drawn to compound events co-occurring, shocks occurring across different timescales, and peaking at various times (or events that are long-term stressors, yet present the greatest impact at various moments in the form of peaks), have been relatively deprioritized.

In the complex socioeconomic and climate context of Rio de Janeiro, these interactions, across spatial and temporal scales must be integrated within a revised and updated urban agenda, especially as it applies to both new infrastructure developments and the ongoing reform of older systems, all of which should be incorporated into the city's broader management plan. While challenges exist for doing so, describing the baseline for what it could look like is a key prerequisite step before progressing into the development and implementation of such an agenda. This prerequisite set or series of steps should consider an assessment of the enabling environments that must exist for the development of a risk-informed urban agenda, in order to inform the co-production of an integrated urban agenda for climate disaster risk management.

Here, we outline some key considerations. We do not aim to prescribe an approach. The guidance here is rather informed by examples on a regional and global scale, with useful aspects of how to develop a sufficiently structured (yet sufficiently flexible/adaptable approach) to assess enabling environments for climate disaster risk management in urban contexts in Brasil. Recommendations are then formulated for the co-development process, and, further, towards implementation in the coming years across Brasil—to inform similar forthcoming processes.

Key Considerations for Enabling Environments of Risk-Informed Disaster Management

In Rio de Janeiro, significant gains have been made in recent decades related to disaster risk assessment, early warning, and recovery and resilience. Some of these gains have been underscored by leveraging the existing and thriving nature of community networks and social groups in all steps from community and participatory risk mapping, to establishing substantive relationships and informing the design of early warning and anticipatory action systems (Calvello et al. 2015; de Mendonca et al. 2016; da Silva et al. 2020). In this section, we delineate four enabling environments for consideration when designing climate-risk-informed disaster management. While these enabling environments are also present in non-urban settings, they are particularly sensitive in urban areas. Additionally, they are of increasing importance to understanding the interaction within urban areas, which are characterized by tight gradients of socioeconomic vulnerability and climate hazard risk (La Vaccara 2012; Boroto and Fenner 2024). Primary data concerns are related to all hazards, but particularly to hydrometeorological events, leading to landslides and flash floods, which overwhelmingly harm poorer communities in hillside favelas, heat islands (which also affect the poor living in exposed settings), and, in compound events contexts, when these and other extreme events and socioeconomic stressors interact (Kruczkiewicz et al. 2021).

For each of the enabling environments, a Rio de Janeiro specific lens is provided. The intent of doing so is to 1) highlight the progress made in Rio de Janeiro—and, in doing so, establish a certain framing that could be useful in identifying candidates for iteration

to other locations; and 2) suggest opportunities to build off and enhance the current work being done from a multidisciplinary and integrated perspective.

Data

In recent years, the availability of data has increased rapidly, including climate, environmental, and socioeconomic information (Miranda Espinosa et al. 2020). Primary drivers of this increase include artificial intelligence (AI) and machine learning (ML) approaches, social media, transformation of the tech sector to include many "climate tech" specific and adjacent organizations, and increased experience with and awareness of extreme climate and meteorological events driving political will and societal reprioritization of resources and attention. While availability has increased, similar gains in terms of the suitability, accessibility, and use of such data have lagged behind (Guha-Sapir et al. 2023). Further, with a common pursuit to secure the "best" or "highest resolution" data, the need for measures of appropriateness has grown steadily (Overpeck et al. 2011; Mason et al. 2015). In this context, the role of climate data translators and integrators has emerged as one that is of growing importance and should be more present in scientific, policy, and implementation actions aimed at addressing climate risk.

Data availability, discoverability, accessibility, and usefulness are independent critical elements, yet interconnected, that must be normalized within strategies for developing data production, dissemination, and translation guidance and standards. Without addressing each element, as well as the interactions between them, such strategies will be incomplete at best and,

at worst, inappropriate and misleading. Additionally, there is a growing importance in developing layers of data that integrate socioeconomic information with climate, ensuring a more comprehensive and contextually relevant approach to addressing climate risks in urban environments.

Further, as the gradients of social vulnerability tighten, so too does the importance of assessing if, and the extent to which, data is sufficiently representative. Doing so is particularly important in cities and areas that experience a variety of natural hazards across the full spectrum of intensity (Hemmati et al. 2022). One such area is Rio de Janeiro, along with other cities in Brasil and throughout South America. While the availability of data is indeed increasing in Rio de Janeiro, critical questions remain. They include the extent to which these data are discoverable and accessible and, further, if the access and use are sufficient and to what extent the most vulnerable populations benefit from it (Matheus et al. 2014; Oscar Júnior et al. 2023). It becomes particularly relevant considering that less than 40% of the population shows confidence in the government's early warning systems for floods, for example (Bustillos Ardaya et al. 2017).

Governance

Governance for climate-informed disaster risk management can exist in a variety of forms. However, irrespective of its shape and how it is implemented, the presence of sufficient, if not "good," governance is critical for effective and sustainable disaster risk management (Daoud et al. 2016). Each form is potentially useful for the case outlined here. For example, governance can be developed to support the management of various actors within disaster

risk management, including their interactions, decision-making processes, and coordination (Forino et al. 2015). A different, yet related, example of the added value of clear and transparent governance can be found in processes to assess challenges and gaps in reviewing and potentially revising, approaches for disaster risk reduction, adaptation and the extent to which the two can be integrated (Djalante and Thomalla 2012). A third example is specific to climate and weather services when considering how to implement multi-disciplinary working groups as a core or adjacent attribute (Kruczkiewicz et al. 2018).

The Rio Operations Center (COR) is a case of effective governance in urban disaster risk management. Since 2010, it has integrated real-time data from over 1,500 cameras and various sensors to monitor risks, particularly climate-related events, such as floods and landslides, the most common climate hazards in the city. Its advanced technologies and multidisciplinary coordination have enabled a proactive approach to managing crises.

Implementation and Logistics

This sub-section allows for the interplay across physical action-taking dynamics, telecommunications, and econometric elements. While the logistics related to both *ex-ante* (e.g. anticipatory action and early warning) and *ex-post* (e.g. prioritization of resources for recovery and resilience building) are represented in this environment, so are the necessary prerequisites for strengthening technological capacities to communicate risks to vulnerable communities, and for improving information flows (e.g. reporting, monitoring). With the increased availability and accessibility of data, specifically remotely sensed and drone-derived geospatial

data, there has been a general improvement in informing logistics from a pre- and post-disaster management perspective. However, this evolution does not come without certain constraints. For example, the "mosaic effect"–when combining initially independent data points lead to gained significance–may lead to the possibility of gleaning personally identifiable information when integrating remotely sensed and socioeconomic data, which would not be the case if one type was independently used (Czajka et al. 2014; McIrney 2020). These data may be a safer option from a disaster first-response perspective to gain insights into the magnitude, extent, and scope of a disaster. However, without proper attention to how these data are used to inform the prioritization of response (or anticipatory action), the factors that lead to some populations being disadvantaged can continue to be propagated.

In Brasil, post-disaster logistics have been described to align with "basic areas of organization," such as mobilization, evaluation and planning, acquisition, warehousing and inventory management, distribution, transportation, quality control and monitoring, coordination between agencies, and information management (Bastos et al. 2014). De Moura et al. (2020), in a broad approach to developing a Brazilian-wide framework for logistics within disaster management, elaborate further in identifying the importance of temporal elements, such as lead time, to justify when, where, and to what extent to prioritize or de-prioritize resources.

Justice

The climate and environmental justice environment have historically been a key consideration of all types of disaster management.   Disasters,   especially   hydrometeorological

occurrences, have traditionally enhanced the differences in social vulnerability and physical exposure that lower incomes and underserved populations face. However, until recently, integrating justice within disaster risk management has not been a central theme. Here, we identify the importance of exploring the extent to which an equitable and justice-based lens should be placed across and within each of the above mentioned three environments.

Compound Events in Rio de Janeiro–A Focus on Hazards Interacting in New and Increasingly Complex Ways

As an emerging type of disaster, the rapidly expanding sub-category of disasters of compound events is used here to demonstrate a case study of how such an exploration of enabling environments could take place. This is done through a lens of Rio de Janeiro, keeping in mind the overarching goal of informing the process design of a developing climate-informed disaster risk management programming that is both relevant now and in a rapidly changing landscape of climate, socioeconomic, and global change (Zscheischler et al. 2020).

Rio de Janeiro is located in a unique geographical region, whose climatology has been of great influence on locals in the region long before anthropogenic emissions became a talking point. Most notably, Brasil has faced (and still faces) a large number of intense rainfall events spawned by the South Atlantic Convergence Zone (SACZ). The SACZ is most distinguishable by its northerly-north westerly flow, which transports a large quantity of moisture from the Amazon region to central and southeast Brasil. This region is located beneath an upper-level trough, providing the atmosphere

with additional instability that intensifies SACZ rainfall events and thus creates catastrophic phenomena (Alcantara et al. 2023). The SACZ is most active from November to March, which leaves a large period when the atmosphere is, on average, drier. During such periods, much of Brasil has suffered historic droughts, oftentimes caused by natural forces such as El Niño. During its maximum magnitude, the typical wet-season rains are delayed long enough that Brasil's rivers cannot fully recharge and recover before the next drought occurs (Azevedo et al. 2023).

Brasil has seen increasingly frequent compound climate disasters, such as the 2011 Região Serrana landslide, which claimed over 900 lives. In May 2024, Rio Grande do Sul suffered catastrophic flooding, affecting 478 cities and nearly 2.4 million people. The disaster led to 182 deaths, 29 missing persons, and economic damages projected at US$ 18 billion. These events highlight the growing risks of extreme weather in vulnerable regions.

In Região Serrana, many of the region's most vulnerable populations live in communities in areas of complex topography where vegetation has been removed. This issue is exacerbated by unplanned urbanization, which often accompanies a process of soil impermeabilization, and the construction of inadequate drainage systems. Overall, it raises important questions regarding the definition of standards for infrastructure at the favelas, and if and to what extent these patterns integrate, or could potentially fuse with historical, current, and prognostic climate data. Nearly 90% of landslide deaths occurred in urban areas with a direct correlation to the steep, deforested hillsides (Alcantâra et al. 2023). It is important to note that not only are the most vulnerable communities facing changes in the way that hydrometeorological events occur. In the

2011 landslide events, 64% of total dollar loss was related to damage done to public buildings and infrastructure (Alves et al. 2021), including bridges, highways, and sanitation systems.

Following the 2011 landslide events, the Brazilian Development Bank (BNDES) launched a set of emergency programs to reduce the financial vulnerability of firms in affected areas (Alves et al. 2021). The overarching idea was to provide local establishments with subsidized credit that they could use to guarantee their suppliers' payment while simultaneously rebuilding physical capital and maintaining the approximately same number of employers. For the 2011 Região Serrana landslides, R$ 400 million was awarded to affected areas. There have been many such efforts to mitigate the effects of disasters after the fact, but whether or not affected areas are being proportionately aided (i.e. most affected areas getting the most attention) must be better understood in order to define best practices for future risk reduction programs.

It is important to note that while there is still a gap in the knowledge of how we can disaggregate loss and damage between socioeconomic groups that feel the most damage, losing bridges, highways, and especially sanitation systems are effects that will be felt regardless of social class. This reality is especially true as the frequency and longevity of drought events increase. Air quality has also suffered in recent years, with one factor being the wildfires in areas within Brasil, yet far to the west and north, impacting air quality in many cities and rural areas alike. More recently, residents of Rio de Janeiro were faced with fine particle rates five times higher than the recommended safe limit, with São Paulo topping the rankings of the world's most air-polluted major city (France-Presse 2024).

While providing aid to affected areas should continue to be done, there is a relative lack of attention on mitigating the disasters before they happen. It is important to consider disasters not only as a matter of immediate response but also as an opportunity to discuss and implement adaptation policies, which could ultimately prevent such events from occurring or reduce their impacts. Effective adaptation requires the promotion of public policies that are developed in cooperation with academia, private institutions, and the third sector (Cia Alves et al. 2022). By doing so, resilience-building within the cities is more likely, while promoting accountability.

Geo-Rio (founded in 1966) has been making efforts to contain many of the slopes within Rio de Janeiro, taking the first step toward preventative measures for landslide events. They coordinated a geological-geotechnical mapping of 196 favelas spanning 103 of Rio's slums, which, based on their mappings, helped them to install Alarm Sirens (Nunes et al. 2019). While this project is an example of the promise of advanced warning systems, which are critical in such susceptible urban areas, monitoring and evaluation must be more robust to the extent to inform the potential revision and updating of such systems as new technology becomes available and social dynamics evolve. To address these challenges, it is crucial to close the gaps within science and technology while integrating systems to enhance governance driven by current and future societal, and not only climate, projections. By advancing scientific research and leveraging technological solutions, such as improved data collection, predictive modeling, and sustainable infrastructure design, we can create more responsive and adaptive frameworks. Doing so will enhance the likelihood for improved coordination across sectors, ensuring that governance structures are equipped to address critical issues like climate resilience, urban

planning, and disaster risk management, ultimately benefiting those most vulnerable.

Urbanization and Climate

Increased attention should be placed on ways in which policy that affect Brasil's current—and future—urban areas can be more appropriately and effectively designed to allow for increased resilience to extreme events as well as better access and infrastructure (for example physical infrastructure, digital infrastructure, media, etc.) to enable early warning systems and anticipatory action. A prerequisite for this is an acknowledgment that even in the most resilient cultures and communities, there will be hazards of a significant magnitude and complexity that will drive some extent of impact when they occur. The adaptation elements of early warning, anticipatory action, and rapid response must be within policy to some extent, even if the overarching motivation is to mitigate risk to a near zero state.

Conclusion and Next Steps

Many countries face the reality of increasing risk of compound events and urbanization in the coming years. While the "best practices" of one area may not be possible to generalize, there can be key principles or useful examples that may act as guidance. These can be derived from the Brazilian experience of past, present, and planning for the future. Particularly, it includes how disproportionality across communities is addressed (specifically in the design of climate policy in urban areas), and how disaster

risk management and adaptation can evolve into a way that is more equitable in terms of not only the availability of services and resources but also of accessibility and integration of the most vulnerable populations and communities.

Further, the interaction between two hazards, both of which are the most or nearly the most extreme, will almost certainly lead to nonlinear and difficult conceptualization of impacts (in terms of impact profiles and indirect/direct socioeconomic effects). The precise impact, and even the uncertainty of such events occurring, may not be known, but what will likely remain true is the disproportionate impact felt by the most vulnerable and traditionally underserved populations.

Therefore, an urban agenda related to disaster risk management must be solidified. To do so, resources for substantive engagement with communities must be prioritized–but this must just be an initial next step. However, the "co-production" model around climate services and policy (including but not limited to adaptation policy) benefits are not equally shared. Certain groups are still left out of the room, and others that have a "seat at the table" still do not have a voice. Even those who have a voice may not have their words represented within the decision-making process and final drafts and of the standard operating procedures.

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16.

Mobilizing Finance for Climate Adaptation and to Build Back Better

Frederic de Mariz

The occurrence of natural disasters, their rising frequency and severity, and their disruptive nature for economic and financial systems have gained wide recognition over the past two decades. "Green swan events" are disasters with an expected occurrence and contrast with "black swan" events, whose occurrence is exceptional in nature (Bolton et al. 2020). The earthquake that struck Lisbon in 1755 and the subsequent tsunami and fires are sometimes presented as the epitome of a natural catastrophe. The post-earthquake efforts involved not just public finance and architectural innovation—with the first grid in modern cities—but also capitalists who financed its reconstruction. Climate science suggests that severe events will become more frequent. In that context, sustainable finance often incorporates climate adaptation or sustainable cities (as stated in Sustainable Development Goals 11 and 13) with 41% of bond issuance in Brasil in 2021–2024 being linked to those two topics, but just 7% mention disaster prevention or recovery. While every disaster has

its specificities and the literature on building back better is ample, there has been limited focus on how finance and the private sector can prepare for and support the efforts of reconstruction. We attempt to fill this gap, in light of the 2024 tragedy that devastated the State of Rio Grande do Sul (RS), in southern Brasil. We do not attempt to explain what could have been done differently, but we analyze the Rio Grande do Sul events to propose a template for how private capital can be mobilized to help the reconstruction efforts before and after. We contribute to the literature with data analysis of sustainable finance in a large emerging market: Brasil, focusing on resilient cities. Moreover, we define a schematic timeline describing the types of financial actors who can engage in reconstruction efforts.

When a Natural Event Becomes a Disaster: The Context of Rio Grande do Sul

Heavy rains in April and May 2024 caused widespread devastation in the State of Rio Grande do Sul (RS), in Southern Brasil, impacting 94% of all economic activity in the State. Of the 497 municipalities in RS, 95 were in a state of public calamity and 323 in a state of emergency (Rio Grande do Sul 2024a), representing the worst disaster in southern Brasil in recent history (Andrade and Rigue 2024). Official accounts reported at least 183 deaths, more than 150 thousand people displaced, and many key infrastructures flooded, damaged, or destroyed, including the international airport of the capital Porto Alegre, and a collapsed dam near the city of Bento Goncalves (Buschschlüter 2024; Leal 2024). The combination of climate events related to El Niño, insufficient preparedness in a densely populated area, and difficult conditions for rescue teams

are some of the reasons for the unprecedented disaster.

The 2024 RS floods are already considered the worst economic disaster in Brazilian history, driving a possible GDP contraction for the State of RS of -2%, compared with the expected growth of 3.5% before the disaster (Gallas 2024). Material losses were estimated at US$1.6bn in May 2024, with 52% of those losses coming from damaged private homes, 27% incurred by the public sector, and 21% by the private sector (Gallas 2024). The economic impact in the state has national implications, causing a downward revision of Brasil's GDP of -0.2–0.3%, according to estimates. RS represents 6.5% of Brasil's GDP. By comparison, the State of Louisiana—which was severely affected by Hurricane Katrina in 2005—represented 1% of the US economy. The RS disaster may impact national accounts in at least three ways: lower GDP with less output and temporary disorganization of supply chains, disruption in agribusiness with a ripple effect on exports and domestic food inflation, and fiscal accounts with federal assistance to the State and loss of fiscal revenues.

Southern Brasil has experienced previous climatic events and their frequency is rising. In September 2023 and November 2023, floods had already caused damage and loss of lives. This followed the worst drought of the past 70 years that took place in 2022 and caused significant losses for agribusiness, the second most important economic activity in the State. The 2023/2024 floods represent three out of the four worst floods in RS since 1900.

The connection between disaster risk reduction (DRR) and sustainable development has long been recognized, with the Yokohama Strategy and Plan of Action for a Safer World (1994) being the first major international framework for DRR. Since then,

several internationally negotiated documents and conferences have shed light on the criticality of DRR (UN 2024). Already in 2004, on the occasion of World Water Day 2004, guidelines for reducing flood losses were launched, providing decision-makers with a range of options to consider for reducing losses associated with flooding. The Sendai Framework for Disaster Risk Reduction, adopted at the Third UN Conference on Disaster Risk Reduction (Sendai, March 2015) is a reference for stakeholders involved in space. It is a 15–year non-binding agreement, with seven targets and four priorities for action. Early on, such frameworks recognized the importance of finance, with the Sendai document having 30 mentions related to finance, including "financial support," "assistance," "incentives," and "protection," being organized by financial instruments, institutions, and regulators.

This chapter focuses on the intersection of finance with disaster risk reduction. We do not attempt to list what could have been done differently before the events or the responsibilities of different stakeholders. We also do not describe the multifaceted impact of a catastrophe. We analyze a narrowly defined topic of finance and DRR. For that, we reviewed the existing literature on DRR and "build back better," a rich and varied group of academic contributions, and interviewed experts who have worked closely with disasters, in RS and other geographies. Our dual approach combines an analytical view of the existing literature and capital markets transactions, together with practitioners' perspectives on dealing with disasters. In that sense, the interviews with experts help provide real-world recommendations.

Our main conclusion is that companies are now routinely including climate considerations in their funding and investment

decisions. However, the corporate focus has been essentially on climate mitigation, on the back of the growth in renewable energy, and not on climate adaptation or resilience. There is ample room to improve the integration of climate risk into the corporation's decision-making process and this will require new skills for board members and executives. After the disaster has struck, we find that financial institutions both from the public and private sectors are typically fast to respond, and they can follow a playbook to smooth the impact on borrowers and eventually reduce credit losses.

Before, During and After a Disaster: The Role of the Private Sector and Resilient Infrastructure

Before: Planning for Resilience and Adapting to Future Events

In their book entitled *The Green Swan*, Bolton et al. (2020) described the interconnection between climate change and financial stability. They analyzed the challenges posed to Central Banks, regulators, and supervisors. Risk systems tend to focus on backward-looking data, which proves less useful in the context of changing weather patterns. They define green swan risks as "potentially extremely financially disruptive events that could be behind the next systemic financial crisis." Green swans are different from black swans in three regards. Contrary to black swans, climate events cannot be considered rare and unexpected, even if their timing and characteristics are difficult to predict. Green swans can be more serious and pose an "existential threat to humanity," and their complexity and cascade effects are "of a higher order than for black swans" (Bolton et al. 2020, 3).

Financial institutions and Central Banks cannot solve this collective

action problem alone, and policymaking is central to this discussion (Alamillos and de Mariz 2022). The financial sector is essential to developing instruments and policies that support climate change mitigation and remediation. This includes carbon pricing, clarity on fiduciary duty (de Mariz, Aristizábal, and Andrade Álvarez 2024), sustainable finance (Deschryver and de Mariz 2020a), and new accounting frameworks.

Climate change is a recurring topic in business circles. In its annual report capturing risk perceptions of 1500 experts globally, the World Economic Forum highlights the 10 largest risks perceived over a time horizon of 10 years. Out of those 10 risks, 5 are environmental in nature, with the number one risk cited by respondents being "extreme weather events" (WEF 2024). Climate mitigation, especially investments in renewable energy, is the most common theme for sustainable finance and has a clear connection to the overarching topic of climate change mitigation.

The International Capital Markets Association (ICMA) illustrates how popular the climate narrative has become for corporations. We analyzed the ICMA database for the years 2020–2024 and researched the four most common Sustainable Development Goals (SDGs) that are referred to in bond issuance globally. First comes SDG 7 in 87% of instances, related to "affordable and clean energy," followed by SDG 11 in 73% of instances related to "sustainable cities and communities." In a third position, we find SDG 12 in 39% of instances, related to "responsible consumption and production," followed by SDG 13 in 38% of instances related to "climate action."

For the topic of this paper, we find that SDGs 11 and 13 are the most critical as they relate to sustainable cities and communities and climate action. The frequency of instances is encouraging and

suggests that issuers—be it private corporations or public entities—are aware of and engaged with climate challenges.
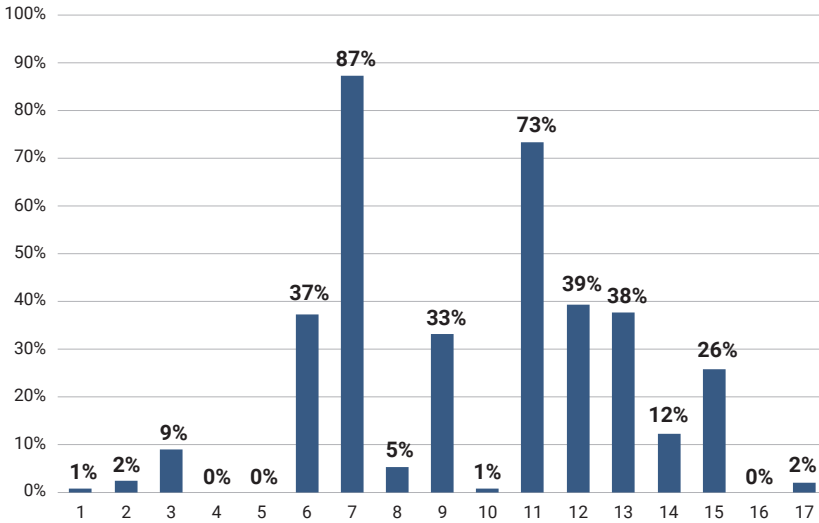

Chart 1. Breakdown of transactions by SDGs.
Source: Author, with ICMA global database of labeled bonds, for the period of 2020–2024. Last accessed on August 24, 2024.

The Brazilian market for sustainable finance has experienced strong growth. Brasil provides compelling insights into the ESG market. With its cleaner energy mix, there is a perception that Brasil does not need to decarbonize as urgently. In fact, 83% of Brazilian energy electricity production is renewable versus 38% in Europe and 20% in the United States. Other challenges can be incorporated into ESG issuances, including deforestation risk, racial diversity, and climate adaptation (de Mariz 2022). Some hurdles remain for ESG debt to flourish in Brasil and elsewhere. Key challenges include complexity and insufficient standardization in corporate disclosure, fund labels, and ESG ratings, the difficulty in financing a

transition towards a low-carbon economy and building evidence on the financial impact of following ESG strategies and their positive contribution to climate.

Enhanced standardization—such as uniform company disclosure, a taxonomy of investments, and clearer labeling of investment funds—could boost ESG markets while abating market participants' fears of greenwashing. More asset managers could support ESG strategies if their fiduciary duty were adapted to the paradigm of sustainability. While clear rules mitigate greenwashing risks, market participants will need to be aligned with investors so that funding does not flock exclusively to the greenest opportunities and finances the transition in hard-to-abate sectors. Standardization in ESG scores and regulated second-party opinions would prevent arbitrage between providers while raising the bar toward ambitious targets and market transparency. ESG scores are rarely available for Brazilian issuers, except for the large frequent issuers; when available, they vary among providers, highlighting global concern about inconsistent scores (Berg, Kolbel, and Rigobon 2022). SPO providers also vary in their interpretations of the ICMA guidelines, reinforcing the issue of divergence. Those considerations impact the global ESG markets.

Another challenge consists in fully grasping the financial impact of following ESG strategies. We stress that having financial incentives is critical to accelerate the growth of investments in a low-carbon economy. Academic evidence suggests benefits for both investors and issuers globally. Companies with better sustainability practices can attract more demand and incur a lower interest rate at the time of the issuance of a fixed-income security or loan in the euro or dollar markets. Sustainable bonds also outperform comparable

non-sustainable bonds during the life of the instrument (Harrison 2022). However, the domestic Brazilian market, which is shallower, struggles with inconclusive evidence of a financial advantage offered by ESG issuance.

Mark Carney, in his 2015 speech, stressed that climate change is a tragedy on the horizon and can become a defining issue for financial stability (Carney 2015). Climate resilience is a financial threat, and companies now routinely incorporate climate risk in their disclosure, acknowledging to some extent the urgency we face.

The Taskforce on Climate-related Financial Disclosure (TCFD) was set up by the Financial Stability Board in 2015, with the goal of developing consistent disclosure standards for companies, in order to enable investors and other stakeholders to assess the companies' climate-related financial risk. The recommendations were published in June 2017 and are now incorporated into the International Sustainability Standards Board's (ISSB) climate-related disclosure standard. In their latest available update report dated October 2023, TCFD found that 90% of companies in 2022 provided disclosures in line with at least one of the TCFD's 11 recommendations, compared with 80% in 2021 and only 64% in 2020. Average disclosures are consistently improving (IFRS 2024).

That said, while climate mitigation is often the focus of green bonds, climate adaptation or resilience is rare among transactions of sustainable finance.
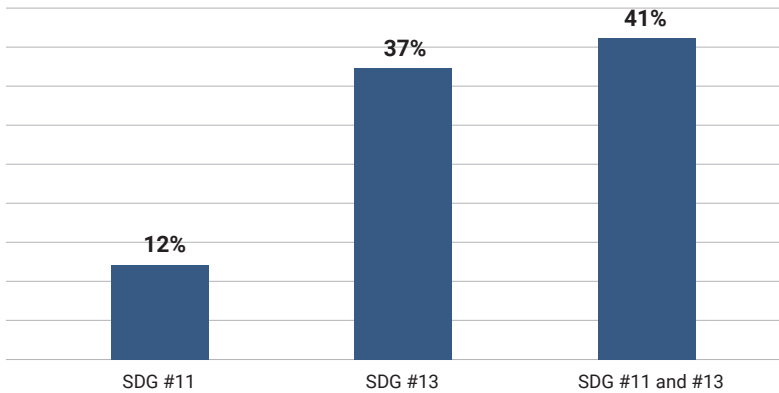
Chart 2. SDGs 11 and 13 in Brasil labelled bond issuance.
Source: Author, with database from Nint-ERM for the years 2021–2024. Last accessed on August 24, 2024.

Brazilian issuers often refer to SDGs 11 or 13 and emphasize the importance of climate change, but very few explicitly mention disaster risk reduction, prevention, or recovery. Some issuers that stressed the importance of SDG 11 included Banco do Brasil and Solfacil and aim to reduce by 2030 "the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management" (SDG 11.6). Other goals include "by 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries" (SDG 11.3). SDG 13.1 consists in strengthening "resilience and adaptive capacity to climate-related hazards and natural disasters in all countries." The Federative Republic of Brasil, in its inaugural sustainability bond issued in 2023 explicitly included in the eligible projects "expenditures […] to address risks caused by natural disasters through prevention, mitigation, preparedness, response and recovery actions." The framework also includes

"surveys, studies, mechanisms, and infrastructure to enhance resiliency and adaptive capacity of vulnerable communities and urban infrastructure against flooding and extreme rainfall events."

Eletrobras—the largest electricity utilities company in Latin America—provides an interesting example of how to incorporate climate change adaptation into financial planning and how to integrate DRR before a disaster happens (ISS 2023). Bonds issued by the company that are labeled as sustainable can serve to finance projects such as renewable energy, pollution prevention and control, environmentally sustainable management of living natural resources and land use, and climate change adaptation. This last category includes "projects, works, equipment, programs and measures required for mitigating the consequences of climate change on the Company's activities and its stakeholders, through adaptive measures […] and will be "supported by a vulnerability assessment and an adaptation plan." Examples of such investments include "efforts to make infrastructure more resilient to impacts of physical climate risk, such as strengthening transmission lines and towers, adapting dams for spillage of excess water."

Another example of critical infrastructure is water supply and sanitation. Sabesp is the water utilities company of the State of São Paulo (SP) and one of the largest globally by number of customers. The company organized 2020 a webinar to discuss its strategy for adaptation to climate change, aiming at "moving away from crisis management to risk management." The company's strategy aligned with the Brazilian National Adaptation Plan (NAP) was published in 2016 (MMA 2024). Sabesp emphasized that it was inspired by the US Environmental Protection Agency (EPA), which recommends six key themes for water companies:

awareness, adaptation, policies, mitigation, community, and partnership. The company identified six material challenges related to climate change, namely "unknown climate risks," "water pollution," "water scarcity," "excess of water," "rising sea level," and "disaster preparedness" (Sabesp 2023). When flash floods hit the state of São Paulo in February 2023, with loss of lives and critical infrastructure, Sabesp responded quickly to reestablish critical water supply and build stronger infrastructure.

During: Crisis Response

The 1755 Lisbon earthquake is the epitome of a natural catastrophe causing unprecedented devastation while also illustrating resilience and innovation. It is therefore commonly referred to in the literature on disaster risk reduction. The disaster had profound repercussions in the Western world, leading to groundbreaking innovation in the city in the fields of architecture and production as well as the emergence of a class of capitalists.

On All Saints Day, November 1, 1755, Lisbon experienced one of the most devastating earthquakes in European history. Estimated to have registered 9.0 on the Richter scale, the quake and its aftershocks were felt as far east as Venice (Ockman 2002, 15). Before the catastrophe, the capital had around 200,000 inhabitants. Between 10,000 and 15,000 people were killed and one-third of the city was destroyed. The quake struck the city while many were attending mass. A tidal wave, or tsunami, shortly followed. Most who had escaped rushed to the riverbank, where they gathered close to the splendid royal palace at the water's edge and were overwhelmed by an immense tidal wave (Watson 1908, 267).

Minister Pombal did not call foreign architects to rebuild the city, as it would have been done earlier in the century in Portugal. In an emergency that required quick reaction, Pombal instead immediately brought in Portugal's military engineers. Three military engineers were to play key roles: Manuel da Maia (1677–1768), Eugénio dos Santos (1711–1760), and Carlos Mardel (1695–1763) who collaborated to build a new capital. He supervised very closely the rebuilding of the city, approving every single plan drawn by Mardel and Santos, and defined three immediate priorities: dispose of the dead in order to avoid disease, feed the population, and third, impose public order.[1]

Pombal introduced legislation prohibiting any building, action, or sale of property before the master plan had been devised. He requested Maia's proposals for the rebuilding of the city. Engineer-major[2] since 1754, Maia published the first part of his *Dissertação* on December 4, 1755. The key notion in Maia's dissertation is uniformity. Streets are to be symmetrical in height and the form of doors and windows. Maia proposes to soften symmetry through a variation in the façade's colors (França 1965, 298). Several plans were elaborated, and it was finally the most radical one, drawn up by Santos and Mardel, that was accepted. It involved a total reinvention of the city's core with a complete overriding of previous street patterns and property lines. The combination of a dramatic situation and an activist Minister with absolute powers was key to urban reinvention. Lisbon is in particular the first large example of a grid in a western city. What is unique is that it is a new city built on old territory, but one that was radical in terms of its planning and

1. Pombal notoriously defined his priorities as "enterrar os mortos e tratar dos vivos" (bury the dead and care for the living).

2. His title was "Engenheiro-mor", reflecting his position in the military.

execution, therefore, neither like Turin nor London (Maxwell 2002, 39). Maia mentions these two cities in his dissertation, where there were "similar renovations" (França 1965, 296 and 306). He finds the design of the streets in London not clear and acknowledges that in Turin, a new city was built, adjacent to the ancient one. In London, property rights, parishes, and the location of churches remained: after the Great Fire, London was reconstructed within its old urban configurations. As Pombal himself put it: public good—meaning symmetry and beauty—overruled particular interests.[3]

Legislation was passed in May 1758 to provide for the assessment and reallocation of property rights. Property owners were compensated for the land, houses, and old street space reallocated under the new urban plan. Loans were provided to people who needed them, and those who took on new property were given five years to complete the construction of the new buildings. A class of capitalists emerged, who financed the reconstruction, including Pombal himself who developed a large number of buildings in central Lisbon.

New production standards were introduced for mass construction. The reconstruction led to the creation of an extensive infrastructure for the prefabrication of standardized parts and stimulated an industrial artisan class. Rationalization was demanded by the shortage of workers and input. Windows, doors, balconies, ceramics, and nails were designed for standardized production. Azulejos' designs (typical tiles) become monotonous in order to adapt to all buildings. This movement resulted in the creation of a unit of continuous architecture at the heart of the city, according to art historian Robert Smith (1968, 105), which comprises one of

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3. "A utilidade pública da regularidade e da beleza da capital foram preferidos aos interesses particulares." In an Act passed on June 12, 1758, cited by França (1965, 101).

the "greatest uniform architectural undertakings of the age of the Enlightenment." If we had to define two principles that founded the rebuilding, they would be *order* and *sobriety* (de Mariz 2004).

After: Rebuilding while Avoiding Lock-In Effects

In RS, heavy rains started on April 27, 2024, and rapidly intensified. As noted by an expert in disaster response Mr. Leo Farah, public generosity is typically instantaneous, but it is sometimes ineffective and fades with time, with donations falling by 90% 30 days after a disaster strikes. Channels for donations were not properly organized, with donations of kind getting a limited uptake that eventually resulted in waste.

Crisis response can be more effective with donations of money, which is fungible, via official channels. The World Bank emphasizes that "fungible funding is equally important in addressing regional and sectoral gaps" (Fengler, Ihsan, and Kaiser 2008). Donations can avoid duplicated efforts, and waste of food or materials, and avoid further disruption to local small businesses. It is also most helpful in the post-disaster phase, which requires more capital for reconstruction. That being said, donations in kind can also play a role, if companies contribute with a product that is core to their business and the logistical delivery is viable and cost-efficient, such as apparel makers donating basic clothing. The post-disaster period involves rebuilding the local economy and communities.

Mr. Farah emphasizes the need for companies to anticipate potential disasters and suggests that they define upfront in which form they would be able to contribute and to what extent, in order to speed up response time and avoid emotion-filled aid that can be ineffective

for impacted populations. Corporations would ideally join in efforts, as public entities designed for this purpose may not be properly staffed or prepared. Mr. Farah emphasizes that prevention is less expensive than disaster recovery.[4]

In the case of RS, responding to the crisis demanded difficult decisions and arbitrations, with the initial target of protecting lives. Federal troops were called by the governor of RS on May 1 to help stabilize the situation.

In the wake of the November 2023 floods, the State developed a Climate Program 2050 (Rio Grande do Sul 2024b) and created a cabinet for the climate crisis with a scientific committee, but those initiatives came under criticism for their lack of preparedness and slowness in answering the April 2024 events (Prazeres and da Mata 2024). Images of the flooded Porto Alegre airport and the collapse of a dam near Bento Goncalves were strong images that resonated with the public and illustrated the importance of resilient infrastructure in disaster prevention. Best practices in reconstruction take into account the need to avoid locking in poor design or infrastructure. In some cases, rebuilding in the same location is not viable.

Once the crisis is contained, building back better (BBB) is a complex effort. The World Bank defines "better" as "stronger, faster, more inclusive" (Hallegatte, Rentschler and Walsh 2018). Opus Construtech, a modular construction company headquartered in the State of Minas Gerais, Brasil, is one of the companies that responded quickly to the events to propose its solutions of temporary, high quality and cost-efficient building units to municipalities in RS via public procurement. Modularity, which is traditionally

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4. I would like to thank Mr. Farah for sharing some of his experience and insights for the purpose of this chapter. Mr Farah holds a Master's degree in engineering and disaster prevention from UFOP and is CEO of Humus.

used in construction sites, can be a solution to respond effectively to a disaster. That said, reconstruction bears social challenges and disasters have a redistributive impact with more vulnerable people finding it more difficult to respond and recover. The ones who need housing post-disaster are often the ones who were more vulnerable before the disaster hit. In fact, the challenge for authorities is not just to provide shelter, but the disaster acts as a magnifying glass of urban and social preexisting weaknesses.

How to Engage with Financing

The academic literature indicates that disasters tend to have a limited impact on the long-term development of a region (Noy, Ferrarini and Park 2019).[5] However, studies also suggest that disasters can have a negative impact on education and health outcomes (Noy, Ferrarini and Park 2019, 8), and those consequences impact groups differently, which is consistent with the literature that analyzes the redistributive impacts of climate change (Bolton et al. 2020). To quote Amy Gutman in her insightful analysis of Hurricane Katrina, the disaster was "not just a misfortune, but also an injustice" (Birch and Wachter 2006). Reconstruction is a multifaceted effort, involving practitioners from many disciplines.

Financial services are essentially a tool to smooth intertemporal changes in revenues and wealth and are a natural part of crisis management and the BBB equation. Public finance, including Government-to-people transfers (G2P) or Government-to-government (G2G), is a fundamental mechanism. Capital markets

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5. See Klomp and Valckx (2014) and Lazzaroni and van Bergeijk (2014) for an excellent review of the short-run macroeconomic recovery literature.

and innovative instruments, such as green bonds, sustainability-linked bonds, or social impact bonds can play a role in the toolkit of interventions (de Mariz and Savoia 2018; de Mariz et al. 2024). Issuers and investors are eager to develop flexible instruments that extend beyond pure green to include transitions from brown, but only if credible and commonly shared guidelines and frameworks are established (Deschryver and de Mariz 2020b).

Public Finance Mechanisms

We present a typology of financial instruments and a schematic timeline or sequence of their use. Public finance can include mechanisms from national or international, federal or state public actors. Measures can include loan forgiveness, exceptional payments to impacted populations, and new lines of credit or guarantees.

In the case of RS, the federal government proposed to the Brazilian Congress that payments by RS on its debt with the Union would be suspended for three years, representing a grace period until the fiscal situation of the state normalizes and allowing for the state to direct scarce funds to the reconstruction efforts. The federal government also announced that it would anticipate a list of Government-to-people (G2P) payments, such as benefits and reimbursements of taxes paid in advance. The federal government announced a new one-off transfer of R$5000 per family in the form of a reconstruction voucher. There were also announcements of new lines of credit for small—and medium-sized (SMEs) companies and farmers, in the form of additional guarantees offered by the Federation for bank lending (Gallas 2024; Schreiber 2024). Technology plays a key role in advancing G2P payments, fostering inclusion and resilience, by easing and reducing the cost of transfers (de Mariz 2020).

Transfers via PIX are another example of technology benefiting end users. PIX is an innovation-driven by the Brazilian Central Bank and is a person-to-person (P2P) payment method that is free and instantaneous. It has been often used in the case of RS for P2P transfers and donations.

In some cases, those measures repeated emergency actions taken as a response to the COVID-19 crisis, such as Pronampe (a program to support SMEs). Less than a month, after a partial lockdown in Brasil began on March 24, 2020, 91 million citizens had already experienced a late payment on a credit installment or a utility bill. This compared with 59 million in early March 2020 and represented a jump from 39 percent to 58 percent of the adult population (de Mariz 2020b). In April 2019, Complementary Law 166/2019 was signed by Brazilian President Jair Bolsonaro (complementing Law 12.414/2011), enhancing the roles and responsibilities of credit bureaus under an opt-out system. This came on the heels of years of discussions between banks, regulators, and consumer protection groups. Bureaus had been using positive data since 2011, though adhesion remained low due to an opt-in system. Presidential Decree 9.936 was then signed in July 2019 and banks began to contribute their data to bureaus in October 2019, alongside datasets from retailers and utilities, such as gas, electricity, and telecom companies. With this addition, credit bureaus in Brasil leapfrogged from a binary (good or delinquent payer) to a continuous logic (scores). Bureaus can play an essential role in financial inclusion, as credit bureaus and the scores they produce reduce the asymmetry of information between lenders and borrowers. Disasters often raise the question of how to treat late payments for the calculation of credit scores of individuals and companies, and whether data should not be considered during times of catastrophes.

Within the public finance space, a critical player includes development banks, such as the Brazilian National Bank of Economic and Social Development (BNDES). BNDES quickly launched an emergency program designed to provide loans and guarantees to impacted businesses and people, attending to a wide range of customers with companies, farmers, cooperatives, logistics companies, and microentrepreneurs (BNDES 2024; Brasil 2024). Lines of credit included working capital loans, machinery and equipment, capex lines for reconstruction, and emergency working capital, including immediate needs such as payroll or supplier payments, inventory purchases, and short-term needs to restart economic activities. BNDES conditioned the lines of credit to the maintenance of corporate headcounts.

However, there are challenges and limitations for public finance and the deepening of the already significant fiscal deficits.

Accelerate Transition Finance

Sustainable finance has evolved into a quickly growing segment that encompasses several asset classes and incorporates environmental, social, and governance (ESG) considerations. Various asset classes, including mutual funds, private equity, public equity, real estate, and bonds, could adopt an ESG framework (Aramonte and Zabai 2021). In the bond category, markets have developed four ESG typologies: green, social, sustainability, and sustainability-linked. Green, social, and sustainability bonds raise funds to be used in projects with environmental or social objectives. Sustainability-linked bonds are raised by companies that set ESG objectives but do not immediately proceed directly to pre-defined projects.

The issue of those four types of securities reached a record of $883 billion in 2021 globally, 112 percent higher than in 2020 when total issuance amounted to $416 billion (de Mariz 2022). R2024 issuance is expected to reach or even surpass 1 trillion. Sustainable bond issuance now represents almost ten percent of total public bond issuance (Environmental Finance 2022) and is expected to grow meaningfully. While Europe represents the largest region for these bonds, with fifty-two percent of global sustainable bond issuances in 2021, other regions are catching up. Emerging markets (EM) represented twenty-one percent of total bond issuance in 2021, compared to seventeen percent in 2020 (Michetti et al. 2023). While some hurdles remain for sustainable finance in EM, lessons from its development, particularly those gleaned from Brasil, can be used to help guide policymakers in the developing world.

Transition finance instruments are investment vehicles specifically aimed at "greening" (improving, cleaning) the "brown" (dirty, polluting) industries and transforming the practices of the least sustainable sectors and companies. A framework for the issuance of transition instruments was elaborated by the International Capital Market Association in 2023. The transition finance handbook provides credibility to issuers and investors, with a transition strategy to a low-carbon economy that is credible and aligned with science (ICMA 2023). However, transition finance often faces the challenges of access to private capital for individuals and corporations.

Typology of Financial Mechanisms and Schematic Timeline of Use

Banrisul is the leading bank in the State of Rio Grande do Sul, with a market share of approximately 20% of loans and 40% of deposits in the state, and a presence in all the 497 RS municipalities. The

bank published a press release on May 7, 2024, commenting on the "severe rains in recent days, the consequences of which resulted mainly in the loss of lives, damage to homes and properties, disruptions to the road, electrical and water supply networks, as well as flooding due to the rise in the level of important rivers in the state." The bank emphasized that it remained "fully operational" and "with full availability in its various customer relationship channels, whether digitally or via the network of branches and banking correspondents," highlighting the importance of several channels to serve customers.

Other geographies in emerging markets are often plagued by natural catastrophes, such as Mexico with hurricanes or earthquakes. Banco Compartamos is one of the largest microfinance players in emerging markets, with more than three million clients, and is often exposed to disasters, which impact the most vulnerable segments of the population as they may have fewer mechanisms to cope with emergencies. When they faced the challenges of hurricane season or the unique challenge of COVID-19, Compartamos responded with a three-pronged strategy to protect its staff, protect its customers, and protect the bank. Protecting staff included the need to migrate to online channels when being in the field became impossible or unsafe. Protecting customers included quick actions such as debt forgiveness and not requiring collateral on new loans, as this collateral was often fully destroyed during the climate event and families typically had no other guarantees to offer. Microfinance and financial inclusion present challenges that are unique to this segment of financial institutions (Glisovic et al. 2015). Protecting the bank included emergency measures, such as drawing down on pre-approved lines of credit with other financial institutions and multilateral.

Phase 1: Prevention, Disaster Risk Reduction (DRR)	Phase 2: Crisis management	Phase 3: Post-disaster, Build Back Better (BBB)
Instruments:	Instruments:	Instruments:
• Labeled bonds aligned with SDGs 11 and 13. • Transition finance. • Insurance mechanisms.	• Own wealth and savings of affected communities. • Aid from the national public sector, federal funds, direct Government-to-People and Government-to-Business transfers (G2P, G2B), and emergency lines of credit from development banks. • Aid from international organizations, including multilateral. • Philanthropy, donations, and crowdfunding, especially through digital donation mechanisms such as PIX, and people-to-people transfers (P2P). • Insurance mechanisms to compensate for losses. • Debt forgiveness, automatic renegotiation of loans by private banks, new lines of emergency credit, or reduction in fees and charges for emergency transfers.	• Borrowing with private banks. • Public finance. • Transition finance.

Chart 3. Build back better: a typology of instruments and schematic timeline.

Conclusion

Twenty years after Hurricane Katrina hit New Orleans, how have we implemented lessons learned? Climate science suggests that extreme weather events will become more frequent. When they

impact densely populated areas with poor preparedness, they have the potential to become disasters. There are several financial mechanisms involving the private sector, public finance, and private financial institutions. Each phase of the disaster is more likely to be addressed by specific instruments. Preparedness can be addressed by capex, which is invested by corporations and the public sector to strengthen infrastructure and financial instruments such as labeled bonds. The acute phase of the crisis can be best addressed by public finance, solidarity as well as loan forgiveness. In that phase, public institutions play a key role, and transfers can support affected communities. The post-disaster phase revolves around difficult arbitration to build back better and requires planning and long-term funding. Awareness around climate adaptation appears to be insufficient, which is consistent with the focus defined on the Sendai Framework to understand (#1) and invest in DRR for resilience (#3). We know that the cost of inaction is significantly higher than the cost of mitigating and adapting to climate change.

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Frederic de Mariz — PhD, is an adjunct Professor at Columbia University and Brandmeyer Fellow for Impact and Sustainable Investing. He leads ESG Advisory for UBS BB Investment Banking, having reached the first position for sustainable finance in Brasil in 2023. He was previously Head of FIG & Fintech and has more than 20 years of experience in investment banking. His last book, *Finance with a Purpose*, was published in 2022 (World Scientific). He graduated from Columbia University and holds a PhD in Finance from USP. He represents UBS at Anbima and sits on Wickbold's sustainability committee.

H.E. Fahd bin Abdulmohsan Al-Rasheed — H.E. Al-Rasheed is an Advisor at the Council of Ministers of the Kingdom of Saudi Arabia. H.E. Al-Rasheed serves on the boards of multiple organizations, including some of Saudi Arabia's most significant urban development initiatives. He represents the Kingdom of Saudi Arabia as a lead on the Urban 20, which he chaired in 2020. H.E. Al-Rasheed was previously the CEO of the Royal Commission for Riyadh City (RCRC) and Group CEO and Managing Director of King Abdullah Economic City (KAEC). H.E. Al-Rasheed holds a Bachelor of Science in Business Administration from Washington University in St. Louis, an MBA from the Stanford Business School, and is also a graduate of the Advanced Management Program in Real Estate at the Harvard Graduate School of Design. He was honored as a Young Global Leader by the World Economic Forum in 2011.

Hazem Galal — PwC, Global Cities and Local Government Leader and Global Smart Mobility Co-Leader. Galal is a global expert in strategy formulation and implementation. He co-authored the book *Delivering Sustainable Competitiveness* (2016) and worked with the WEF and numerous global organizations on multiple urban development domains, including financing. He is a member of the Global Commission for Urban SDG Finance. Galal is a frequent speaker at many global conferences and news networks.

Hellas Lee — Recent Master's graduate from Columbia Climate School's Climate and Society program and holds a Bachelor's in Environmental Science from UC Berkeley. Deeply dedicated to interdisciplinary approaches in climate science, adaptation planning, and sustainable design, Lee has interned with Ove

Arup & Partners and the Resilient Coastal Communities Project. Her work seeks to expand the intersections between climate data, environmental policy, and community needs to advance transformation toward equitable and resilient communities.

Isabella Pereira — A graduate student in the Master of International Affairs program at Columbia University's School of International and Public Affairs, concentrating on Human Rights and Humanitarian Policy. She is a fellow in the International Fellows Program and a scholar of the Lemann Foundation. Pereira earned her degree in International Relations from the Federal Fluminense University. She specialized in Politics and Society at the Institute of Social and Political Studies, where she researched Colombia at the South American Political Observatory. Her research interests include migratory movements, climate change, and gender issues.

Jacqueline M. Klopp — Research scholar and Director of the Center for Sustainable Urban Development at the Columbia Climate School in New York City, where she also teaches Sustainable Development. Dr. Klopp works extensively on urban policy and governance, focusing on land use, mobility, emissions, and technology, as well as equity and justice lenses. She is also a co-founder of DigitalTransport4Africa and leads the Partnership for Research on Informal and Shared Mobility, a global consortium working to close the popular transport research and policy gap.

Jeff Schlegelmilch — National Center for Disaster Preparedness Director at the Columbia Climate School, Columbia University. He is also the author of the book *Rethinking Readiness: A Brief Guide to Twenty-First-Century Megadisasters* (2020) and co-author of the

book *Catastrophic Incentives: Why Our Approaches to Disasters Keep Falling Short* (2023).

Jessica Weinberg — A third-year undergraduate student at the University of Miami's Rosenstiel School studying meteorology. Weinberg's experience lies in authoring publications related to climate modeling and the projected distributions of invasive species under a climate change scenario. As she continues her undergraduate career, Weinberg has turned her interests to both climatological risk assessment and mitigation and intends to continue her postgraduate education in related fields.

João Carlos Cochlar — International Relations and Cooperation Advisor at the Rio de Janeiro City Hall. LL.M Candidate at the Pontifical Catholic University of Rio de Janeiro (PUC-Rio). LL.B. from the Rio de Janeiro Law School-Getúlio Vargas Foundation (FGV Direito Rio, 2020). Visiting Student at the Institute of Political Studies in Paris (Sciences Po Paris, 2019, first semester) and Université Paris-Dauphine (Paris IX, 2019, second semester). Recipient of the XI Alfredo Lamy Filho Award for innovation in the final monograph at FGV Direito Rio. Lawyer and academic researcher.

Li Zhuang — Deputy director of the Eco-City Research Department at the Research Institute for Eco-civilization at the Chinese Academy of Social Sciences and the deputy secretary-general of the China Society of Urban Economy. His current research focuses on the resilience of urban infrastructure and urban and regional development.

Mariana Cammisa — Fellow of the Center of International Strategies for Governments and Social Organizations (CIG), Universidad Austral, Argentina. Cammisa is a specialist in international cooperation and development agendas at the local level. She is an Integration and Trade Consultant for the Inter-American Development Bank in Buenos Aires, Argentina. Previously, she was the International Cooperation Manager at the Buenos Aires City Government and was responsible for localizing the 2030 Agenda for Sustainable Development. Likewise, she is a Fellow of the Center of International Strategies for Governments and Social Organizations of Universidad Austral. She has an MA in International Peace Studies from the UN-mandated University for Peace (Costa Rica) and a BA in International Relations from UCC (Argentina).

Marianna Albuquerque — Professor at the Institute of International Relations and Defense, Federal University of Rio de Janeiro (IRID-UFRJ). Senior Fellow at the Brazilian Center for International Relations (CEBRI) and Editor of CEBRI-Journal. Raisina Fellow at the Observer Research Foundation (ORF-India). Albuquerque holds a post-doctorate in Military Sciences from the Army Command and General Staff College (ECEME), a PhD in Political Science from the Institute of Social and Political Studies at the State University of Rio de Janeiro (UERJ) (IESP/UERJ), and an MA in Political Science from the same institution.

Mauricio Rodas — Mauricio Rodas served as the Mayor of Quito, Ecuador, from 2014 to 2019. During his tenure, he hosted the UN Conference Habitat III and held prominent international positions such as World Co-President of UCLG, Vice-Chair of C40 Cities,

and board member of the Global Covenant of Mayors and ICLEI. He is a Visiting Professor at the University of Pennsylvania, a Senior Advisor on Extreme Heat and City Diplomacy at the Atlantic Council, and a member of the UN's Committee of Experts on Public Administration. Dr. Rodas co-chairs the Secretariat of the SDSN Global Commission for Urban SDG Finance.

Mohamed Abdelraouf — Dr. Abdelraouf is the Director of the Gulf Research Center research program on Sustainability and Environmental Issues and is currently the co-chair of the Major Groups Facilitating Committee at the United Nations Environment Programme (UNEP) representing the Science and Technology Major Group. Dr. Raouf is currently a member of the United Nations Environment Programme (UNEP) Global Environment Outlook GEO-7 Intergovernmental and Multi-stakeholder Advisory Group. He is a certified trainer in Water Footprint and Water Diplomacy and a part-time lecturer on environmental issues at various universities in the Middle East and North Africa. He published various policy papers and authored five books on environmental/sustainability issues in the Gulf and MENA regions.

Mounir Kabbara — PwC, Director, Cities & Local Government Consulting. Kabbara specializes in strategic planning and implementation, governance, and operating model design for cities and local governments. He has advised several clients on their smart city transformation projects and has 9+ years of experience focusing on sustainability, working with real estate developers, consultants, and contractors.

Munsu Kang — Agricultural economist and associate research fellow of the Africa, Middle East, and Latin America team at the Korea Institute for International Economic Policy (KIEP). His research interests extend to agricultural production, climate change, and energy policies in African and Middle Eastern countries. His recent research includes Impacts of Climate Change and Policy Implications on Food Security in Africa and the Middle East, Research on Green Energy Cooperation with East Africa, Research on Policy Reforms and Perceptions of Energy Subsidies in the MENA Region, and Food Security Threats and Policy Responses in EU and Africa. He received his PhD from Kansas State University.

Paul Gallay — Gallay teaches at Columbia Climate School and directs its Resilient Coastal Communities Project, a partnership with the NYC Environmental Justice Alliance dedicated to fostering actionable, equitable solutions to flood risks and complementary benefits like habitat restoration, job creation, and more empowered communities. He also served in government and held leadership positions with Hudson Riverkeeper and land conservation organizations in New York and Maine, after earning degrees from Columbia Law School and Williams College.

Pedro Vormittag — Chief of Staff to State Congressman Eduardo Cavaliere at Rio de Janeiro's State Legislature. He was previously Chief of Staff to the Presidency of CEBRI and Director of Government Relations. Vormittag represented CEBRI as an Emerging Leader at the Atlantic Dialogues in Morocco, a NEXT Leader in Milan, and a Delegate at T20 in India. He holds Master's degrees in International Relations (Columbia University) and

International Management (FGV). A lawyer from the University of São Paulo (USP), Vormittag also served in various government roles and is currently a member of the International Relations Commission of the Brazilian Bar Association.

Rajat Chowdhary — PwC, Partner, Technology Consulting. Chowdhary counts on 15 years of global advisory experience across diverse domains. Specialized in projects involving digital services, security and surveillance, homeland security, and integrated command and control centers. Chowdhary's expertise spans advising 100+ clients globally, including engagements in smart cities and ICT Master Plans.

Rebecca Bill Chavez — PhD, is president and CEO of the Inter-American Dialogue. She served as Deputy Assistant Secretary of Defense for Western Hemisphere Affairs during the Obama administration. Before serving in the government, Dr. Chavez was a tenured professor of political science at the United States Naval Academy. She is the author of *The Rule of Law in Nascent Democracies* (Stanford University Press), and her work has appeared in numerous journals and newspapers. Dr. Chavez received her MA and PhD in Political Science from Stanford University and her BA in Public and International Affairs from Princeton University.

Riatu Mariatul Qibthiyyah — Faculty member in the Economics Department and a senior researcher at the Institute for Economic and Social Research University of Indonesia (LPEM FEB UI). She was one of the executive co-chairs of Think20 Indonesia in 2022, an engagement group for the G20. She is a public finance expert in the areas of decentralization, intergovernmental transfers, and taxation.

Seungho Lee — Assistant Professor in the Department of Spanish and Latin American Studies at Jeonbuk National University (JBNU). Before joining JBNU, he was an Associate Research Fellow in the Americas Team at the Korea Institute for International Economic Policy (KIEP). His research interests include Latin American political economy, international trade, and East Asia–Latin America relations. He holds a BSc in Economics from the University of Warwick, an MSc in Latin American Studies from the University of Oxford, and a PhD in International Studies from Seoul National University.

Victoria Sanders — The Climate and Health Programs Manager at the NYC Environmental Justice Alliance. Her work includes research and advocacy to support environmental health initiatives to promote equitable, resilient, and healthy environmental justice communities, focusing on climate change-induced extreme weather, air pollution prevention, and promoting green infrastructure. She previously worked at the NYC Department of Health after earning an MPH in Environmental Health Sciences from Columbia University's Mailman School of Public Health.

Walter Baethgen — Senior Research Scientist, Director of the Regional and Sectoral Research program in the IRI of the Columbia Climate School, and served as Acting Director of the IRI and the Agriculture and Food Security Center at Columbia University. He has established regional programs to improve climate risk assessment and risk management in agriculture, health, water resources, and natural ecosystems. In 2020, he became the vice president of the Board of Directors of the Uruguayan National Agricultural Research Institute. He was an author in IPCC's Second,

Third, and Fourth Assessment Reports and he was a member of the IPCC team that received the Nobel Peace Prize in 2007.

Xin Dong — Professor at the School of Applied Economics at the University of Chinese Academy of Social Sciences and the Director of the Eco-City Research Department at the Research Institute for Eco-civilization at the Chinese Academy of Social Sciences. Her main research fields include urban and regional economics, sustainable development, housing and land policies, and population migration.

Yoon Jae Ro — Associate Research Fellow at Korea Institute for International Economic Policy (KIEP) with a PhD in Economics from UC Riverside, a Master's from Yonsei University, and dual Bachelor's degrees in French and Economics from Sogang University. Specializing in development and labor economics, her research focuses on policies affecting human capital and socio-economic development. Her work includes studies on the impact of green energy on education, population dynamics in India, and the effects of climate change and digitalization on labor markets.

Knowledge Partner Institutions

CEBRI

Rethink Tank

The **Brazilian Center for International Relations (CEBRI)** is an independent and non-profit think tank that has since 1998 been dedicated to promoting constructive debate on agendas that serve the national interest and on Brasil's competitive and strategic participation in the global arena. Based in Rio de Janeiro, CEBRI is recognized in Brasil and abroad as a platform for the analysis, development, and coordination of pragmatic and innovative solutions. The CEBRI Board of Trustees includes recognized national leaders and is a key part of CEBRI's non-partisan, diverse, and plural network of experts in various fields and perspectives. Our more than 100 members believe in and promote our mission: to influence a constructive and high-level dialog on Brasil's international relations. The CEBRI community encompasses not only individual members and several foreign diplomatic offices, but also major Brazilian companies active in various industries.

The **Rio G20 Committee** was formed based on the diagnosis that the city of Rio de Janeiro could–and should–proactively support the Brazilian Federal Government's logistical and intellectual efforts in the unprecedented challenge of chairing and hosting the G20. The municipal committee encourages, promotes and coordinates logistical actions and intellectual initiatives that strengthen Rio's role as the capital of the G20, in a public effort that spills over into civil society institutions.

The **Penn Institute for Urban Research (Penn IUR)** fosters collaboration among scholars and policymakers to address the needs of an increasingly urbanized society. Working across the University of Pennsylvania and the world of practice, Penn IUR informs urban decision-making and public policy on sustainable urban growth and development issues. https://penniur.upenn.edu

The **Policy Center for the New South (PCNS)** is a Moroccan think tank that aims to improve economic and social public policies that challenge Morocco and the rest of Africa as integral parts of the global South. PCNS pleads for an open, accountable, and enterprising "new South" that defines its own narratives and mental maps around the Mediterranean and South Atlantic basins as part of a forward-looking relationship with the rest of the world. Through its analytical endeavors, the think tank aims to support the development of public policies in Africa and to give the floor to experts from the South, focused on dialogue and partnership to cultivate African expertise and excellence for the accurate analysis of African and global challenges, and the suggestion of appropriate solutions.

Climate Hub Rio fosters global collaboration on climate issues through research, education and public events. Building on Columbia Global Center Rio's mission, it connects Columbia University and Brazilian NGOs, public, and private institutions through programs and activities to accelerate climate science and climate action.

THE DIALOGUE
Leadership for the Americas

The **Inter-American Dialogue** engages our network of global leaders to foster democratic governance, shared prosperity, and social equity in Latin America and the Caribbean. Together, we work to shape policy debate, devise solutions, and enhance cooperation within the Western Hemisphere.

Atlantic Council

The **Atlantic Council** promotes constructive leadership and engagement in international affairs based on the Atlantic Community's central role in meeting global challenges. The Council provides an essential forum for navigating the dramatic economic and political changes defining the twenty-first century by informing and galvanizing its uniquely influential network of global leaders. The Atlantic Council—through the papers it publishes, the ideas it generates, the future leaders it develops, and the communities it builds—shapes policy choices and strategies to create a more free, secure, and prosperous world.

As the host city of the G20 Summit under the Brazilian presidency in 2024, the Rio de Janeiro City Hall has embraced the commitment to ensuring this milestone event's legacy. Rio engaged in a productive knowledge partnership with the Brazilian Center for International Relations (CEBRI) as part of these efforts. This book is a result of this fruitful combination of perspectives.

Urban Sustainable Development: Governance, Finance and Politics addresses the critical challenges of promoting sustainable growth in rapidly expanding cities. Divided into two sections, the book first delves into conceptual debates, exploring the intersections of governance, finance, and politics in urban sustainability. It examines key themes such as multilevel governance, the role of local governments in fostering sustainable policies, and the financial mechanisms crucial to green initiatives. The second section presents a series of case studies from cities worldwide, showcasing practical applications of governance models, financing strategies, and political approaches.

By examining both successes and challenges, the book offers insight into how different cities tackle the complexities of sustainable development. What sets this book apart is its diverse pool of contributors, including academics, national and subnational government leaders, and experts in sustainable finance. This multidisciplinary approach ensures a well-rounded perspective, blending rigorous research with practical insights.