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Local Governments for Sustainability

FINANCING
THE RESILIENT CITY

A demand driven approach to development, disaster risk reduction, and climate adaptation

An ICLEI White Paper

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Financing the Resilient City:
A demand driven approach to development, disaster risk reduction and climate adaptation

An ICLEI White Paper

The report in brief

- **The level of resilience of our cities and towns is dependent on the quality and performance of the overall urban system, not solely on the climate change adaptation of single infrastructure elements.**
- **Adaptation to climate change is becoming increasingly relevant as the negative impacts of climate change increase. At the same time, awareness about disaster risk reduction is also a growing concern.**
- **There needs to be a shift, in both adaptation to climate change and disaster risk reduction, from a singular and specific focus on affected infrastructures and locations towards a more integrated focus on overall risks, development conditions, and local area performance.**
- **The report calls for:**
  - Mainstreaming climate and disaster risk reduction to become factors in conventional planning processes, project design and development decision making.
  - Developing specialized financial instruments for the risk-oriented components of these projects that cannot be addressed via mainstreaming measures.
  - Building local institutional capacity to prepare, structure and manage large scale re-development
- **The right capacity must be available at the local level to leverage the right finance. Capacity is needed at the local level to organize effective demand for resilience as one of the key conditions for comprehensive resilience upgrading of vulnerable urban areas. This would allow locally driven, large and complex projects to advance as quickly as conventional top-down projects.**
- **The challenge is to match local demand for resilience with the supply of finance.**
- **Conditions at the local level for leveraging finance include:**
  - Building capacity of bottom-up *planning processes* for identifying vulnerabilities and risks, and linking the related risk mitigation solutions with priority performance enhancements in relevant areas or systems.
  - Ensuring bottom-up *technical and institutional capacity* for designing comprehensive resilience upgrading projects; for managing and staging complex project execution; and for preparing the different investment propositions related to different components of these projects.
  - Suporting the bottom-up *procurement of investment* through managed, competitive sourcing mechanisms and processes.
- **In addition, there are challenges to the supply of finance:**
  - The market for resilience finance requires a high degree of responsiveness to differentiated demand, so that the projects themselves can be locally responsive.
  - Markets require a considerable degree of standardization of the investment propositions and predictability about the pipeline and subsequent performance of the propositions.
  - Industry needs to learn how to integrate resilience as a new design and project performance element into the front-end of project planning and product design. Until then there could be a need for new, non-conventional financing instruments to support initial resilience upgrading.

Foreword

Cities taking action

Cities and local communities are at the front line of the battle against climate change and already suffer from increasing stresses it causes. At the same time cities and urban areas need to continue to develop, plan for and reduce risks from other sources. They need to be able to mobilize resources to respond to these challenges and become more resilient.

This report provides a conceptual framework for better understanding how to integrate climate and other risk reduction measures in urban areas and systems. Here resilience is offered as an economic and performance model with far reaching implications. The report calls for more locally responsive climate financing investment strategies and instruments. It also sets the scene for and provides a valuable contribution to the ongoing international discussions on climate financing for adaptation; how it can be mobilized, leveraged and innovated for the local level.

I sincerely believe that the innovative ideas, approaches and proposals presented in this report will also provide excellent guidance in realizing the ambition of the Mexico City Pact. The Pact was an outcome of the World Mayors Summit on Climate in Mexico City on 21 November 2010, which was convened under my leadership in my capacity as the Chair of the World Mayors Council on Climate Change. The Mexcio City Pact establishes a set of voluntary commitments to promote strategies and actions aimed at mitigating greenhouse gas emissions and adapting cities to the impacts of climate change.

The concepts in this report build upon long standing experience of ICLEI - Local Governments for Sustainability in providing adaptation tools and programs for local governments from local governments. It gives me great pleasure to confirm the full commitment of the World Mayors Council to spread the ideas developed in this report and seek their concrete realization.

Marcelo Ebrard

Mayor of Mexico City
Chair of the World Mayors Council on Climate Change

Introduction

Implementing climate adaptation financing

Climate finance has become an intense talking point around the world, especially in regards to adaptation financing. Cities play a key role. The World Bank recently estimated that up to 80 percent of the expected US$80-100 billion per year in climate change adaptation costs are to be borne by urban areas.

Finance needs are being calculated, governments are making commitments, and international and financial institutions are positioning themselves and developing elaborate funding criteria and rules.

At the Resilient Cities 2010 world congress it was felt that a top-down approach could emerge. But, cities and local governments need to design infrastructure projects that are optimized according to a set of local criteria and finance institutions need to instead finance what is needed on the ground rather than determine what they think cities might – or should – need.

The congress endorsed my proposal to look into an inversion of climate finance mechanisms and mandated ICLEI to examine this issue and report back to the Resilient Cities 2011 world congress.

ICLEI is pleased to have secured the support from urban strategy expert Jeb Brugmann of The Next Practice Ltd. who elaborated the proposal. I would also like to acknowledge the constructive discussions and creative input provided by urban development and climate finance experts from a variety of institutions that came together at a Think Tank meeting in Bonn in February 2011.

As one conclusion of this process ICLEI submits this White Paper to the global cities and adaptation community on the occasion of Resilient Cities 2011 to inform inter-national, national and local policy considerations and discussions. We look towards the 'inversion' concept being taken up by governments and finance institutions. The 'how to' of and 'which' financing is as important as the 'how much'.

Secretary General
ICLEI – Local Governments for Sustainability

The author

Jeb Brugmann

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Managing Partner, The Next Practice Ltd.; Founding ICLEI Secretary General (1990-2000)

Jeb Brugmann is a strategist and innovation expert in the fields of business and urban development, serving major corporations, local governments, and non-profit organizations worldwide. In addition to providing disciplined innovation processes and tools to clients, using a framework developed with the late Prof. C.K. Prahalad, Jeb Brugmann focuses on innovation in market analytics, product development, and business modelling to increase local responsiveness and customization as a source of competitive advantage and global problem-solving. With professional experience in 28 countries, he has been a pioneer of new practice domains including urban sustainability and climate change mitigation, 'base of the pyramid' (BOP) business development for large low-income market segments, place-based development and social enterprise.

In 1990, he founded ICLEI – Local Governments for Sustainability, an international association within meanwhile over 1,200 cities and towns worldwide that are advancing practices in local sustainable development. He served as ICLEI Secretary General from 1991-2000, and as interim Executive Director of ICLEI USA in 2009.

In 2004, he co-founded The Next Practice innovation consultancy with Prof. Prahalad. He is speaker to business, government, civic, and academic audiences worldwide, and has received a variety of distinctions and awards for his international initiatives and publications. His latest book, *Welcome to the Urban Revolution: How Cities Are Changing the World*, was published in 2009.

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Executive Summary

This report presents a strategy for scaling adaptation to climate change impacts within urban areas. It approaches the adaptation challenge within the overall context of other pressing risks and development challenges confronting the world's urban regions. The strategy specifically focuses on the requirements for mobilizing large amounts of capital for urban risk reduction, above and beyond the amounts that will likely be mobilized through new international adaptation funds. It argues that adequate and effective mobilization of resources will only occur in response to localized demand for broad-based urban investment.

In presenting this 'demand-driven' strategy, the report proposes a reframing of the adaptation challenge from its primary focus on risk reduction to a broader focus on increasing *the performance* of the area or system in which the investment is to take place. This re-emphasis on the issue of performance is captured in the concept of 'resilience'.

Urban Resilience is defined here in economic terms as the ability of an urban area or system to provide predictable performance, i.e. benefits, utility, to residents and users, and predictable returns to investors, under a wide range of often unpredictable circumstances. Resilience is proposed as a more attractive objective for city leaders and investors than adaptation, because it is aligned with the primary, underlying driver for global urban growth. We build and invest in cities to secure their economic utility and advantages, and their quality of services and amenities. We don't build urban areas in the first instance to escape risks. Strictly speaking, 'adaptation' focuses development on mitigating specific risk factors without a clear connection to the overall performance of the relevant area *as a functioning urban unit*. Rather than just being a risk-reduction cost, resilience investments aim to create a performance and investment premium for an urban area. From an urban property and infrastructure development perspective, 'resilience upgrading' is implementing a set of financially justified risk reduction measures that increase the reliability of investment returns and asset values under a wider range of circumstances. The challenge of climate adaptation, and of other risk reduction strategies, is to create the institutional, planning and policy frameworks, business practices, and financing instruments to establish a market basis for resilience upgrading of vulnerable urban areas and systems.

Towards this end, the report proposes a framework for integrating climate and other risk reduction measures into broader public sector and market-driven investments planned for urban areas and systems; and for efficiently matching the different measures to the most suitable types of finance. New types of market-based finance will likely need to be invented. With regard to international development assistance (IDA), the framework proposes three 'inversions' of the conventional development assistance approach. These are:

1. bottom-up *planning processes* for identifying vulnerabilities and risks and for integrating related risk reduction measures into the other priority performance enhancements for the area or system;

2. bottom-up *technical and institutional capacity* for designing such comprehensive 'resilience upgrading' projects; for managing and staging complex project execution; and for preparing the different investment propositions related to different components of these projects; and,

3. bottom-up *procurement of investment* through managed, competitive sourcing mechanisms and processes.

On the basis of such a demand-driven approach to investment planning, design, and financial sourcing, the different kinds of measures required in comprehensive resilience upgrades can be identified. The different risk-reward profiles and the performance of these resilience measures in reducing risks (within the context of different types of conventional urban re-development or upgrading projects) can be established. On this basis, financial services providers would be in a position to bundle similar measures, across large numbers of projects, into portfolios. Specific financing instruments could be designed to create diversified, scaled pools for investment. The instruments could each be tailored to a targeted class of measures that share a similar risk-reward profile. The instruments might take the form of portfolio-based loans, catastrophe bonds, re-insurance, securitization, or other structured finance instruments. In this way, much larger private capital flows could be sourced for adaptation and other kinds of disaster risk reduction.

To lead this kind of financial innovation and the development of such an investment market for resilience measures the report proposes that international adaptation funds, or similar national-level funds or programs, could be very effectively leveraged by focusing on three areas. These are:

- Funding for local, national, and international initiatives to 'mainstream' new resilience standards into conventional urban development projects, much as recent 'green building' standards have been mainstreamed into urban development and construction over the last decade.
- Funding for local planning and project preparation, including financial structuring for comprehensive resilience upgrading projects in known highly vulnerable urban areas and systems.
- Funding for financial product innovation for the purpose of creating scalable private investment flows into global resilience upgrading.

1 Introduction: Background and purpose

This report was prepared in response to a concurrence among experts at the Resilient Cities 2010 congress held in Bonn, Germany in May 2010. Strategies need to be developed for better deploying and leveraging the limited amounts of available climate adaptation funds to make them more responsive to local challenges and the scale of demand for climate and other disaster risk reduction needs.

Specifically, at the Resilient Cities 2010 congress, ICLEI Secretary General Konrad Otto-Zimmermann called for the establishment of processes for more bottom-up, demand-driven adaptation and disaster risk reduction investment, complementing a reform, that is inversion, of conventional top-down, supply-driven approaches to international development assistance (IDA). This proposal was supported by former United Nations Framework Convention on Climate Change (UNFCCC) Executive Secretary Ivo de Boer in his plenary address to the congress. This report was subsequently commissioned as a follow-up to the inversion proposal.

The following concepts have been developed on the basis of two decades of work and experience by ICLEI – Local Governments for Sustainability. Since 1991, ICLEI has been pioneering methods, technical protocols, software tools, and capacity-building programs for local greenhouse gas (GHG) mitigation and, more recently, for climate adaptation planning. During the 1990s, when local climate action was not considered to be a mainstream idea, ICLEI assumed leadership in developing and 'mainstreaming' local GHG mitigation practices. By the late 1990s ICLEI had researched, tested, diffused, and supported the technical, planning, and administrative methods and tools for local GHG mitigation in hundreds of local governments in more than 20 countries.

More recently, ICLEI's regional offices have been piloting regionally applicable approaches to local/municipal climate change adaptation planning in 30-40 cities in Australia, Brazil, Canada, Ecuador, Finland, Germany, Hungary, Indonesia, India, Italy, Mauritius, Mozambique, Namibia, Philippines, South Africa, Tanzania, and the United States. These efforts, as part of the Cities for Climate Protection (CCP) initiative, have involved leading regional scientists and scholars along with pioneering local government leaders, planners and managers. ICLEI has recently developed a new software tool to support local climate adaptation planning.

In other words, through the above Cities for Climate Protection (CCP) initiative, ICLEI learned a great deal about how to establish and scale new local practices internationally, particularly addressing complex, initially exotic problem areas such as climate change, where local governments have limited political mandate, statutory authority, or market incentives.

Generally speaking, these efforts have demonstrated the efficacy and efficiency of bottom-up approaches to GHG mitigation and climate adaptation, and of demand-driven approaches to related investment planning.

The above mentioned ICLEI programs have received financial support, often sustained, from the governments of Australia, Canada, the Netherlands, Germany, India, Japan, Switzerland, and the United States as well as the European Union. It is ICLEI's hope that

the lessons derived from this support and from ICLEI's work in this area can now be applied to aid these governments as they prepare adaptation finance strategies for their own cities as well as for newly-established international adaptation funds.

An initial draft of this report was prepared with support from 12 ICLEI professionals who are working on climate adaptation activities in eight different offices. These contributors are recognized in the acknowledgments at the end of the report (Acknowledgements). ICLEI convened a Think Tank of urban development and climate finance experts in February 2011 under the patronage of the German Ministry for Economic Cooperation and Development (BMZ) in partnership and with support from the German Development Cooperation / Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The Think Tank met to discuss and enhance the main concepts of the draft report over a period of two days. We are especially thankful to the very experienced and busy experts who participated in the Think Tank, as well as for GIZ's continuing support. These participants and their institutions are also recognized for their generous collaboration in the acknowledgments at the end of the report (Acknowledgements).

The human, economic, and financial risks arising from climate change are extremely serious for urban regions and nations. The risks are of two kinds: catastrophic and systemic. Catastrophic risks arise from the poor design and location of the built environment including infrastructure, and include vulnerabilities and losses associated with flooding, violent winds, temperature extremes, and sea level rise. The character of these risks has been graphically illustrated by recent weather-related catastrophes. In New Orleans alone, the Hurricane Katrina disaster caused nearly 800 deaths, a loss of more than 90,000 jobs, and $3 billion in lost wages in the first ten months after the disaster. It is generally accepted that total economic losses from the event exceeded $200 billion. The 2011 flooding and landslides in cities of Rio de Janeiro and Sao Paulo left more than 800 dead and 20,000 homeless. In the same year in Australia, in assessing the damages caused by 2011 Cyclone Yasi, reinsurance broker Aon Benfield has estimated that the cyclone cost more than $20 billion in losses due to flooding alone, a large percentage of this in urban areas.

In addition to these catastrophic risks, systemic risks associated with climate change arise from the poor design and performance of typical urban planning and construction, and of urban services and management systems, under changing climate conditions. Systemic risks create sustained losses due to highly inefficient energy, water, food supply, and health care systems, arising from poor maintenance, old technology, and poor demand-side and lifecycle management. Such systemic under-performance results in urban requirements for considerably greater inputs than can be sustained in times of extreme ecological and economic transition. These risks have been graphically illustrated by sustained water and energy supply shortages in China, India, and western parts of the United States.

Catastrophic and systemic risks are related. Measures to reduce poor systemic performance can be designed to reduce vulnerabilities to weather-related catastrophes, and vice versa.

Governments, international organizations, and prominent institutes have produced widely differing top-down and high-level estimates of the investment required for adaptation to climate change. Prominent estimates vary by a factor of two to three from the UNFCCC's own wide-ranging 2007 global estimate of $49-171 billion per annum by 2030 (see Parry

ET AL., 2009)[1]. Such estimates will undoubtedly be debated for years to come, although they will likely remain inconclusive due to the uncertainty of climate change scenarios; poor understanding of local engineering, operational, and cost realities; and the generalizing nature of top-down modelingo itself. The debate itself could slow down the fulfillment of government pledges to the established international adaptation funds, such as the Global Environmental Facility, the Adaptation Fund, and the Strategic Climate Fund.

In spite their variances in cost estimates, the top-down models share one clear conclusion: that the dominant portion of future adaptation costs will be in infrastructure and urban areas. The UNFCCC attributes up to 76 percent of its estimate to the infrastructure category, which by their calculation excludes the category "housing and other buildings." The World Bank recently released a report estimating that up to 80 percent of the expected $80-100 billion per annum of climate change adaptation costs will be borne by urban regions (World Bank, 2010)[2]. These estimates highlight the extent to which the urban dimension of adaptation may easily account for the largest share of long-term climate change adaptation cost. Developing ways to more pragmatically deploy capital for urban adaptation, as part of the vast financial momentum behind global urban development and other forms of urban risk reduction, is essential for effective adaptation resource mobilization and allocation from both a public and private sector point of view.

Consequently, the above estimates of urban adaptation finance requirements highlight the scale of what this report describes as a 'resilience investment opportunity'. This is the opportunity for profitable market-based investment in value-adding measures to reduce risks to urban assets, areas, and systems and to increase their overall performance i.e. resilience.

The proposed strategy arises from a broader view of the phenomenon of urban risk. Climate-related risks are a subset of a larger pool of risks confronting the world's growing cities and urbanizing countries, recently exemplified by the 2004 Indian Ocean tsunami and the 2011 Tohuku earthquake in Japan. Other disasters such as the 2010 Deepwater Horizon oil spill in the Gulf of Mexico are also 'urban risks,' in that they are the result of systemic risks, directly related to the enormous resource demands of growing cities, such as their under-optimized energy systems, which altogether account for some 80 percent of global energy demand. We are investing trillions of dollars annually in global urban development, typically designing and building geographies of chronic systemic risk and often building geographies of extreme catastrophic risk, even in affluent regions such as Japan, California's Silicon Valley, Vancouver's coastal plains, or the low-lying and hurricane prone Southern Florida metropolis.

A broad view of urban risk highlights a common denominator between the many different types of risk: many risks in cities are *manufactured* by the way that we locate, design, construct, and service urban places and systems. Development investments in our cities design often multiple vulnerabilities to weather, seismic activity, disease, crime, resource shortages, and

1 The factor 2-3 argument is presented in Martin Parry et al. (2009). The authors argue that it is inaccurate to estimate adaptation requirements on the basis of increments to current levels of investment in the considered sectors. Adaptation and resilience, they argue, also requires eliminating the current investment deficit in the sectors, within the context of the UN Millennium Development Goals.

2 World Bank representatives cited this figure extensively during their public statements during the COP 16 in Cancun.

industrial disaster. On the other hand, it is possible to simultaneously reduce a wide range of such vulnerabilities in an urban area or system through an integrated set of measures or investments. Yet we are prone to establish institutions, funds, programs, and management routines for different risks as if they functioned independently from each other within urban space and urban systems. By seeking to address them in silos, we reduce the efficacy and efficiency of all efforts and all resources to reduce all forms of urban disaster risk.

In large part, ICLEI draws its conclusions about the need for broader and more integrated bottom-up approach to urban climate adaptation from its experience with urban GHG mitigation. During the 1990s, international organizations, expert institutes and consulting firms alike prepared wide-ranging estimates of the economic costs of GHG mitigation, using top-down methodologies and models. Many estimates highlighted the negative economic consequences of a lower carbon economy. But as local governments began to use bottom-up methodologies to cost and target local GHG emission reduction investments, the paybacks of these investments demonstrated that the costs would be lower, and that the local economic benefits would be substantially greater than the top-down scenarios used to (mis)guide national government policy makers. In fact, the addition of this exotic new agenda of GHG mitigation into the traditional local policy portfolio resulted in a wide range of unanticipated additional benefits, ranging from traffic management solutions to increased green space amenities to reduced government operating budgets to mobilization of new sources of finance. At the local level, measures could be designed to simultaneously address a variety of systemic inefficiencies, increase institutional or geographic performance, and improve local amenities. Measures initially conceived as `mitigation measures` proved capable of serving as comprehensive upgrading measures.

This bottom-up work on GHG mitigation also provided opportunities to pilot a variety of new financial instruments, such as green bonds, revolving loan funds, consumer financing of household energy efficiency and renewable installations, tradable renewable energy certificates, feed-in tariffs, etc. In other words, a bottom-up approach proved the market upside, fostered new streams of investment, and brought real-world evidence to an otherwise often abstract international policy debate.

For years, the UNFCCC Secretariat and the annual COP meetings have been receiving reports of these unexpected results from ICLEI's local government leaders, and the UNFCCC Secretariat has taken great interest in them. ICLEI believes that similar opportunities are now available in the climate adaptation context through the adoption of a bottom-up and demand-driven strategy.

2 Framing the demand-driven strategy: Mobilizing response by defining opportunity

> "Never let a serious crisis go to waste."
>
> Mayor Rahm Emanuel (White House Chief of Staff, USA, 2009-2010; Mayor, City of Chicago, 2011-Present) commenting on the 2008 global financial crisis.

The international response to the climate adaptation challenge has to date been focused on marshalling government funding pledges into a collection of new adaptation funds and programs. These funds have been slow to secure targeted pledge amounts and to establish portfolios of urban adaptation projects. Although the World Bank estimates that 80 percent of global adaptation costs will be urban, most international adaptation funding has been allocated to agriculture, rural watersheds, villages, rural coastal vulnerability, and ecosystem vulnerability (GEF, 2010)[3]. A very small number of urban projects have been funded for climate risk assessment and adaptation planning, and for targeted 'climate proofing' investments.

A few hundred billion dollars may ultimately be allocated to special climate adaptation funds over the next decade. These resources cannot be efficiently or effectively deployed without direct reference to the few hundred trillion dollars in new urban fixed investment expected over the next two decades.

There are no full assessments of annual, global fixed investment in urban development and assets. However, some compelling estimations have been made. The McKinsey Global Institute, for instance, has estimated that growing Chinese cities will make US$46 trillion in fixed asset expenditures between 2005 and 2020 (Woetzel, Mendonca et al., 2009)[4,5]. In other words, just one year's worth of Chinese investment in fixed urban development – an estimated $2 trillion, excluding expenditure on planning, governance, and operations – is approximately 67 times the total adaption fund pledges made to date for the three year period of 2010-12.

China will account for an estimated 23 percent of global urban population growth during the 2005-2025 period (2011). If the estimated Chinese urban investment is extrapolated on a per capita basis for each new urban dweller globally during this 20-year period, then a rough global estimate of urban fixed asset expenditures between 2005 and 2025 would be in the magnitude of US$ 200 trillion – or $10 trillion per annum. In other words,

3 The Global Environmental Facility's portfolio of some 112 projects involves $475 million of direct GEF financing, which leverages an additional $6.9 billion in funds from other sources. The vast majority of projects are focused on planning and research regarding agriculture, rural watersheds, villages, rural coastal vulnerability, and ecosystem vulnerability.

4 The report defines urban fixed investment as primarily "construction and purchases of fixed assets in cities."

5 The report states: "Over the past ten years, almost 50 percent of China's overall GDP growth has come from urban fixed investment with an annual expenditure of 6.4 trillion renminbi in 2007. If this trend continues, overall urban investment will reach over 24 trillion renminbi by 2025 or 93 percent of total Chinese fixed investment compared with 79 percent in 2007."

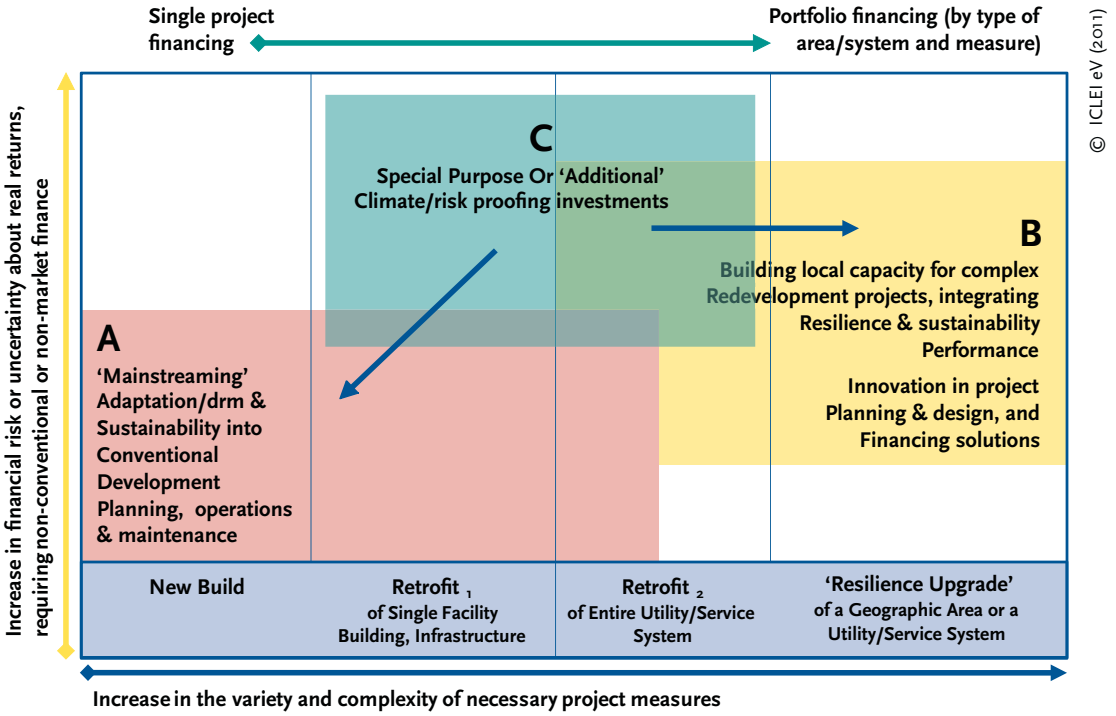

Figure 1 Leveraging climate adaptation funds

investment in urban fixed assets could well be in the magnitude of 300 times the available adaptation funds. Generalized to a single urban project investment, this would imply that some US$100,000 would be available to 'climate proof' a US$30 million urban investment. At this magnitude, even the most ambitious estimates for climate adaptation funding – assuming the funds are substantially allocated to urban projects – would have a negligible impact if directly allocated for fixed asset investments. The 'additional' climate funds could only have an impact on the US$30 million project from a technical assistance perspective, i.e. planning, design. Therefore, an effective adaptation strategy would seem to require both a commitment to explicitly excel in providing necessary technical assistance, and to finding ways to very substantially leverage conventional urban development investments.

Leveraging these limited resources would require a fundamental shift from the conventional supply-driven strategy of 20th century IDA. There are three problems with the supply-driven strategy, whether applied to climate adaptation or to development assistance generally. The first is that the strategy fails to marshal sufficient funds relative to the scale of required financing. The second problem is that the approach deploys funds inefficiently due the top-down nature of fund administration and the often siloed application in single purpose projects. The third problem, specific to risk-related issues, is that by focusing specifically on risk reduction rather than the broader, revenue-generating opportunity for investment, little incentive is created to attract private investment into adaptation and other risk reduction projects.

The proposed demand-driven strategy seeks to address these three problems by integrating climate and other disaster risk, as well as broader low-income access and sustainability considerations, into urban development projects that are attractive to private investors. There are two main approaches, illustrated in Figure 1 above.

The first approach is to shift resources from climate-proofing urban areas and systems ex post facto (type-C expenditures) to initiatives that integrate risk reduction and sustainability

into the local, sub-national, and national design and development approval requirements for new urban construction and infrastructure investments (type-A investments). This 'mainstreaming' shift, as indicated in Figure 1, re-focuses resources from high-risk/low-return type-C expenditures towards lower-risk, market-based investments in revenue-generating type-A urban development projects. The role of the climate funds, as noted above, is to finance the scaling of effective technical assistance programs for mainstreaming risk reduction across the construction and infrastructure industries.

The second approach focuses on leveraging adaptation funds together with other public and private finance in type-B urban upgrading investments within existing, highly complex urban areas and infrastructure/service systems. This shift towards a 'resilience upgrading' approach shifts resources from stand-alone climate proofing measures to investments that broadly improve the conditions and performance of the established urban area for investors, residents, and users. The resilience upgrading approach thereby aligns the adaptation agenda with the agendas of slum upgrading, green building, urban re-generation, and urban development generally.

The remainder of this report focuses primarily on the unique challenges of the resilience upgrading shift, which will require more extensive development of new financial instruments as well as new local institutional capacities for large-scale, integrated projects. The mainstreaming strategy is equally important, but relative to the upgrading challenge the methods of mainstreaming are well understood.

Governments working with the private sector and with professional training institutions have repeatedly introduced new standards and design considerations into the building and infrastructure development industries. Not long ago, standards for daylight orientation, safety, disabled person access, water efficiency, energy efficiency etc. were exotic, or additional concerns. In particular in developed countries, they are now truly mainstream standards. This is also the case with regards to conventional disaster risk reduction. Here, the primary strategy has been to 'mainstream' new zoning, siting, and building standards into the development process so as to reduce seismic or flood risks. The full implementation of these standards remains problematic, as evidenced by regular crisis events in both developing and developed countries. This gives all the more reason to apply further resources to their updating and implementation, rather than to presume that the implementation gap could possibly be filled through direct investments from centralized international funds.

In summary, the new climate adaptation funding mechanisms being established by the international community are critical. They provide means for financing research into new standards and planning approaches, and for diffusing new standards and approaches via their government constituents. They also provide necessary sources of funding for developing local capacity, and for collaboration with the private sector to develop new financial instruments. The contribution of the climate adaptation funds will increase the more they effectively assume such a catalytic funding role. The contribution will be reduced to the extent that the international funds function as quasi-banks or foundations, seeking a direct role with their relatively limited resources in the multi-trillion dollar, decentralized urban development boom that will continue to be the defining feature of global development investment over the next decades.

3 The requirements of resilient city building

The Resilient Cities strategy has a *purpose* that is inclusive of the climate adaptation agenda, but is somewhat distinct from this agenda. The strategy also promotes *an approach* to urban development that is different from the conventional 20th century development assistance approach.

Distinct purpose

Best practices in urban development highlight the efficacy and efficiency of a comprehensive approach to the re-development of urban areas or infrastructure/service systems. Recognized best practice projects address local environmental factors, infrastructure, buildings, commercial life, social life, institutions, and governance issues comprehensively, in an integrated fashion[6]. We argue that climate risk reduction is most efficiently and effectively achieved when addressed together with other major catastrophic and systemic risks confronting specific urban areas, such as earthquakes, epidemic, water system leakages, social marginalization or economic hardship. We further argue that these risk-related investments are more effective and efficient when fully integrated with performance-related development improvements to the relevant areas or infrastructure systems. In other words, we challenge the rationale for stand-alone adaptation projects.

Different approach

Risk-related investments are more effective and efficient when they are locally originated through a comprehensive local development planning process for the area or system, involving local stakeholders. The resulting, comprehensive (re)development projects provide opportunities to recruit finance from a variety of public and private sector investors for these projects, thus better leverage the limited supply of special-purpose adaptation funds.

The purpose and approach of the proposed strategy is based on the following premises:

1. Cities, by nature, are complex systems. Urban development investments that address only single, specific risks or functions are inherently inefficient – and often ineffective – because they continue the tradition of ignoring the systemic character of cities, treating them as accumulations of stand-alone investments, projects and services. When under stress, the systemic weaknesses and interdependencies in cities intensify. It is these interdependencies that prompt cascading failures that often lead to crisis events. For instance, the failure of so many systems in New Orleans during flooding from Hurricane Katrina – health, commerce, policing, transport, social community etc. – is an example of this systemic reality.

2. The precise incidence of specific climate-related events in specific urban areas, and the interaction of climatic events with other local risk factors, is difficult to predict with precision. Therefore, although we can broadly understand the vulnerabilities of specific

6 The comprehensive urban re-development approaches in specific districts of Barcelona; Chengdu; Curitiba; Hamburg; Malmo; Melbourne; Rio de Janeiro; Vancouver – and many others – have defined the global urban best practices landscape.

areas, calculation and comparison of actual risk for purposes of resource allocation is very difficult. The vulnerabilities and risks associated with climate change in specific areas represent only part of the distinct mixes of natural and man-made risks to which resident populations are exposed. Climate risks alone are therefore an imprecise way to allocate funds for reducing local risks and increasing local resilience. Broader investment in resilience focuses resources on the total risk profile.

3. The primary purpose of all urban investment from both a policy and a financial perspective is to enhance the functioning and performance of the relevant urban area. New investment for climate adaptation will be more attractive to investors to the extent that it is leveraged not only to mitigate risks but to develop more productive, healthy, serviceable and value creating urban areas.

3.1 Resilience upgrading: A description

The distinctiveness of 'resilience' as an investment opportunity is more than semantic. Resilience focuses investment on increasing a city area's overall ability to support a vibrant, healthy society and economy under a wide range of circumstances. We don't build urban areas in the first instance to escape risks; we build them to provide economic utility and advantages, and quality services and community life. In other words, we build them *to perform*. 'Adaptation' focuses development resources on mitigating specific risk factors, often without a clear connection to the overall performance of the area *as a functioning urban unit or system*. Resilience focuses on the reliability and efficiency of performance. More specifically, from an urban property and infrastructure development perspective, resilience is the reliability of an investment in a city to generate returns and revenue streams under a wider range of circumstances. Resilience, therefore, creates a clearer linkage with the area's or infrastructure system's overall investment attractiveness and potential. Rather than just being a risk-reduction cost, resilience investments aim to create an urban area's development premium.

Consider the photograph of a typical location in the northern suburbs of Mumbai, India (Photo 1 below). Much of Mumbai's population resides in co-located formal sector developments and informal sector settlements. The high-rise buildings in the background of (Photo 1). are representative of typical formal sector development. The 'slum' in the foreground of the same photograph represents a typical, mixed-use residential, commercial, and manufacturing informal settlement. Although the two areas reflect dramatically different city-building strategies and worlds, they are typically linked as a single location in a variety of ways. For instance, the construction labourers, cleaners, cooks, and other service workers for the formal sector buildings often live in the so-called slum. In terms of risks, a flood, fire, or health crisis in the slums generally also affects the formal development, and vice versa. Finally, the real estate investment potential of the area is determined by the development opportunities, constraints, and risks of the whole area, consisting of the formal and informal properties combined.

Any investment to increase the resilience and to improve the functioning and performance of this area requires at least three types of investment. Three different performance gaps need to be closed in the development of this area. These are illustrated below in Figure 2. The rectangles (with downward facing arrows) in Figure 2 indicate the drainage system

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Photo 1 A typical vulnerable location in Mumbai, India

investments required to prevent seasonal flooding during heavy monsoon rains and the associated health risks and traffic stoppages. They also indicate the additional water supply infrastructure required to adapt this seasonally arid region to new climactic conditions. These investments in basic infrastructure close the area's environmental performance gap under current and possible future rainfall trends, relative to the local drainage and water supply system standards and investments, associated for historic rainfall patterns and demographic realities. Environmental performance is the ability of an area or its systems to perform efficiently and effectively for its population under a range of likely environmental conditions. This is the primary, if not the sole focus, of adaptation investments.

But the ovals and arrows in Figure 2 suggest that further investments are necessary to develop the resilience and overall performance of this area. The ovals highlight the need for improved services e.g. solid waste collection to maintain infrastructure operability and for additional services like as rescue services to address a variety of risks in the area. These measures close the *development performance gap* between the current institutional capacity and the capacity required to operate and maintain infrastructure, manage risks, and deliver essential services. Environmental adaptation without necessary developmental investments is clearly both ineffective and inefficient. It makes no sense to de-link adaptation and broader urban services investments. For instance, flooding and health risks are not addressed effectively by storm drains without effective solid waste management, or by a back-up water supply without a distribution network.

Finally, the arrows highlight the potential, if not the need, to further optimize the performance of the area as a place in which to live and generate wealth. These investments in fixed assets have their own developmental function and investment logic. They close a *systemic performance gap* between the functioning of the individual components of the area and their more optimized functioning together as part of a *place-based system*. Investments in

Figure 2 The elements of a `Resilience Upgrade` project

systemic performance are the common ground between risk reduction, sustainability, and economic development agendas. Referring again to our example, the indicated systemic performance measures, represented by the arrows, result in a transportation corridor that is designed as a retail and commercial services area that serves the whole area, and as a more optimized mobility and storm water runoff infrastructure; and in rooftops that are optimized for temperature control and energy production purposes. Again, it is inefficient, if not also ineffective, to dig up the road for new drainage infrastructure without also improving the road as a traffic corridor that provides important access and egress from an emerging high-density residential and district retail area. It makes no sense to de-link adaptation from broader urban performance enhancements.

Considering the numerous implicit interdependencies between the three types of indicated projects, the example simply highlights the advantages of applying any additional, incremental investment for urban climate adaptation to a comprehensive and integrated effort to reduce overall risks and to increase the overall performance of the urban location. The three highlighted types of investments, jointly designed and implemented, enhance not just the area`s performance but also the resilience of its performance, the range of circumstances under which the area will function at a higher performance level. In principle, this creates or increases various returns on investment, and thereby attracts new forms of investment to the area, which will be further discussed in section five. In this report, we have been referring to this performance-oriented approach as 'resilience upgrading'.

As illustrated in Figure 3 below, resilience upgrading differs in two fundamental respects from the conventional strategy for development, including adaptation, finance. First, the purpose of the adaptation project shifts from a singular, special purpose focus on specific climate-affected infrastructures and locations towards a more integrated focus on overall risks, development conditions, and local area performance. Second, the approach to

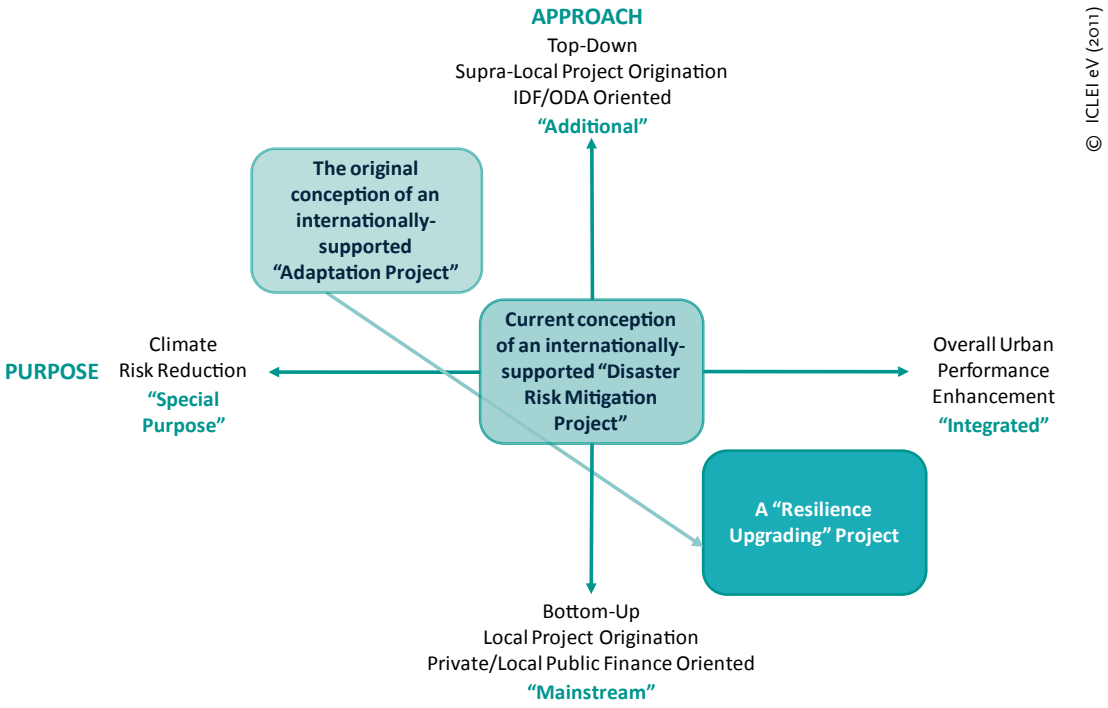

Figure 3 Resilience Upgrading: A demand-driven approach

achieving this purpose shifts from a 20th century, top-down, international development finance approach to a bottom-up, diversified and leveraged finance approach that reflects the more decentralized and market-oriented character of 21st century societies.

The approach to project preparation, finance, and execution in resilience upgrading is substantially different than a conventional single-purpose development project approach. Adaptation projects are currently understood as a response to an 'additional' policy agenda, being established through international climate negotiations. The framework parameters and rules for fund-worthy projects are defined by the established international climate funds, and are negotiated first with national ministries and international organizations. Substantial terms of the projects are therefore originated by the supra-national finance suppliers and supra-local institutions.

In contrast, the resilience upgrading approach is inherently mainstream. The starting point is the unique, overall development requirements of the vulnerable place and its stakeholders. The aim is to bundle a set of mutually-supportive investments in the area, and then to source the most appropriate financing from local government, private investors, and international funds for the different elements of the integrated project. The international climate funds can be critical partners and contributors, but the nature of their contribution is integrated within a more comprehensive development plan. To the extent that the international climate funds can organize themselves to be responsive to such bottom-up demand, resilience upgrading can substantially add to the achievements of their project portfolios.

ICLEI sees three main benefits from such an inversion of the current top-down adaptation finance strategy and of an inversion of development finance generally into a more comprehensive, bottom-up development project approach: effectiveness, efficiency, and investment attractiveness.

3.2 Performance-oriented investment: Re-focusing the purpose

Effectiveness

Even if the investment purpose is limited to reducing specific vulnerabilities and risks, incremental retrofit investments in these complex places and systems are not likely to be sufficient to mitigate risks. To address risks at the scale of whole areas or systems a very different approach to adaptation investment planning is likely to be required.

As noted, cities are dense, complex systems. They are characterized by intense, regular interactions that are structured in identifiable built-activity areas such as a district or in key resource management or mobility subsystems e.g. urban energy systems, transportation networks. The character of urban systems is very different than that of lower density rural areas where activities are more spatially separated and interactions are less intense. In the urban environment in particular, the resilience of a place or system is only as great as its weakest part. The density of interactions and intensity of interdependencies amplifies and accelerates feedback and cascading effects, starting in spatial proximity or spreading through system networks. As a result, urban function or performance during stress events is as much determined by the relationships and interactions between built components and the way that they structure human activity patterns, as they are determined by the general resilience of individual fixed assets i.e. buildings, roads, pipes. In this context, the performance of adaptation project investments is dependent upon the performance and design of many other fixed assets and utility/service systems in the same area.

This spatial understanding of the requirements for effective adaptation investment is a key technical insight underlying the resilience upgrading concept. Investment value is increased when a place or whole system is being transformed, not only a single building, facility, or infrastructure intervention. This differentiates resilience upgrading from conventional development planning, which often does not distinguish between the supply-side definition of an attractive unit of investment e.g. a sewerage treatment plant or new ring road, and the integrated functioning of the total urban areas and systems.

Lessons derived from the still-limited body of IDA-financed urban adaptation projects point towards this conclusion (GEF, 2010). The largest urban adaptation project financed by the Global Environmental Facility (GEF), "Adaptation to Climate Change in Ho Chi Minh City", Vietnam, involves nearly a billion dollars in pledged resources. It quickly showed the need to spatially calibrate and customize adaptation interventions. This topic has been explored at length in a series of papers by Professors Kiduk Moon and Harry Storch, with N. Downes and H. Rujner, based on their planning experience in the Ho Chi Minh City (HCMC) project. Moon et al.'s (2009) primary conclusion is that effective intervention requires a spatial definition of 'urban structure typologies' that are associated with distinct vulnerabilities and risks, requiring distinctive adaptation and disaster risk management (DRM) measures. They call the process of factoring local structural typologies when developing portfolios of development and risk reduction measures 'downscaling'. To quote Moon et al. (2009):

> *"Vulnerability to climate change varies considerably from settlement to settlement and even within settlements. The location, urban structure, dominant building type, socio-economic characteristics and institutional capacity are key factors that affect vulnerability and adaptive capacity of a settlement in the mega-urban region... Climate change-related urban adaptation decisions require a rational characterization of urban structural*

landscapes according to risk relevant features. Urban structure types, block size, and form are dependent upon the transportation or surface water networks that frame the block, as well as the formal or informal nature of the building typologies, their individual forms, their connections as well as their interconnections to adjacent structures... Other differentiations are made based upon land uses, orientation, structure density and building and sealing material. Furthermore, at the street level, via valuable local knowledge, photography and site visits, the climate change relevant indicators and parameters for each urban structure type can be surveyed..." (author's selections from pp 2-4).

Another example of resilience upgrading is a GEF-funded adaptation pilot in Quito, Ecuador. The project focuses on establishing resilience in Quito's drinking water supply system by

> *"developing an alternative drinking water source, implementing an integrated monitoring and management system of the catchments supplying the city's water, improving the efficiency of the city's water distribution network, and reducing consumer demand through campaigns and awareness raising."* (GEF, undated, p.19).

The scope of the project highlights the project team's understanding that resilience is only created if all components of a subsystem are taken into consideration. In this example, the intervention measures reflect the variety of ways that the system can adapt to a decrease in natural water replenishment, e.g. a back-up source, demand-side management, and better system-wide supply management. Of course, the singular focus of this project on the water supply system means that it may overlook risks and performance failures arising from specific areas such as informal housing invasions in watershed areas or other systems like solid waste management.

Sample investors	Benefits from direct investment	Benefits from other, integrated investments
International Adaptation Fund	Upgraded storm water drainage and retention system. Reduced flood risk and damage.	Permeable surfacing reduces size/cost of upgrade. Street & BRT contribute to planned drainage pattern.
Local Roads Department (Municipality)	Upgraded street & sidewalk grades. Permeable surfacing. A greener more user friendly streetscape.	Reduced maintenance cost due to reduced flood risk. Reduced traffic congestion/ increased emergency access due to separated bus lane.
Local Property Developer	Community center (cum emergency shelter) in new commercial/retail building.	Increased development height allowance in exchange for center. Increased property value and shopping trips due to reduced congestion and risk.
Regional Transportation Department (Sub-national Government)	Separated, above-grade BRT water retention wall abutting residential area.	Reduced planning cost/increased routing efficiency due to community permission in exchange for retention wall.

Figure 4 Efficiency and performance synergies from integrated upgrading

Efficiency

As illustrated by the above Quito example, developing and sourcing financing for the different measures together offer efficiency opportunities as well as increased value. The integrated development of supply- and demand-side water service measures allows the water utility to optimize capital deployed for new supply and distribution projects by providing the water utility with means to adjust demand pressures in specific zones, uses, and seasons, thereby focusing capital investments on those projects with compelling engineering and financial propositions.

Designing projects to increase the performance of whole areas or systems and not just of single buildings or infrastructure changes supports the performance of each component measure. To return to the above example from Rio de Janeiro, Figure 4 demonstrates how the integrated upgrading approach provides efficiencies for four different hypothetical investors in that vulnerable area.

Attractiveness to Investors

Of course, increased effectiveness through integrated project design and efficient leveraging of complementary investments makes for more attractive investment propositions. The total performance of an area matters to the prospective investors in individual assets or businesses in an area. This attractiveness, or performance, of an area is reflected in the amount and variety of private investment in local property development; in decisions of companies to locate an office or retail outlet in an area; and in the cost of capital for municipal development corporations and public utility companies that are developing that area.

Most of the market-based value in an urban area is found in its real estate. The level of value of an individual property asset is directly a function of the performance of the location. That is the attractiveness and reliability of the location for residential, retail, and other commercial activities and the revenue streams they produce. Basic utilities, such as water and energy services, offer additional revenue streams that can attract private investment for upgrading activities. Basic infrastructure, such as a drainage system, a road system, or a retention wall, underpins local value, but does not generally provide a direct investment opportunity. In other words, the ability of adaptation or resilience projects to attract private investment is generally linked to the integration of these non-revenue producing projects with a broader upgrading or re-development strategy for an area.

In conclusion, the most responsive, efficient and effective form of an adaptation or DRM project is a project of which the purpose is the improvement of an area's or system's total performance, and not just on a single, incremental or surgical interventions in the urban fabric, a utility or infrastructure system.

3.3 Demand-driven investment: Re-focusing the approach

Referring again to Figure 3, a similar set of arguments can be made regarding the bottom-up approach of Resilience Upgrading.

Effectiveness

Projects that are locally originated in response to unique local circumstances and interests, and that are supported by the established local planning, regulatory, and budgeting processes have a much greater chance of success than projects that have been designed in the first instance to respond to the needs of external institutions and their supra-local agendas. This is why the climate finance community, and the international development finance community in general, pay so much attention to the challenge of what they call the 'mainstreaming' of their development agendas.

Efficiency

A key measure of the efficiency of bottom-up resilience upgrading would be the ability to reduce the need for special purpose external adaptation financing. When climate risk and other risk reduction is a basic design factor in conventional urban development, so-called no-regrets opportunities for risk reduction can be found, and implemented, at little or no additional cost. As Professors Clive Hamilton and John Quiggan (1997) have explained with regards to GHG mitigation:

> "*As a rule, bottom-up models indicate that the costs of reducing emissions would be much less than suggested by top-down models mainly because they allow for the existence of 'no-regrets' energy savings i.e. measures that will reduce a firm's costs and are therefore worth doing even in the absence of greenhouse benefits.*" (Hamilton and Quiggan, 1997).

The same no-regrets potential, we hypothesize, exists in the area of climate adaptation/DRM through the introduction of risk mitigation criteria in the planning, design, and development approval of the trillions of dollars worth of annual construction activity in the world's fast-growing city-regions. Added to this, the resulting clarity regarding which adaptation/DRM measures cannot be taken in no-regrets fashion supports more efficient allocation of limited adaptation funds to these particular measures.

Lastly, the bottom-up organization of quality local demand reduces transaction costs for external sources of finance that are seeking quality local investment opportunities. Local, demand-driven investment facilitates coordination of often parallel external IDA investments, with the myriad of other local no-regrets projects and private investments being approved through conventional local planning and project approval processes. It also offers the potential for streamlining the protracted and often wasteful process of negotiating financing terms and managing contracts down the long chain from highly centralized international funds to national ministries to sub-national departments to the many distributed and differentiated local end-users.

4 Creating market conditions for resilient city-building

Comprehensive resilience upgrading of vulnerable urban areas only becomes possible if the bottom-up strategy is able to organize effective demand i.e. responsive, efficient, attractive demand, so as to attract a responsive and, hence, effective supply of finance i.e. forms of financing that are responsive to local project requirements. On the one hand, the establishment of a real market for resilience finance requires a high degree of responsiveness to differentiated demand, so that the projects themselves can be locally responsive. On the other hand, such a market also requires a considerable degree of standardization of the investment propositions and predictability about the pipeline and subsequent performance of these propositions, so that the due diligence and transaction costs can be minimized and investment performance can be predicted. Furthermore, to achieve scale and operational economies, the various types of financial solutions, while needing to be expanded, also need to be relatively standardized – a market will not likely develop if every financial solution needs to be custom engineered. To overcome this seeming tension between demand-side requirements e.g. responsiveness and customization, and supply-side requirements e.g. standardization and uniformity, each side must confront a different innovation challenge. This challenge is illustrated in Figure 5 below.

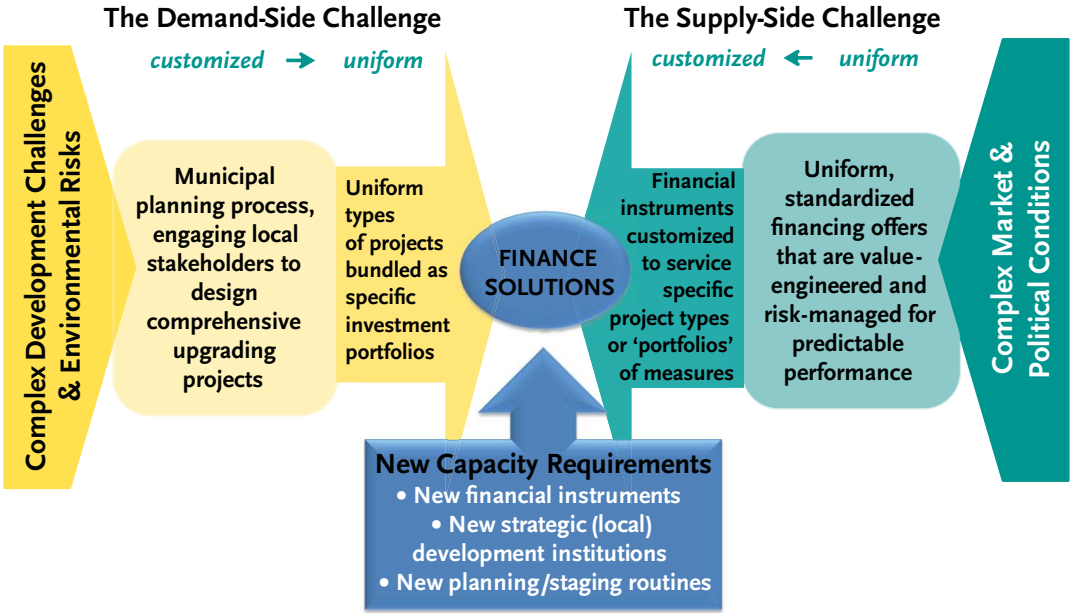

Figure 5 Creating a market for resilience: Resilience Upgrading innovation challenge

This demand-side investment challenge requires the establishment of three distinct local capacities for resilience upgrading. These are:

- bottom-up *planning processes* for identifying vulnerabilities and risks, and linking the related risk mitigation solutions with priority performance enhancements in relevant areas or systems;

- bottom-up *technical and institutional capacity* for designing comprehensive resilience upgrading projects; for managing and staging complex project execution; and for preparing the different investment propositions related to different components of these projects; and
- bottom-up *procurement of investment* through managed, competitive sourcing mechanisms and processes. Figure 5 suggests that the establishment of large-scale capital flows into comprehensive upgrading projects will require the unbundling of specific types of measures within a locally customized upgrading project and their re-bundling into portfolios of similar measures from other projects, thereby matching appropriate types of financing instruments with types of measures. This unbundling and re-bundling for investment procurement purposes also supports the diversification of investment risk across a portfolio.

Increasing the performance and resilience of any urban area requires systemic re-design. Best practices and, in some regions, standard practices demonstrate that, with adequate mandate and support, bottom-up processes and capacities can be established in cities to prepare sophisticated, complex projects and to directly source investment for these projects. Once this bottom-up capacity is established it can advance a large project as quickly as or perhaps more quickly than in a conventional top-down project planning and financing cycle of an international development institution, with its complex political and administrative negotiations, resource allocation and contracting processes. The aim should be the creation of local markets and of national urban sector market readiness for diverse forms of adaptation/DRM investment, reducing pressure on centralized institutions to try solve the adaptation challenge from a great distance. All three capacities, in any instance, are required to achieve the 'mainstreaming' of adaptation measures.

4.1 Establishing planning processes for resilience upgrading

Today's prevailing adaptation/DRM planning approach involves the following activity sequence (see Figure 6). As indicated, the approach involves four stages beginning with a high-level understanding of climate/disaster scenarios and likely impacts, followed by an assessment with identified stakeholders of local vulnerabilities to the identified scenario impacts. Once vulnerabilities are prioritized from a stakeholder and political point of view a further analysis of risk can be undertaken on the priority areas, on which basis risk reduction measures can be identified. Based on the resulting identification of investments, risk controls, and management routines i.e. measures, a cost-benefit analysis of the measures can be undertaken to determine their investment worthiness, prioritization, and staging. Thereafter, the effectiveness of the implemented measures can be monitored and evaluated.

Generally speaking, the illustrated adaptation planning sequence does not establish clear linkages with the conventional process of local development project planning, design, and construction approvals. A city's planning department might complete a climate risk assessment and action plan, and even integrate it into the official comprehensive plan. However, the same city's roads or sewerage department, not to mention a private real estate developer, might fail to effectively factor the findings and recommendations of the general adaptation plan into the design of individual infrastructure projects and property development schemes. In fact, these other investors and public managers of the same

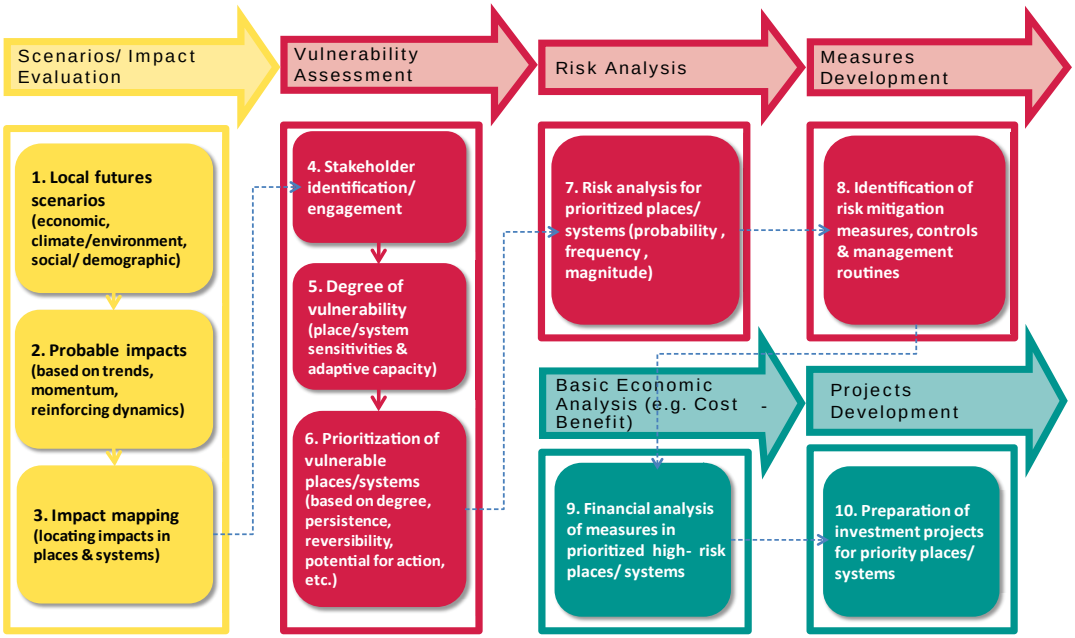

Figure 6 A generalization of prevailing adaptation planning practice

area will likely run their own planning processes in parallel, leading to their own economic decisions and project commitments.

Most urban residents are familiar with the phenomenon of a traffic department repaving a road, followed by the water department digging it up again to work on their system, followed by a private gas or electrical company again doing the same. This approach to managing projects in urban areas, as if intervening from parallel universes, also highlights the unmet potential of highly complex urban areas and systems.

These parallel processes can be coordinated without necessarily merging them into a single area-based investment planning process. But again, the world's recognized best practice cases suggest that a single, integrated process for area or system upgrading is most efficient and effective. This is the case whether addressing the upgrading of informal slums, the re-development of downtown historical districts, or the master-planned development of cleared brownfield sites.

The successful US$180 million Favela Bairro 'slum to neighbourhood' project of the city of Rio de Janeiro, Brazil, and the Inter-American Development Bank re-organized traditionally separate municipal departments into single teams that worked with favela residents on customized and comprehensive plans for infrastructure, services, and social investments for each favela. In another good example the much-studied, district-by-district 'transformation projects' of the city of Barcelona, Spain, organized local commercial interests, city and regional government departments, and private utilities into special development companies for each district, supporting a single, integrated investment plan for each district. In Sweden, Malmö's re-development of its old industrial harbour into an 'ecologically sustainable information and welfare society' started with the creation of a cross-departmental planning team that reported directly to the head of municipal services. Plans and large-scale projects were developed through a multi-year series of open design studios that engaged thousands of residents and municipal employees, more than 30 property developers, and numerous local, national and European institutions, including inputs from 17 other cities.

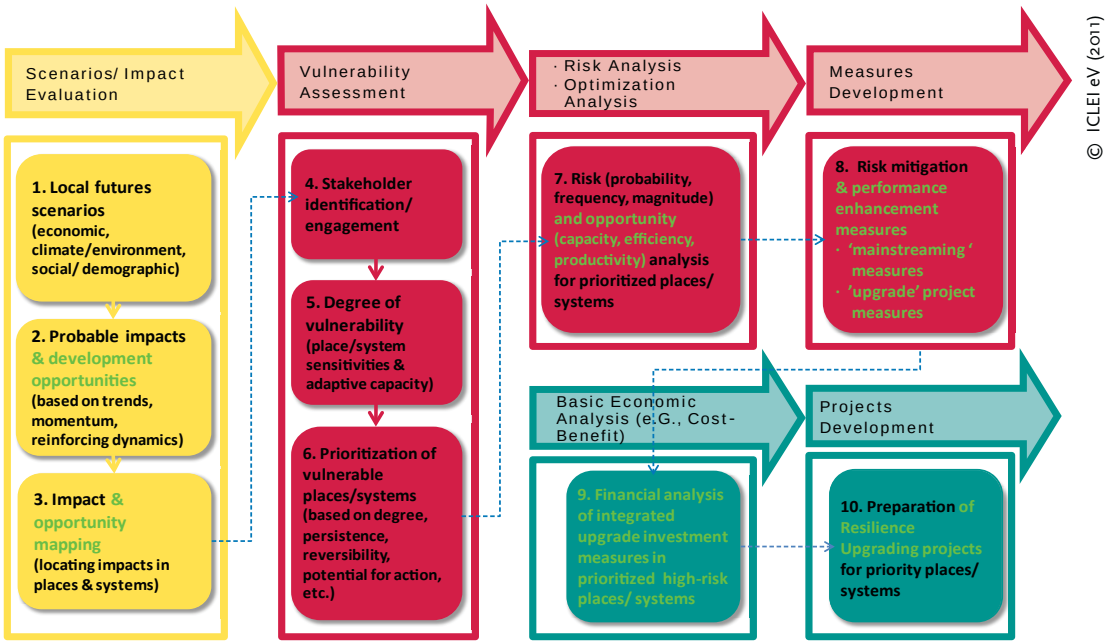

Figure 7 A generalization of integrated planning for resilience upgrading

These and other award-winning development planning approaches highlight the increased performance outcomes achieved through integrated, comprehensive investment planning tailored to the unique problems and opportunities of specific city locations. Therefore, having developed a basic planning model with a clear sequence logic and widely accepted methods, the next challenge of the adaptation/DRM practice community is to more fully integrate the process into the statutory land-use and development planning processes which establish conditions for local planning and construction permit approvals i.e. local comprehensive planning, official planning and/or strategic planning. In this way, these mainstream processes can be made sensitive to climate and disaster risk factors, just as in the past they have been made sensitive to sustainability concerns. The result can be an effective deployment of the vast sums of capital being mobilized for conventional urban development projects to address the realities of climate change and other disaster risk.

Such an integrated process is roughly illustrated in Figure 7. In this figure, amendments to the prevailing adaptation planning process have been highlighted in green shaded font. In short, and in generalized terms, the proposed process now engages the affected stakeholders and investors in a full review of both risks and opportunities. Owners, residents, stakeholders, and municipality undertake a sort of SWOT analysis of their shared asset: a location whose performance can and needs to be increased. This more comprehensive assessment is continued through to the risk analysis stage. At this stage, the planning studies consider both risks and opportunities to increase the performance and resilience of the area or system. While risks are understood from the perspective of probability, frequency and magnitude, opportunities can be understood from the perspective of potential for further financial value optimization of assets and systems within the location. Specific attention would be paid to the utilization of under-utilized capacity, efficiency gains, and development of assets to enhance productivity from various perspectives including resource production, human employment, revenue generation and materials cycling.

The above analysis informs the development of measures, some of which involve direct investments and others that can be achieved through standards, incentives and regulatory measures that shape private investment decisions. Economic analysis of measures is undertaken to supplement the earlier analysis of stakeholder preferences. Considering the emphasis placed on upgrading the location or system and not just the single asset, the analysis should evaluate the economics of bundling mutually reinforcing measures to achieve a greater total performance effect. On this basis, the requirements for project staging, budgeting, and investment can be determined.

4.2 Building institutional capacity for comprehensive resilience upgrading

The difficulties of transforming existing built areas and infrastructure/service systems are widely recognized in the urban planning and property development industries. The difficulties include, but are not limited to, problems of land consolidation, liens and rights of way, historical liabilities, and the grandfathering of semi-formal and informal claims and tenure rights. Further complexities include the challenges of different building types and conditions, varieties of economic activities with sensitive place-based dependencies, and the claims and preferences of place-based, organized communities. These difficulties are a primary reason why the property development industry, and the financial industry that supports it, show preference for new-build or 'greenfield' projects which in turn result in the urban sprawl that is a worldwide urban growth phenomenon. They are also a primary reason why local governments so often establish, special planning districts for areas requiring thorough upgrading, as well specialised development agencies or utilities for systems to manage upgrading comprehensively within these zones.

In addition to the special planning frameworks established to support such special purpose entities, and the statutory authority granted to them to acquire property and implement special development laws, these special purpose institutions are often also vested with unique financial license and financing mechanisms. In addition to managing complex project execution, they also manage complex finance procurement and structuring. Local development corporations that are carefully focused on upgrading specific areas or systems have been at the forefront of innovations in urban development, including in financial aspects. Some of their financial innovations include the creative use of land leases, land-swaps, 'bonusing' incentives, value capture schemes, tax-increment debt financing, revolving loan funds, property assessed clean energy financing, and project guarantees[7].

The development of local institutions with special financing and re-development authority and capabilities, focused on the upgrading of specific areas or systems, is a critical capacity-building requirement in societies wishing to rapidly and effectively reduce their risks from climate change and other disasters. Considering the variety of measures necessary for resilience upgrading – or for any complex urban re-development project, even of a conventional nature – and the different ways that these measures must be bundled together

7 However, it is important to note that where these special-purpose companies are given both very broad authority and long-term operating license, their record has been more mixed because of, among other reasons, their greater independence and reduced accountability to the public. There are many stories of bureaucratic inefficiency, land speculation, and poor execution associated with such broadly defined, permanent entities.

and staged in integrated projects for purposes of efficiency and efficacy, the financing of these projects will also often require combinations of different forms of finance for the different types of measures in these projects. An indication of the components of a re-development or upgrading project is provided in Figure 8.

The creation of this kind of local institutional capacity is essential for international development banks and special climate funds to be able to leverage their limited resources to respond to rapidly emerging risks and to develop quality project portfolios. Supporting the development of such institutions, particularly in high vulnerability urban regions, may be the most important capacity-building investment that the adaptation funds can make.

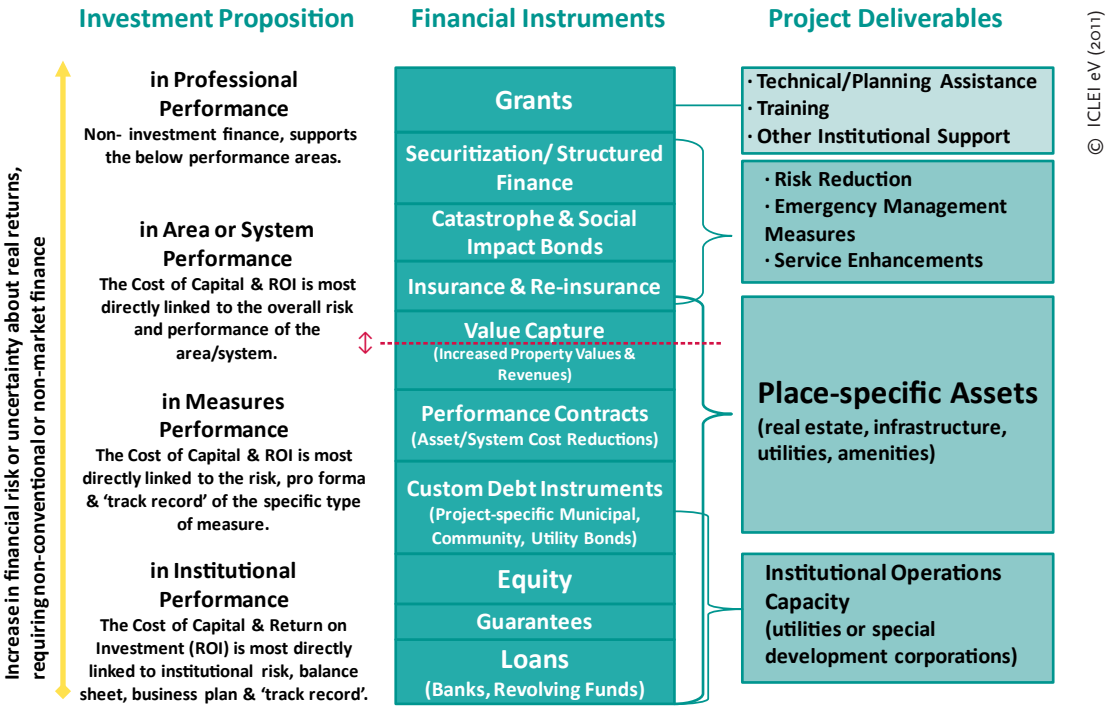

Figure 8 Investment structuring for complex urban upgrading projects

The above figure provides a snapshot of the working elements of any complex urban redevelopment project. There are multiple types of investment, ranging from investment in the development institutions, in specific measures and fixed assets, and in local capacity-building and technical support. Each type of investment reflects a different "investment proposition", seen in the left column, and seeks a different kind of performance outcome. To secure finance, the project proponents must prepare robust performance propositions for prospective investors, in the form of business plans, investment prospectuses, contracts, or capacity-building proposals. Different types of financial instruments are available or must be created to structure the finance for the different performance propositions; this results in the use of a mix of financial instruments for each project. In this way, specific instruments tend to be used for financing specific kinds of project deliverables. It is this matching between instruments and measures/deliverables that provides the opportunity, for investment recruitment purposes, to create portfolios of similar measures across multiple cities and projects.

5 Financing the resilient city

Figure 8 provides a simplified view into the finance recruitment and integration requirements of a resilience upgrading project. Consider again the examples of Quito and Ho Chi Minh City.

In the Quito project, the expansion of water supply, e.g. through building reservoirs or wells, could likely be financed through the provision of conventional development loans to national governments, or through the issuance of special bonds by local governments or utilities that are guaranteed against future revenues by the water utility, or otherwise by the local government. Measures to reduce risks to the distribution network e.g. upgrading pipes could be written into the above bond, or financed through a performance-based instrument or contract that pays part of the revenues or savings associated with reduced water losses via leakages and illegal connections to the investor or contractor performing the specific distribution upgrade. Upfront funding for the demand-side management program could be budgeted through existing utility or local government assessments, as a strategy for reducing the necessity of new supply infrastructure and its associated debt. Catastrophic risk could be addressed through a catastrophe bond, catastrophe insurance, or other securitization instruments; or through structured finance that pools and thereby further spreads risk in scores of cities. Finally, IDA adaptation funds could finance project planning, financial structuring services, and the establishment of necessary monitoring, preventive maintenance, and emergency management systems. To implement such a comprehensive project effectively, the basic planning elements introduced earlier in Figure 7 need to be further expanded into a finance planning stage. The institutional question posed in the preceding section is: Who will lead the financial planning? Will it be a local development entity or a distant central government department or an international adaptation fund?

The challenge of finance planning is even greater when the focus of adaptation or resilience is a geographic area of a city, such as a district, transportation corridor, or neighbourhood. Urban services systems are relatively investor-friendly because they are organized and managed as business operations. But a piece of urban geography, although it may constitute a functioning economic unit of a city e.g. producing a stream of tax revenues, is not organized and does not function to create a return that can be captured by a single entity, excepting the tax collection of the local authority. An urban district, for instance, may host a variety of activities and entities, and produce systemic positive externalities that make it a robust place of financial and other value creation, but the wealth created accrues to its various businesses and households and not to the district as a unit of investment. The investment potential of an area's resilience upgrade is, therefore, more dependent upon creative disaggregation and re-bundling of numerous interdependent measures rather than trying to finance the district or neighbourhood transformation as a single investment proposition.

For instance, the resilience upgrade of a mixed-use commercial-industrial-residential district in Ho Chi Minh City, which includes both formal and informal sector property development and business activity, will require scores of different interventions calibrated to the sources of and exposures to risk in the different sectors and resident/user groups. Conventional urban services upgrades could be bundled with broader service system upgrades. Risk reduction retrofits to formal sector housing and other structures that have recognized market value in

the primary and secondary mortgage markets could be retrofitted through mortgage-style debt, secured against equity. Risks that could not be reduced through retrofit measures could be managed through insurance policies or securitization and structured instruments, if measures were bundled with similar measures in other geographic areas. Meanwhile, very different mechanisms such as micro-credit and small business loan funds might be most applicable to the informal sector parts of the district.

5.1 Creating greater financial flows for resilient city-building

As argued above, adaptation and resilience will initially add a further dimension of complexity into already complex urban development projects, where the primary risk-management focus has been reducing liabilities and ensuring near-term financial returns to developers and builders. Introducing resilience as a new performance requirement into the conventional process of upgrading specific urban districts and service systems involves the addition of measures that have not historically been associated with industry's way of creating new property value or revenue streams. Therefore, until industry learns how to integrate resilience as a new design and project performance element into the front-end of project planning and product design there will likely be a need for new, non-conventional financing instruments to support initial resilience upgrading. This chapter addresses the associated financial innovation challenge.

In Figure 8, the line indicated by ↕ (red horizontal line in the center) suggests the existence of a threshold for new financial instrument innovation. The investments and financial instruments indicated below the line are structured to secure returns for investors on the basis of institutional and asset performance, or on the basis of cost savings arising from customized efficiency measures such as energy efficiency retrofits in buildings. The use of these instruments for resilience upgrading generally involves the mainstreaming of risk performance criteria into the associated investment propositions and project deliverables. It only secondarily involves changes to the instruments themselves. Once again, the wide acceptance of green building performance into development industry practice and conventional finance exemplifies the potential of mainstreaming of new performance criteria into conventional financing instruments. Due to the effective mainstreaming of green performance criteria into urban product design, as a way to increase property value and secure higher rents and profit margins in these rents, the industry did not need to develop unusual new financing instruments to achieve these new levels of performance. 'Building green' itself became a way to optimize return on assets by reducing operating costs and by offering higher quality living spaces and work environments.

The investments and instruments indicated above the ↕ line (red horizontal line in the center) in Figure 8 are geared towards providing returns to investors *on the basis of risk mitigation*. To the extent that conventional urban development finance is not yet available to cover substantial additional costs for increasing overall risk and resilience performance of whole areas or systems, we suggest that risk-based instruments will need to be further developed for this purpose. In other words, if the industry does not yet know how to generate returns on resilience through its production and retrofitting of specific urban property assets or utility systems, then the best way to generate investment for resilience will likely be to create financial instruments that reward investors for sound financial evaluation of risk profiles and of the related contribution of different measures to reduce those risks.

The remainder of this report will focus on further defining the innovation challenge in terms of creating new private and public financial flows for urban resilience through risk-based financial instruments. In doing so, it will generally describe the types of instruments that may offer the greatest potential to fill the risk-based financing gap.

As suggested below in Figure 9, to the extent that addressing priority risks requires non-conventional project interventions from a financing perspective, the level of required financial innovation will be greater. Local project developers e.g. local government development entities, utilities and private development companies, will need to unbundle the individual measures in their multi-faceted, integrated projects and seek specific kinds of financing for different kinds of measures. New financial instruments will need to be developed for particular risk-based measures that cannot be bundled into conventional development measures. Figure 9 simply highlights, in a different way, the particular areas of resilience upgrading that will specifically require such financial innovation attention.

As illustrated in Figure 9 under 'type A' measures, some risk reduction measures can be integrated into investments that are serviced by standard or conventional financial products e.g. debt and equity finance and loan guarantees. To the extent that local planning and policies can be reformed to 'mainstream' adaptation/DRM/sustainability as design factors in development projects, existing market-based solutions should be available to finance certain upgrading measures. In other words, there would be little need for boutique financial instruments or for IDA 'additionality.'

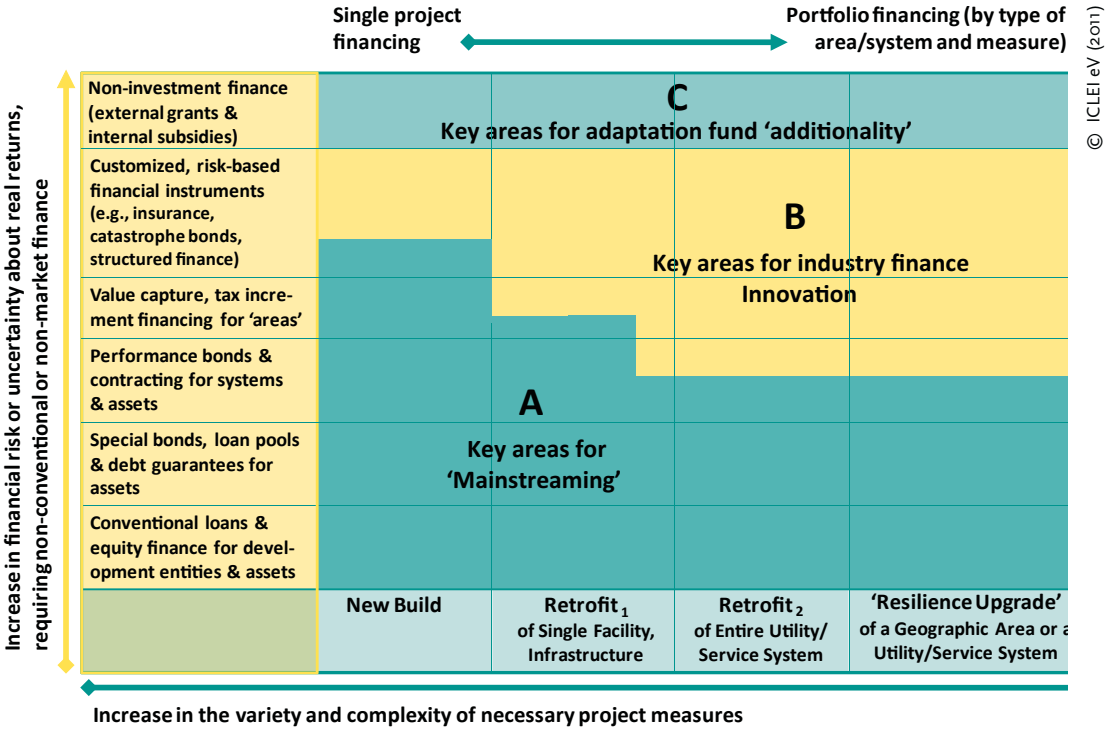

Figure 9 Focusing the areas for resilience mainstreaming and finance innovation

However, more complex upgrading projects will require special risk reduction measures that cannot be integrated into conventional investments without undermining their investment propositions. These special measures will require innovation in 'type B' financial instruments

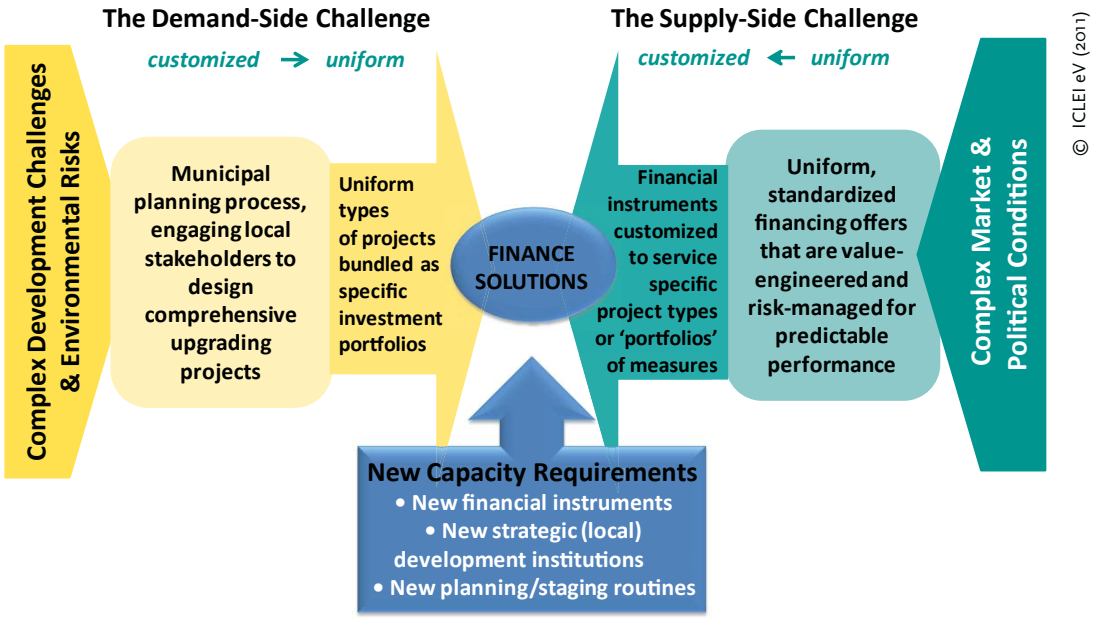

Figure 10 (5 reprinted) The resilience upgrading innovation challenge

as well as the development of local institutional capacity to prepare and implement such measures, including the structuring of their finance.

Finally, in addition to innovation in risk-based financing, we assume that there will be specific adaptation funding needs left unaddressed by market-based financing. This outstanding need could be served by public sector funds or by the new adaptation funds. As a result of first exhausting the type-A, conventional financing solutions, and the type-B, special risk-based financing solutions, the local proponents of climate adaptation/DRM activities may now bring more narrowly focused and higher quality proposals to the special adaptation funds, leveraging the market-based investment finance.

Considering the scale of global climate and other disaster risk – as cities expand into coastal, seismic, tropical, and water-scarce areas worldwide – new risk-based financial instruments will also need to be scaled. To scale the new solutions, a relatively uniform demand will need to be created for them, from cities internationally. Once again, this scaling challenge is illustrated in Figure 5 which has been reprinted in Figure 10.

Scaled sourcing of new private finance for risk-specific measures will require the development of large pools of quality new demand for the new kinds of risk-based financing. A key requirement of 'quality' will be the relative uniformity or even standardization of the types of risk reduction measures in each pool. In other words, while the measures will have to be extremely locally responsive to be effective, they will also need to be bundled with measures of similar types of risk and predictable ranges of risk reduction effectiveness into portfolios for investment.

The portfolios of comparable or related risk mitigation measures:

- would offer a similar risk-reward profile,
- could be implemented and perform within a predictable range of parameters,
- would be available at sufficient scale so as to make a bundled offering or pooled investment attractive.

By selecting or designing the measures across a number of cities to be bundled into portfolios, risk could be distributed. These more diversified portfolios of risk or risk-mitigation measures could be structured into secondary or derivative instruments, similar to the strategies of the secondary mortgage and re-insurance markets. In this way, a much larger group of investors could be attracted to these new risk investment opportunities.

Creating scaled portfolios of measures and the instruments to service them as a pool would of course require the engagement of international institutions and or transnational financial services companies.

5.2 Financial product innovation

This report cannot at this point present detailed proposals for specific new financial instruments. Referring again to Figure 5/10, the development of new instruments must first be concretely explored within specific local project contexts. On the basis of pioneering solutions customized for individual resilience upgrading projects, the general design and performance requirements of viable new types of instruments, possibly linked to defined types of measures, can then be determined. On this basis, as local efforts begin to scale across larger numbers of cities, opportunities can be evaluated for bundling portfolios of specific types of measures, or for pooling investment demand by creating secondary financial instruments such as catastrophe bonds or structured financed instruments that bundle thousands of project-specific instruments. We may notionally identify the types of instruments that might be most suited to the particular, non-conventional resilience measures indicated above in Figures 8 and in the cited examples. More detailed financial product designs would need to be based on further experience and assessment of local needs and shall not be based on theoretical assumptions at this point.

Value capture instruments

The existence of local tax assessment authority over geographic areas may offer a unique opportunity for financing comprehensive, place-centred resilience upgrades. Local governments have widely used value capture mechanisms and borrowing against future tax revenues, such as tax-increment financing, to incentivize if not finance investments in blighted areas i.e. areas with high private investment risk. Value capture mechanisms use special district-level taxes and community improvement fees to capture part of the value created for private owners and developers as a result of local government investments. In principle, the same mechanisms used to capture the value created for private owners through public investment in transport or drainage could be applied to public investments to reduce disaster or insurance risks to private land owners. Tax-increment financing is a form of value capture based on borrowing i.e. via a bond, against future increases in market-based land values and associated increases in tax revenues in order to finance investments in deteriorated or high-risk areas. In principle, if it can be established that climate or disaster risks are directly lowering property values, then value capture mechanisms should in principle be available to finance the measures to reduce these risks, and thereby increase those values.

Insurance and re-insurance

Insurance provides an important instrument for reducing the extent of possible losses of those who invest and hold assets in a city or urban infrastructure system. In this sense, insurance is a very important financial instrument when seeking to mobilize additional capital for any kind of city-building.

Consider, for instance, a resilience upgrading project in which some of the area's required risk reduction measures can be 'mainstreamed' into conventional projects, other measures can be financed via special risk-based financial instruments like catastrophe bonds, but where there are still no reliable, economic measures available for reducing other catastrophic risks. The prospective investors, whether in the conventional projects or in the special risk reduction measures, may not be willing to invest if there is still an outstanding catastrophic risk that cannot be mitigated in the area. Insurance provides the prospective investors a way to manage those extreme risks, thereby making their other investments attractive.

Re-insurance further spreads the risk of major losses by sharing parts of the insurers risk portfolio with the secondary insurer. Re-insurance allows an insurer who holds thousands of policies to select the exact portfolio of risks that it wishes to manage and for which losses it will be directly liable, passing on the remaining risks to the re-insurer for a contracted premium.

The central role of insurance aside, it is important to note that insurance instruments are not conventionally used to directly create new streams to address the risk situation. In other words, the proceeds of insurance policy sales are not reinvested in risk reductions measures, but are instead managed as an investment pool to generate profits for the insurer while maintaining assets to cover possible policy losses.

This being said, in recent decades insurers have experimented with health insurance policies that are linked to measures or organizations whose specific purpose is to prevent the illness of the policy holders. For instance, the American model of the health maintenance organization bundles health insurance to cover the costs of treatment during illness with preventative medical service to cost-effectively reduce the risk of illness. Similarly, in 2006 ICICI Prudential launched a unique, specialized insurance policy for people with Type 2 diabetes and pre-diabetic symptoms. The policy covers not only treatment, but the cost of a preventative wellness program. It further reduces the insurance premium for those who demonstrate good control of their condition. These policies suggest how insurance premiums can be structured in such a way so as to create special funds for risk reduction measures in addition to coverage of potential losses.

Catastrophe bonds

Catastrophe bonds were first developed by insurers in the early 1990s in response to the increasing strength of hurricanes striking highly urbanized southern Florida, causing losses significantly above the levels that insurers were willing to bear. In effect, the first catastrophe bonds were an alternative to re-insurance. Re-insurance passes risk on to the re-insurance company, which diversifies its risk through issuance and control of a managed pool of re-insurance policies. A catastrophe bond instead passes the insurer's extreme risks on to a variety of private investors who are willing to assume the risk of losing all of their investment principal (in the instance of a defined catastrophic condition) in exchange for the opportunity to earn substantial interest on their investment.

Following the introduction of catastrophe bonds by the insurance industry, governments began issuing their own catastrophe bonds to cover losses from extreme national crises. For instance, in 2006 Mexico issued catastrophe bonds to establish a pool of funds for responding and recovering from major earthquakes. In 2009, the World Bank established a Multi-Catastrophe or "MultiCat" Program to help governments structure "coverage" against multiple kinds of catastrophe risk, or to pool the risks of multiple governments through issuance of a special bond. Mexico was the first government to issue a bond to cover extreme losses due to earthquake, flooding, and tropical storms. In effect, the World Bank issues a bond whose proceeds would be used to cover the Mexican natural disaster fund in the instance of extreme losses.

A major innovation in the MultiCat approach is the pooling of different kinds of risks or of risks across a number of countries. A further innovation might be to use the catastrophe bond instrument to cover a portfolio of *specific kinds of catastrophic risk* across a large number of cities. The portfolio approach might be even more attractive if the proceeds could be used, in part, to finance risk reduction measures in these cities that establish predictable reductions of the risks covered by the bond. This could be called an 'active' use of a catastrophe bond.

The current uses of catastrophe bonds are passive; that is, proceeds are held in managed funds for a 'rainy day' event against which catastrophic losses could be claimed. In the meantime, the funds invest the proceeds to generate a return. Interest is paid from the funds to investors for each year that a catastrophe, of specified severity and conditions, does not occur. In this sense, the bonds do not serve to reduce risks or prevent catastrophe.

An actively structured catastrophe bond would use part of the proceeds from sales of the bond to implement reliable measures that actively reduce risks that are covered by the bond. In other words, the bond covers risks for which there is a record of risk management success through particular types of measures. The measures would have to be able to produce reliable risk reduction effects at predictable range of cost. By using proceeds from the bond to reduce the risk of triggered payouts to the covered cities, the interest payments demanded by investors could also be reduced, and the issuer of the bond could maintain a balance of funds to generate its own financial returns and to cover future claims against the bond.

Social impact bonds

Social impact bonds are a particular kind of 'active' bond, which is structured to generate proceeds to finance specific measures intended to reduce a social ill, cost, or risk. For instance, in the United Kingdom a social impact bond was issued to generate funds to finance social agency efforts to reduce re-offense or recidivism by convicted criminals of specific types of crimes. The bond was structured such that the relevant government department would pay a proceed to the bond issuer for each offender who was prevented from re-offending. The proceed was calculated as a part of the full cost that the government would have to spend in the instance of re-offense. A specified part of the proceeds were paid to investors.

Such a bond only works when there is considerable predictability that 1) a group of agencies have established the capacity to implement reliable measures to reduce the risk e.g. of re-offense 2) at a cost that is less than the cost of the risk event. The cost savings can thereby be predicted, and the investor, the issuer, and the government department can negotiate the sharing of the savings.

There is no reason why the same kind of instrument could not be used to mobilize resources for climate risk reduction measures in the instance that the above three conditions can be met.

Securitization and structured finance

Securitization of pools of revenue-generating assets into structured financial instruments reflects a basic idea that is complex in its execution. The basic idea is that similar investment instruments, such as mortgage loans, automobile loans, or credit card debt, can be structured into large portfolios in order to generate immediate revenues from long-term revenue streams as well as to diversify risks. For example, when a bank originates a mortgage loan it secures a stream of revenues for the term of the loan. If the bank would like to gain more rapid access to that revenue stream it might transfer the ownership of the loan to a third party in exchange for part of the long-term revenue stream.

Consider a municipality, a local development corporation, or a utility company. The utility company may offer loans to thousands of building owners to retrofit their buildings. In exchange the utility holds a contract that gives it right to charge monthly loan payments from the building owners on regular utility bills. Similarly, the municipality may offer building owners finance for specific resilience upgrading measures, and charge quarterly fees on property tax bills to recover their loan. In both instances they would likely charge interest to the building owners on the loaned balances.

If the utility or municipality would like to immediately access a large part of the revenues i.e. loan principal plus interest charges to invest in a resilience upgrade of the whole system, then it might structure the pool of loans into a secondary financial vehicle instrument. The special purpose vehicle would take ownership of the whole portfolio of outstanding loans and associated revenue collections. In exchange, the utility or municipality would receive an immediate payment that is equivalent to part of the total discounted revenue stream predicted over the term of the pool of loans.

If a number of local development corporations or utilities, across a large number of cities, are supported to finance similar types of resilience measure across millions of buildings, then the ability to mobilize immediate capital via securitization of millions of small loans is even greater.

This kind of securitization is an instrument in the world of high finance. The risks of such finance were made apparent in the collapse of mortgage-backed securities or “collateralized debt obligations” in the 2007-2008 global financial crisis. Nonetheless, the use of securitization to generate immediate capital from predictable, regulated long-term revenue streams such as utility bills or small loans provides a possible way to bring private capital into resilience investment activities.

6 Conclusion

The purpose of this report has been to consider the benefits of addressing climate change risks through comprehensive resilience investments. The report further considers the benefits of approaching resilience investments in bottom-up fashion, by those who manage the human settlements to be adapted; that is, by the regional and local governments who are responsible for planning, development approvals, and services delivery for most of the world's built environment. Adaptation and the development of resilience are by definition local processes. They require unique solutions for unique, context-specific conditions. To maximize impact as well as the value created through resilience investments, projects must be made responsive to unique local development challenges and opportunities.

Achieving a substantial, widespread increase in the resilience of human settlements in the face of both traditional disaster vulnerabilities and new climate change related vulnerabilities is an enormous global challenge. The strategic framework offered in this report provides a way to map the key areas for strategic innovation and programmatic action. In conclusion, when it comes to 'new build' and facility-specific retrofits, the IDA community and local governments, along with their NGO and private sector partners, might focus resources on mainstreaming climate and disaster risk reduction into conventional planning processes, project design, and development decision making. When it comes to the comprehensive re-development of urban areas or systems, governments and the IDA community and its partners might focus resources on developing local institutional capacity to prepare, structure, and manage large-scale redevelopment. They might also support the development of specialized financial instruments for risk-oriented components of these projects that cannot be addressed via mainstreaming measures.

This broadly outlined strategy has focused on establishing local mainstreaming efforts; on developing new sources of capital for quality resilience upgrades; and on developing local institutional capacity to structure projects that are suitable for these new sources of finance. This suggests the need for a major programmatic initiative.

This initiative, akin to global efforts like Local Agenda 21, City Development Strategies, Cities for Climate Protection, or major disease eradication programs, could initially be constituted in the form of an 'alliance for resilient cities.' The alliance could consist of local governments and their support institutions, whose focus would be to develop the local adaptation and resilience project pipelines. The alliance would include corporate partners, whose focus would be to engineer and specify market viable technical measures in the broad project pipeline. Finally, the alliance would include financial services providers, whose focus would be to develop new financing solutions.

The initial focus of such an alliance could be to pilot some comprehensive resilience upgrading projects, including their investment and financial planning. The pilots would support deeper understanding of the financial aspects of such projects by all within the alliance. The initiative would also identify the necessary mix of financing solutions required to implement a truly comprehensive upgrade. On the basis of such pilots, the associated planning process could be more widely diffused and applied, on which basis the alliance could then focus on scaling resilience upgrading across the world's vulnerable urban areas.

7 References

Hamilton, C. and Quiggan, J., 1997, *Economic Analysis of Greenhouse Policy: A layperson's guide to the perils of economic modeling*. Sydney, Sustainable Energy Development Authority of New South Wales. www.tai.org.au/documents/dp_fulltext/DP15.pdf (accessed 6 December, 2010).

ICLEI, 2007, *Resilient Communities and Cities Initiative*.

ICLEI, 2010, *Resilient Cities: The annual global forum on cities and adaptation to climate change*, www.iclei.org/resilient-cities.

Moon, K., Downes, Rujner and Storch, 2009, Adaptation of the Urban Structure Type Approach for Vulnerability Assessment of Climate Change Risks in Ho Chi Minh City In: *E-Proceedings: 45th ISOCARP Congress 2009 "Low Carbon Cities"*. The Hague, ISOCARP. www.isocarp.net/Data/case_studies/1596.pdf (accessed 9 December, 2010).

GEF, undated, The Global Environmental Facility. *Financing Adaptation*. Washington, D.C., www.thegef.org/gef/sites/thegef.org/files/publication/adaptation-actions_0.pdf (accessed 6 October, 2010).

Parry, M., Nigel, Pam, Arnell, Berry et al., 2009, *Assessing the Costs of Adaptation to Climate Change: A review of the UNFCCC and other recent estimates*. London: IIED, Grantham Institute for Climate Change. http://pubs.iied.org/pdfs/11501IIED.pdf (accessed 14 November, 2010).

Woetzel, J., Mendonca, L., et al., 2009, *Preparing for China's Urban Billion*. McKinsey Global Institute, pages 16 and 115. www.mckinsey.com/mgi/reports/pdfs/China_Urban_Billion/China_urban_billion_full_report.pdf (accessed 21 March, 2011).

United Nations, Department of Economic and Social Affairs, Population Division. World Urbanization Prospects, the 2009 Revision. New York. URL: http://esa.un.org/unpd/wup/doc_highlights.htm (accessed 26 April, 2011).

World Bank website at http://climatechange.worldbank.org/content/new-report-sees-cities-central-climate-action, referencing to the report by Daniel Hoornweg et al. Cities and Climate Change: An Urgent Agenda. Washington, D.C.: The World Bank (2010).

8 Acknowledgements

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8.3 Supporting organisations

ICLEI convened a Think Tank of urban development and climate finance experts in February 2011 under the patronage of the German Ministry for Economic Cooperation and Development (BMZ) in partnership and with support from the German Development Cooperation / Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

ICLEI's current services and contributions

- **Resilient Cities annual global forum on cities and adaptation to climate change in Bonn, Germany, are held back-to-back with the UNFCCC Bonn talks.**
  - 3-5 June, 2011
  - 11-13 May, 2012
  - 31 May – 2 June, 2013

- **Adaptation planning guidance for local governments including:**
  - ICLEI Oceania Adaptation Toolkit,
  - ICLEI Canada guide 'Changing Climate, Changing Communities',
  - ICLEI USA ADAPT tool;

- **Implementation of adaptation projects for example:**
  - ICLEI Africa (5 City Adaptation Network, including the use of Interactive Climate Change and Climate Impact Training Tool (ICCCI Tool) and Local Interactive Climate Change Risk and Adaptation Prioritization Training Tool (Local RAP tool));
  - ICLEI Europe in cooperation with ICLEI South Asia and Southeast Asia (AsianCitiesAdapt), specifically community based adaptation, adaptive water management and adaptation measures in integrated urban management systems;

- **Nairobi Work Programme**
  - ICLEI is the only local government network that supports the Nairobi Work Program (NWP) of the United Nations Framework Convention on Climate Chance (UNFCCC). The Resilient Cities congress, the global annual forum on cities and adaptation, is the Action Pledge of ICLEI to the NWP;

- **Intergovernmental Panel on Climate Change (IPCC).**
  - ICLEI is the only local government network that is an official observer organisation to the Intergovernmental Panel on Climate Change (IPCC).

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ICLEI's mission is to build and serve a worldwide movement of local governments to achieve tangible improvements in global sustainability with special focus on environmental conditions through cumulative local actions.

ICLEI was founded in the year 1990 as the International Council for Local Environmental Initiatives.

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