SAFE AND RESILIENT CITIES IN ETHIOPIA

CityStrength Diagnostics in Nine Regional Capitals and Dire Dawa City Administration

WORLD BANK GROUP

GFDRR
Global Facility for Disaster Reduction and Recovery

This work is the product of a collaborative effort of the Government of Ethiopia including the Ministry of Urban Development and Housing, Ministry of Construction, and local governments of nine regional capitals and Dire Dawa City Administration, with contributions of staff of The World Bank. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

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Foreword

Through ongoing efforts across the country, Ethiopia continues to experience economic growth that puts it on track to become a middle-income country by 2025. Part of the economic growth has been the result of the urbanization process observed across the country. Ethiopians are moving to cities where there is a concentration of economic activities, provision of basic services, and other factors that contribute to a higher quality of life. Current urban growth rates are among the highest in Sub-Saharan Africa, indicating that the country will see even more people migrating to and living in urban areas in the coming years. While Addis Ababa continues to be the dominant urban center of the country, it is the small- and medium-sized cities that are witnessing the highest levels of urban growth.

Keeping up with this growth has led to many challenges, however, to provide infrastructure, urban services, and employment to all citizens. Many Ethiopian cities are vulnerable to shocks such as flooding, fire, and earthquakes that can disrupt cities and undermine development gains. For example, in April 2016, a rainstorm caused serious infrastructure damage in Dire Dawa city, which is regularly exposed to flooding. In Addis Ababa, in 2012 a fire in a five-story building in Efoyta Market caused damages amounting to ETB 20 million (US\$1 million). All regional capitals have experienced deadly floods that have also led to casualties and left expensive reconstruction needs. Climate change is likely to make future shocks more intense and frequent.

To achieve Ethiopia's national goals, improve overall economic growth, and lift people out of poverty, it will be necessary to build cities that are resilient to a wide variety of shocks. Cities need to be able to operate and provide for the people who live there, under all conditions. This entails a well-functioning

An aerial photograph of a city, likely Addis Ababa, Ethiopia, showing a dense urban area with many small buildings and some greenery. The image is partially covered by a large teal rectangular overlay on the left side, which contains white text. At the top of the page, there is a decorative graphic of a network of lines and dots in a light blue color.

city that features aspects such as access to safe housing, adequate provision of basic services, and enforcement of building regulations to foster a safe built environment. The Government of Ethiopia is committed to the resilience agenda recognizing that the time to take action is now, while cities are still in the early stages of urbanization. Without proactive measures, the cost of taking retroactive actions in the future will divert key funding from the advancement of development goals.

The Government is already taking steps to realize its urban development vision to “Create resilient and livable cities”. The National Urban Development Spatial Plan (NUDSP) and the Ethiopian Cities Sustainable Prosperity Goals (ECSPGs) recognize resilience as a key pillar for development of Ethiopian cities. Recognizing the need to identify concrete priority actions and investments, with the help from the World Bank, the Government has initiated a strong engagement process with stakeholders from all nine regional capitals and the Dire Dawa city administration. The purpose of the engagement is to raise awareness on the importance of integrating resilience-building measures in all planning and implementation efforts. Furthermore, a collective strategy for resilient cities was laid out based on recurrent shocks and stresses that threaten the long-term viability and vibrancy of Ethiopia’s urban environments.

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Acronyms

AAL	Average Annual Loss
CA	City Administration
CCCs	Community Care Coalitions
CSA	Central Statistical Agency
DHS	Demographic and Health Study
DRM	Disaster Risk Management
DRMFSS	Disaster Risk Management and Food Security Sector
DRM-SPIF	Disaster Risk Management Strategic Program and Investment Framework
EBCS	Ethiopian Building Code
ECPI	Ethiopian Cities Prosperity Initiative
ECSPG	Ethiopian Cities Sustainable Prosperity Goals
EEA	Ethiopian Electricity Agency
EEP	Ethiopian Electric Power
EEPCo	Ethiopian Electric Power Corporation
EEU	Ethiopian Electric Utility
EIA	Environmental Impact Assessments
ESIA	Environmental and Social Impact Assessment
EOC	Emergency Operations Centers
EPA	Environmental Protection Authority
ERD	Earthquake Resistant Damage
ETC	Ethiopian Telecommunications Corporation
FEPPRA	Fire and Emergency Prevention and Rescue Agency
FRTA	Federal Road Transport Authority
GDP	Gross Domestic Product
GoE	Government of Ethiopia
GTP	Growth and Transformation Plan
ICPS	International Center for Prison Studies
ICT	Information and Communications Technology
IDA	International Development Agency
IDPs	Integrated Development Plans
IHDP	Integrated Housing Development Program
ISWM	Integrated solid waste management
IT	Information Technology

IUWM	Integrated Urban Water Management
MDG	Millennium Development Goals
MoC	Ministry of Construction
MOFEC	Ministry of Finance and Economic Cooperation
MoUDH	Ministry of Urban Development and Housing
MoWIE	Ministry of Water, Irrigation, and Electricity
MoWR	Ministry of Water Resources
MSEs	Micro- and Small Enterprises
NDRMC	National Disaster Risk Management Commission
NAPA	National Adaptation Program of Action
NBC	National Building Code
NIMS	National Incident Management System
NRW	Non-Revenue Water
NUDSP	National Urban Development Spatial Plan
ODI	Overseas Development Institute
PET	Polyethylene Terephthalate
PPE	Personal Preparedness Equipment
RB	Regional Bureaus
R&D	Research and Development
RSDP	Road Sector Development Program
RVS	Rapid Visual Screening
SECR	State of Ethiopian Cities Report
SNNPR	Southern Nations, Nationalities, and Peoples' Region
SOP	Standard Operating Procedure
SWM	Solid Waste Management
TA	Technical Assistance
UAP	Universal Access Plan
ULGDP	Urban Local Government Development Program
ULGs	Urban Local Governments
USAID	United States Agency for International Development
USAR	Urban Search and Rescue
URRAP	Universal Rural Roads Access Program

Executive Summary

I. Overview: Urban Resilience is a Critical National Priority

Ethiopia has one of the fastest growing urban populations in the world—projected to nearly triple from 15 million in 2012 to 42 million in 2034, an average annual growth rate of 5.4 percent.¹ Cities are engines of economic growth and already play an important role in Ethiopia’s economy, contributing 38 percent of gross domestic product (GDP) while employing only 15 percent of the total workforce.² Urbanization combined with significant economic and social transformation over the past decade has the potential to shift the structure and location of economic activity from rural agriculture to larger and more diversified urban industrial and service sectors.

With rapid growth comes a significant amount of new construction, much of which will occur in cities with limited capacity to ensure the structures in which people live, work and gather are safely built. During this time of transition to an emerging economy, when significant investments in infrastructure are made and resources are committed for years to come, it is critical for Ethiopia to steer settlement growth and construction toward safe areas and ensure the construction of safe buildings and infrastructure. Ethiopian cities are already struggling with access to jobs, infrastructure, services, and housing.³ Rapid urbanization will lead to greater concentrations of people, assets, and infrastructure, thus increasing exposure to shocks and stresses. Limited capacity for

land-use planning, coordination of services, and mobilization of financing for infrastructure pose major constraints to healthy urbanization and will compound Ethiopia’s continued exposure to shocks and stresses.

Together, these risks increase cities’ vulnerability to disasters such as floods, fire, and earthquakes, with potentially devastating effects on Ethiopia’s economic performance and its poverty-alleviation agenda. Without systems and services for resilience, disasters can push vulnerable people into—or further into—poverty. Recurrent shocks can undermine past gains and hamper future economic growth, leading to a pernicious “poverty trap” for many of the urban poor.⁴ In response to recurrent droughts, Ethiopia has developed a commendable national Disaster Risk Management (DRM) system with effective early warning and response mechanisms. Urban areas, however have not benefitted from this national system, as the focus has been largely on rural food security and drought mitigation.

If managed proactively, urban population growth presents an enormous opportunity to foster economic growth and support the Government of Ethiopia’s vision to reach middle-income status by 2025.⁵ Timely and effective interventions now to promote resilience can have significant positive impacts on the long-term safety, productivity, and smooth functioning of the urban built environment. These interventions can reduce the impact of floods, fire, and landslides—which disrupt a city’s fabric and the lives and livelihoods of the people

¹ World Bank Group (2015). *Ethiopia Urbanization Review: Urban Institutions for a Middle-Income Ethiopia*.

² Ibid.

³ Ibid.

⁴ Hallegatte et al, 2017. Shock waves: managing the impacts of climate change on poverty.

⁵ World Bank, 2013. Ethiopia Economic Update II (Washington, DC).

who live there. Socio-economic stresses—such as unemployment, air and water pollution, lack of housing, or lack of public services—can have the same impacts unless actions are taken to improve urban resilience.

Resilience is the capacity of a city to provide services, adapt and grow, despite chronic stresses and acute shocks that may threaten its collective viability.⁶ Strengthening urban

resilience in Ethiopian cities will require better understanding of risks, and incorporating resilience into land use planning and development, undertaking measures to mitigate risk through disaster and climate risk management, and improving regulatory decisions and emergency preparedness. Box 1 presents the participatory technical assistance employed to identify key priorities for urban resilience in Ethiopia.

BOX ES1

Strengthening Urban Resilience Technical Assistance Program—Scope and Stakeholders

This report is an outcome of a Technical Assistance program supported by the World Bank to help the Government of Ethiopia identify actions to foster resilience in nine regional capitals and one city administration: Adama, Assosa, Bahir Dar, Gambella, Harar, Hawassa, Jigjiga, Mekelle, and Semera-Logia, and Dire Dawa City Administration. The program was led by the Ministry of Urban Development and Housing (MoUDH) along with the Ministry of Construction (MoC), National Disaster Risk Management Commission (NDRMC), Ministry of Finance and Economic Cooperation (MoFEC), Ministry of Water Resources, Irrigation & Electricity (MWRIE), and Ministry of Labour and Social Affairs (MoLSA) as well as numerous national, regional, and local government entities, local universities, civil society organizations, development partners, residents, and the private sector.

The program was conducted between 2015 and 2017, primarily using City Strength diagnostic methodology to facilitate dialogue among stakeholders. Three additional assessments were undertaken to add technical rigor to the assessment: (i) *Hazard mapping*: to identify cities' exposure to seismic, volcanic, flooding, drought, and landslide hazards; (ii) *A review of the national legal framework on building regulations for resilient buildings*: to identify recommendations for improving national policies on the construction of safe buildings and infrastructure; and (iii) *A review of emergency response and management requirements for urban areas*: to assess cities' capacity for emergency preparedness and response.

The City Strength diagnostic focused on ten sectors, reflecting key pillars of the Ministry of Urban Development and Housing's strategy (Ethiopian Cities Prosperity Initiative-2014). These include: Urban Planning and Housing; Urban Finance; Disaster Risk Management and Climate Change; Environmental Management; Transport and Roads; Water Supply and Sanitation; Solid Waste Management; Energy; Local Economic Development; and Community Development and Social Protection. The process consisted of data collection; field visits, and consultation workshops. Facilitated by a multi-sectoral team from the World Bank, city stakeholders identified key shocks and stresses in the ten Ethiopian cities as well as key actions to address them.

⁶ World Bank, 2015. CityStrength Diagnostic Methodological Guidebook

Investing in the resilience of cities and their systems—with forward-thinking and integrated planning, robust infrastructure development, disaster risk management and prevention—can reduce long-term costs otherwise required to retrofit services for poorly planned and overcrowded urban areas. For example, improved fire protection would save thousands of lives each year, and improved flood management and compliance with building code seismic standards could reduce annual economic losses by tens of millions of dollars.

Increasing investment in resilience supports the strategic and long-term national priorities of the Government of Ethiopia. The Government's Growth and Transformation Plan (GTP) (2014/15–2020) emphasizes the fundamental importance of building green, resilient, and well-governed cities to achieving its vision of reaching middle-income country status. The Ethiopian Cities Prosperity Initiative 2014, which builds on the GTP, focuses on Inclusive and Safer Cities Development as a key strategic pillar. Complementing Ethiopia's urban development policies, the Government has developed policies to systematically manage its disaster risks, thereby also enhancing urban resilience. These include the National Policy and Strategy on Disaster Risk Management (NPDRM, 2013), recognizing the need to strengthen urban resilience, in light of the growing risks of fire and other hazards associated with rapid urbanization, and the Disaster Risk Management Strategic Programme and Investment Framework (DRM-SPIF). Ethiopia's Climate Change National Adaptation Programme of Action (NAPA) further contributes to the enhancement of urban resilience. Climate and disaster resilient development is also a focus of the World Bank's Country Partnership

Framework of Ethiopia, given its importance to achieve the World Bank's twin goals of reducing poverty and increasing shared prosperity.

II. Key Findings: Business-as-usual increases impacts of shocks and stresses

Shocks and stresses are disruptions that can threaten the viability of a city's infrastructure, systems and services, and safety. These disruptions are likely to increase with exposure to the impacts of climate change (Hallegatte et al, 2016). Shocks are sudden events that have immediate impacts, such as fires, floods, earthquakes, outbreaks of conflict, terrorist attacks, and severe economic volatility (World Bank, 2015a). Stresses are longer-term trends, often man-made, that undermine the performance of a community or nation and increase the vulnerability of stakeholders. These can include degradation of natural resources, loss of agricultural production, demographic changes, climate change, political instability, unemployment, informality, and long-term economic decline (DfID, 2011). Stresses can be cumulative, compounding gradually until a tipping point is reached, at which stage they can develop into a sudden shock.

All capital cities and Dire Dawa face flooding and fire. Five regional capitals are at risk from earthquakes but lack preparations for a seismic event. Landslides, drought, heavy rainstorms, high wind, and diseases are additional shocks faced by at least one of the 10 cities in the assessment. Examples of such shocks are numerous.⁷ In April 2016, a rainstorm caused serious infrastructure damage in Dire Dawa;⁸ the city already faced floods in 1984 killing 42 people and in 2006 killing 256. In Jijjiga in 2016, 23 people were killed and 84 more people injured

⁷ Note: Information from stakeholders who participated in the CityStrength workshops

⁸ <http://reliefweb.int/report/ethiopia/ethiopia-dire-dawa-floods-ocha-situation-report-no-1>

due to floods.⁹ In January 2016, a 4.3 magnitude earthquake hit Hawassa,¹⁰ causing panic among residents and university students.

A principal stress facing all of the cities in Ethiopia is rapid growth in population and urban sprawl, due to the pressures it places on city systems and the delivery of basic services. Primary among these pressures are shortages of housing, water, and sanitation; informal settlements; unemployment; transportation constraints; and insecurity of energy and public services.¹¹ All are exacerbated by rapid population growth, which is projected to triple by 2037 (World Bank, 2015b).

In short, the capital cities urgently need support and investment to manage already severe shocks and stresses that are only likely to increase with exposure to climate change impacts. The main challenges facing the cities include are presented below.

Managing urban growth: Adama, Bahir Dar, Dire Dawa, Hawassa and Mekelle will likely house nearly 1 million people each in the coming 20 years, almost doubling each city's population.¹² Assosa, Gambella, Harar, Jigjiga and Semera-Logia will comparably house fewer people but are witnessing much higher population growth rate. Urban sprawl (built up areas) in Assosa, Jigjiga and Gambella have noted even more dramatic change with twenty, seventeen and thirteen-fold increase.¹³ In particular, the cities must proactively manage informal settlements and avoid obstructions to the natural drainage systems. This work requires proactive, coordinated, and integrated planning and implementation, taking into account disaster

and climate risks. All cities need dedicated support for their planning efforts. Although every city has prepared master or structural plans, implementing the plans remains a challenge given financial and technical capacity constraints and minimal interjurisdictional coordination.

Managing flooding and water scarcity: The 10 regional capitals face growing impacts from flooding, even as a majority also face severe water scarcity. With climate change, the frequency and intensity of flooding and water scarcity will increase if long-term preventive actions are not taken. The current piecemeal approach of relying on structural measures (primarily retention walls or drainage channels) and/or relocating at-risk populations does not provide effective and long-term flood-mitigation solutions.

Disaster preparedness: The regional capitals do not have any dedicated budget or staff to plan, mainstream, and implement disaster and climate risk management actions; neither is there contingency financing. The cities do not provide flood warnings or earthquake, landslide, or volcano alerts, and no contingency plans are in place to prepare communities for disasters. Cities also lack adequate equipment and resources to respond to fires or take fire safety measures, especially in tall buildings and informal markets. With growth in city populations, higher fire-related mortality is expected, which is already close to 20 times the rate in middle- and high-income countries.¹⁴ Improvements are needed not only for overall safety, but also to enhance each city's competitiveness and its potential to attract and retain new investments.

⁹ https://www.diretube.com/articles/the-jigjiga-flood-killed-28-peoples-in-ethiopia_12110.html

¹⁰ <http://www.ena.gov.et/en/index.php/environment/item/696-hawassa-hit-by-4-3-magnitude-earthquake>

¹¹ CityStrength workshops

¹² Based on the Ethiopian Central Statistical Agency (CSA) and World Bank estimates.

¹³ Based on CSA, 2007, GLCF, www.landcover.org/data

¹⁴ Based on Building Regulatory Review study. Ethiopia is effectively spending roughly 1.5 percent less on fire protection features in buildings than middle and high-income countries (as a fraction of total building cost) and suffering close to 20 times the mortality, which currently totals close to 12,000 deaths per year.

Building regulatory framework: The regional capitals are witnessing rapid growth in new construction but have limited capacity to ensure that the new and existing structures are safely built to withstand earthquake, flooding, and fire, and avoid spontaneous collapse and other harmful conditions. Building regulatory review assessments found four key challenges that hamper the resilience of the built environment: (i) limited human and technical capacity as regional and municipal building agencies are increasingly overwhelmed by the influx of building permit applications and the growing complexity of building projects; (ii) limited effectiveness of quality assurance mechanisms and information on hazard risks; (iii) lack of implementation of new building standards; and (iv) larger institutional and structural factors such as improving safety in informal construction. Improvements in planning, building inspection, and regulations can have significant impacts on the long-term safety, productivity, and resilience of the urban built environment.

Key sectoral priorities: Sectoral assessments carried out during this analysis revealed that resilience can be improved through several steps to ensure robust functioning of the key sectors. Common challenges include limited intersectoral and interjurisdictional coordination, lack of systematic and integrated data collection and management, and relatively weak technical and financial capacity to plan, implement and monitor actions. Each of these challenges affect cities' overall resilience and need to be addressed urgently.

For example, inadequate solid waste management impairs urban drainage systems, increases flooding risk, and increases the likelihood of disease outbreaks. Water supply and sanitation remain critical because water scarcity can jeopardize cities' functioning.

Better transport and roads are needed for daily economic activities but also to ensure timely response to emergencies in at-risk areas of the cities (such as informal markets). Rehabilitation of energy networks is needed to avoid fires caused by faulty wiring, as well as to ensure a 24-hour network for efficient functioning of hospitals, schools, businesses, and offices. Above all, improvements in urban finance are needed not only to ensure adequate resources for infrastructure and services but also the availability of contingency funds during emergencies.

III. Investing in Urban Resilience for Safety, Inclusiveness, and Economic Growth

The findings from this study strongly support investment in urban resilience, with tangible benefits in three key areas:

(i) Safety: Even with limited data on past disasters, the assessment shows large benefits from improved disaster preparedness:¹⁵

(a) Improved fire protection would effectively save 2,900 lives per year, equivalent to 160,000 lives saved in the next 34 years;

(b) Compliance with the seismic provisions of the building code would reduce the average annual loss by 30 percent by 2050, from US\$128 million to US\$90 million; and

(c) Improved flood management practices would reduce the average annual loss to about US\$93 million, a net annual reduction of about US\$230 million each year.

(ii) Inclusiveness: Investment in urban resilience will protect Ethiopia's hard-won development gains and ensure inclusiveness in their benefits. Without systems and services

¹⁵ Based on assessment conducted as a part of Building Regulatory Review assessment (WB,2016)

for resilience, disasters and recurrent shocks can push vulnerable people into—or further into—poverty (Hallegatte, Stephane et al., 2017). According to the Overseas Development Institute, by 2030 an estimated 20 million extremely poor dwellers (living on less than US\$1.25 per day) are likely to be exposed to multiple hazards in Ethiopia, such as drought, flooding, and landslides (ODI, 2013). Improved fire and flood preparedness activities will improve resilience of most vulnerable population, and save long term development gains.

(iii) Economic growth: The benefits of investment in resilience can be measured not only in terms of lives saved and damages averted but also in terms of economic growth from infrastructure built or enhanced, services delivered, and the increased supply of developable land (for example prime city land located in areas at high-risk of disasters such as flooding). City land values increase with infrastructure investments providing protection from disasters. Improved disaster warning and emergency response services will improve the competitiveness of Ethiopia's cities, including their ability to attract and sustain foreign investment. This is especially true for cities like Hawassa which are setting up industrial parks but are at a risk of earthquake.¹⁶

IV. Recommendations: Resilience Priorities for Ethiopian Cities

Five key priority areas were identified to enhance resilience in the regional capitals, based on the needs identified by the cities as well as sectoral assessments. Recommended actions and investments, and their timeline for implementation are presented here. Table ES.1 summarizes the main policy recommendations and implementation responsibilities.

I. Effectively manage rapid urban growth in a risk-sensitive manner focusing on the most vulnerable populations: To manage rapid and unprecedented urban growth in the regional capitals, integrated, coordinated, and risk-sensitive urban planning is recommended, followed by adequate implementation and monitoring processes. Most importantly, support for the most vulnerable groups is needed to promote inclusive and resilient urban growth.

1. Develop integrated, coordinated, and risk-sensitive urban master planning, implementation, and monitoring processes:

Improving risk-informed planning will require following key actions: (i) identifying, mapping, and incorporating hazard risk factors into land-use and structural plans; (ii) establishing a taskforce to facilitate coordination during the planning and implementation and developing a guidance note on incorporating risk information into planning and infrastructure development; (iii) improving stakeholder consultations in all planning actions; and (iv) developing a central information system on planning and risk data to inform planning, implementation and monitoring urban development activities.

2. Resolve housing crisis and support the most vulnerable:

This will require: (i) strengthening the rental market in cities by encouraging owners to rent their units, and incentivizing property developers to construct rental units; (ii) Increasing access to land to build housing, and ensuring hazard and climate change considerations as well as overall accessibility during any emergency; and (iii) taking an integrated and comprehensive development approach towards improving living conditions of existing housing units by upgrading in kebele housing and informal settlements.

¹⁶ Based on hazard mapping conducted using hazard data from the Global Facility for Disaster Reduction and Recovery (GFDRR) Innovation Labs' National Multi-Hazard Risk Profiles, developed as part of the ACP-EU program, "Building Disaster Resilience in Sub-Saharan Africa."

II. Better manage flooding and water

scarcity: Better managing water extremes in cities will require an integrated approach to improving integrated urban watershed management and resolving water scarcity.

3. Plan and implement integrated flood risk management in all regional capitals:

Integrated watershed-level planning and implementation are needed, taking into account the future exposure to hazards by a growing population. This includes (i) improvement in drainage systems based on watershed-level planning for future population and hazard exposure; (ii) improved liquid and solid waste management, including addressing water pollution; (iii) encouraging urban watershed management, including upstream runoff; and (iv) improving green and recreational areas that can enhance water absorption, recharge groundwater aquifers, and serve as buffer zones to prevent encroachment on flood-prone areas. For cities that are highly exposed to flooding such as Dire Dawa, it will be critical to prioritize investing in implementing and monitoring integrated flood risk management plans.

To better prepare for potential future flooding, the cities need to establish or build on existing flood warning systems, linking them with the National Meteorological Agency, the National DRM Commission, and Regional Bureaus. Flood preparedness plans need to be developed as a part of city-level contingency plans and linked with community preparedness activities.

4. Resolve water scarcity: To meet the fast-growing demand for water resources, it is important to take actions that focus on increasing efficiency in service provision and groundwater recharge while identifying alternative sources. It is recommended to establish a national taskforce to address this challenge and which can commission and

supervise needed studies to identify improved policy and practice, with detailed actions required at national, regional and local levels.

III. Improve disaster preparedness, including fire safety and response:

Improving climate and disaster risk management will require establishing a climate and DRM unit and operations center, improving urban disaster risk information system, and improving local fire and rescue capacity:

5. Establish urban Disaster Risk

Management institutional framework:

Following the new national DRM policy, extend the existing national and regional DRM structure to the cities with dedicated staff and budget within city administrations. The urban DRM unit will be in charge of developing a DRM strategy, including: (i) securing early warning on flooding, drought, and high winds, and alerts for earthquakes and landslides; (ii) ensuring community disaster preparedness; (iii) developing contingency planning and budgeting; and (iv) exploring risk financing and insurance options.

6. Improve urban disaster data collection, risk assessment, and information sharing:

Understanding what and where potential risks from urban disasters are, it's necessary to allocate resources rationally. This requires the generation and analysis of hazard and risk information, building on woreda risk profiles and improving seismic and flood hazard monitoring instruments and stations. At the national level, this information system can be housed in the Ministry of Urban Development and Housing, linked to the National DRM Commission and other relevant ministries such as Ministry of Construction. The same information system will need to be extended at regional and local government levels. A joint task force between the Ministry of Urban Development and Housing and the National

DRM Commission can identify next steps to improve risk information collection and sharing, and coordination on DRM actions.

7. Improve fire and rescue response capacity by providing financial and technical support to fire services:

A detailed needs assessment of the fire support services in all cities will identify the specific training and equipment needed to improve response capacity for densely populated buildings and neighborhoods. An investment program will assist in providing mobile firefighting units and search and rescue equipment appropriate for city responses to fire incidents.

IV. Improve the building regulatory framework to mitigate seismic risk and enhance overall safety of the built environment:

Investing in an improved building regulatory framework begins with a building assessment that includes a rapid visual survey and a more in-depth comprehensive structural assessment to identify public structures susceptible to chronic risk (e.g., fire and structural collapse) and disasters. This assessment should produce a prioritized investment plan for structural retrofits, to be financed by government, development partners, and/or multilateral development finance. The second critical initiative is to establish quality-enhancement review and regulatory processes at the national and local levels. This includes developing capacity for building and planning departments, design professionals, and construction workers.

8. Reduce risk in the existing built environment:

The proposed activities address the urgent need to reduce high risk situations that currently exist in the built environment. This includes: (a) funding Rapid Visual Screening (RVS) to assess schools, hospitals and critical public structures. The rapid review will provide the basis for conducting a more

comprehensive structural analysis to define priority structures to be retrofitted (with associated cost); and (b) later establishing a funding facility for building retrofits. Based upon initial findings from the RVS, a more in-depth comprehensive structural assessment needs to be carried out. The outcome of this activity will be a prioritized investment plan for structural retrofits, to be financed with either government, development partner and/or multilateral development finance.

9. Establish quality enhancement review and regulatory processes at national and local levels:

To improve the capacity for building and planning departments, design professionals, and construction workers to build safe buildings that can withstand the impact of disasters, the following actions are proposed: (a) carry out a preliminary detailed process mapping and re-engineering of administrative procedures to determine appropriate technology and scope of modernization; (b) carry out a training needs assessment at the national level, and to train building inspectors and building code officials; (c) conduct a comprehensive capacity needs assessment of building professional associations and academia, to deliver needed training programs for engineers, architects, tradesmen and vocational workers; (d) update current Standard Operating Procedures to include performance-based review and inspection of plans and structures; and (e) conduct a comprehensive needs assessment of testing facilities for soils and construction materials.

V. Support key sectoral priorities: To improve inter-sectoral coordination, data collection and management, and technical and financial capacity, an inter-sectoral committee can review current coordination mechanisms and suggest improvements, especially with regard

to developing integrated and resilient urban development and capital improvement plans. A national think tank can potentially support regional capitals and secondary cities to improve overall technical capacity.

10. Support key sectoral investment

priorities: As a part of the integrated and resilient urban development plan, investments in the following key sectoral priorities are proposed for all cities: (i) Solid waste management (SWM): Improve SWM collection services primarily for communities exposed to flooding; ensure appropriate disposal of solid waste by developing appropriate disposal sites; and develop integrated SWM plans for each city, taking into consideration future needs; (ii) Water supply and sanitation: To improve water security, improve the quality of services and capacity of water utilities, making the sector more inclusive, reliable, and robust. Special attention should be given to conserving water sources, avoiding overexploitation, and monitoring and recharging the aquifers; (iii) Transportation: Improve accessibility to at-risk areas of the cities (such as informal markets), schools (often used as shelters) and hospitals; improve public transportation services, reduce congestion, and increase safety measures; and foster the development of integrated land use, transportation, and drainage plans; (iv) Energy: Rehabilitate and expand distribution networks to reduce fire incidents and increase access; improve the use of renewable energy sources while increasing robustness, redundancy, and reliability; and (v) Urban finance: Improve policies for collection and use of municipal revenues, develop a contingency plan and dedicate funds to improve access to finance during emergencies.

V. Looking Ahead

Achieving resilience in Ethiopia's rapidly growing cities will require sustained leadership and capacity enhancement at all levels, along with access to finance, incentives for local leaders, and greater advocacy and awareness. Improved coordination and capacity building at all levels will be critical. To maintain momentum, government staff, local leaders, civil society, and local universities need to be fully engaged in the tasks ahead—and supported with appropriate incentives. National, regional, and local advocacy on behalf of preparedness for shocks and stresses will require incorporating resilience-based lessons into school curriculum and drills, and citizen education through media and other sources. Finally, and most importantly, it will be critical to access finance for investing in urban resilience.

Meeting the challenges of urbanization is a national priority in Ethiopia. The Government is well-positioned to enhance resilience in its capital cities. Leading ministries, regional and local governments have made strong commitments to address the many shocks and stresses that threaten urban development gains and can affect future progress. The findings and recommendations of this report emphasize the need for long-term and sustained investment in strengthening resilience that will help Ethiopia meet these urban challenges. With resilient communities, infrastructure, institutions, and through increased awareness—the anticipated growth of Ethiopia's cities can lead to thriving, competitive, and inclusive urbanization.

Table ES.1 Priority Interventions, and Implementation Responsibility

Timeline	Actions and Investments	Implementation Responsibility
I. Effectively manage rapid urban growth in a risk-sensitive manner, focusing on the most vulnerable		
Short term	1. Develop integrated, coordinated, and risk-sensitive urban master planning, implementation, and monitoring processes	CA, ULGs, MoUDH,
Short to medium term	2. Resolve housing crisis and support the most vulnerable	CA, ULGs, MoUDH, relevant line ministries
II. Better management of flooding and water scarcity		
Short term	3. Plan and implement integrated flood risk management in all regional capitals	CA, ULGs, MoUDH, MoWIE, NDRMC
Short to medium term	4. Resolve water scarcity	CA, ULGs, MoUDH, MoWIE, NDRMC
III. Improve disaster preparedness including fire safety and response		
Short term	5. Establish Disaster Risk Management institutional framework	CA, ULGs, MoUDH, NDRMC
Short to medium term	6. Improve disaster data collection, risk assessment, and information sharing	ULGs, MoUDH, NDRMC, CA
Short to medium term	7. Improve fire and rescue response capacity by providing financial and technical support to fire services	ULGs, MoUDH, NDRMC, CA
IV. Improve building regulatory framework to mitigate seismic risk and enhance overall safety		
Short term	8. Reduce risk in existing environment by assessing key infrastructure to be retrofitted and developing an investment plan	MoC, MoUDH, RB, CA, ULGs
Short to medium term	9. Establish Quality Enhancement Review and regulatory process at national and local levels	MoC, MoUDH, RB, CA, ULGs
IV. Support key sector priorities		
Medium term	10. Support key sectoral priorities as a part of integrated and resilient urban development	CA, ULGs, MoUDH, relevant line ministries

Note on abbreviations: CA: City Administration; MoC: Ministry of Construction; MoUDH: Ministry of Urban Development and Housing; MoWIE: Ministry of Water, Irrigation and Electricity; NDRMC: National Disaster Risk Management Commission; RB: Regional Bureaus; ULGs: Urban Local Governments.

I. INVESTING IN URBAN RESILIENCE: FOR A SAFER AND PROSPEROUS ETHIOPIA

1. The Case for Investing in Urban Resilience in Ethiopia

Ethiopia has undergone a significant economic and social transformation over the past decade. Poverty rates have declined from 55.3 percent in 2000 to 33.5 percent in 2011, and there was significant progress towards achieving the Millennium Development Goals (MDGs).¹⁷ With 30 percent of Ethiopians living in urban areas by 2028, and a tripling of the urban population by 2034, urban population growth has the potential to shift the structure and location of economic activity from rural agriculture to larger and more diversified urban industrial and service sectors. Cities, and especially the capital, Addis Ababa, already play an important role in the economy, contributing 38 percent of gross domestic product (GDP) while employing only 15 percent of the total workforce (World Bank, 2015b).

Ethiopia is at a crossroads in its efforts to urbanize and develop toward middle income status—a national goal under its Growth and Transformation Plan (GTPII). The country faces key challenges of ensuring that urbanization continues to complement growth by strengthening resilience, rather than losing development gains to disasters and other crises. The rapid growth in building stocks will pose increasing challenges to urban authorities and communities in steering construction toward safe areas and ensuring the construction of safer buildings. At this pace, without proper planning and measures to manage the impacts of rapid urban growth, together with the cities' exposure to floods, fire, earthquakes, water scarcity, and other impacts from a changing climate, Ethiopia risks exacerbating existing urban challenges—poverty, water scarcity, and unemployment—and could miss the opportunity to capitalize on the positive impacts of urbanization.

This chapter explores the meaning of urban resilience in the Ethiopian context. After defining the meaning of urban resilience, the chapter provides a brief overview of urbanization challenges in key Ethiopian cities and current policy and frameworks to manage urban development. The second half of the chapter focuses on key questions to ask in order to identify challenges and actions to strengthen resilience in key Ethiopian cities.

1.1. Understanding Urban Resilience

Urban resilience is the capacity of a city and its component parts—individuals, communities, institutions, businesses, and systems—to survive, adapt, and grow despite chronic stresses and acute shocks that may threaten their collective viability. A resilient city is able to adapt to a variety of shocks and stresses and still provide essential services to its residents, especially the poor and vulnerable (World Bank, 2015a).¹⁸ Resilience works toward long-term sustainability objectives—meeting the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Commission, 1987).

¹⁷ WB, 2017 (forthcoming), Draft Country Partnership Framework for the Federal Republic of Ethiopia (FY18-22)

¹⁸ Adapted from 100 Resilient Cities pioneered by the Rockefeller Foundation.

Cities drive national economic growth and innovation and act as cultural and creative centers. Rapid urbanization, however, especially when unplanned, also brings challenges. The concentration of people, assets, and infrastructure in urban areas, along with a lack of proper planning and measures to mitigate impacts of rapid growth, means that an increasingly complex range of shocks and stresses can jeopardize the well-being of large numbers of people and hard-won development gains. In addition to exposure to natural hazards like flooding, landslides, wild fire, water scarcity, and earthquakes, cities are also vulnerable to economic downturns, crime and violence, public health epidemics, and infrastructure failure (Box 1.1). These shocks and stresses can have devastating effects, bringing some or all of an urban system to a halt, and causing loss of life and asset damage. Disaster losses are often linked with, or exacerbated by, poverty and vulnerability of the poor that stem from socio-economic and environmental imbalances (World Bank, 2015a).

In essence, the resilience of a city depends on the overall performance and capacity of its systems, not solely on its ability to cope with specific natural hazards or to adapt targeted areas to the impacts of climate change (Brugmann, 2012). Cities are complex systems, and, like all systems, depend on the smooth functioning of their constituent parts and the larger organization in which they are nested. A city's resilience is therefore affected by the resilience of all of its systems. Disruptions to the basic services they provide can have cascading impacts that extend well beyond the city itself, affecting the vulnerable the most. The complex interdependencies of these systems also makes resilience-building especially challenging. Focusing on one policy goal, such as climate protection, without considering others can lead to undesirable outcomes. These decisions may come as explicit trade-offs, unintended consequences, or some combination of the two.

Building a resilient city, therefore, requires a holistic, multi-sectoral, and flexible approach to urban development (World Bank, 2015a).

Resilience is measured at different levels, from the individual and household, to the community, municipal, regional and national levels. It requires a deep understanding of the risks and vulnerabilities in order to be adequately prepared. For example, at an individual and household level, resilience implies the capacity to manage stresses and be prepared for the impact of shocks, for example by investing in retrofitting the house and planning for emergency situations. At the community level, resilience implies the capacity to work together to manage stress and respond to shocks. At the municipal government level, cities must invest in risk mitigation measures, and enable households, communities, and businesses to do the same, to maintain critical services following a shock. At the regional and national levels, resilience implies the capacity to undertake policy reforms, investments or financial protection strategies to enhance resilience.

1.2. Why Invest in Urban Resilience in Ethiopia?

Ethiopia has one of the fastest growing urban populations in the world. Growing at 5.4 percent a year, the urban population is projected to triple from 15 million in 2012 to 42 million in 2034. In a business-as-usual scenario, such growth may pose huge challenges from increased exposure to disaster and climate change impacts, exacerbating existing urban stresses such as housing shortages, unemployment, and water and waste management. If managed proactively, however, urban growth can help the Government to achieve its vision of becoming a middle-income country by 2025. Significant opportunities exist to foster economic growth by shifting from rural agriculture to the larger and more diversified urban industrial and service sectors. The consequences of not taking timely action may be lost economic opportunity

and the greater human and economic costs of disaster and climate change impacts.

Resilient and integrated urban development is key to sustaining Ethiopia's decade of economic progress and achieving the Government of Ethiopia's (GoE) objective of middle-income status. From one of the least urbanized regions of the world, estimated at only 17 percent in 2012, the urban population share is projected to increase to 30 percent by 2028. Ethiopia's urban areas contribute more than 38 percent of its GDP while generating about 80 percent of GDP growth. Yet, Ethiopian cities are already struggling with access to jobs, infrastructure, services, and housing (World Bank, 2015b). Rapid urbanization will lead to greater concentrations of people, assets, and infrastructure, increasing challenges and exposure to shocks and stresses. An absence of land-use planning, coordination of services, and mobilization of financing for infrastructure pose major constraints to healthy urbanization, and compound Ethiopia's continued exposure to natural hazards. Together, these risks increase cities' vulnerability to shocks, with potentially devastating effects on Ethiopia's economic performance and its poverty alleviation agenda.

Two main benefits justify investing in urban resilience. First, forward-thinking risk management and development planning are key to avoiding long-term costs otherwise associated with retrofitting services to poorly planned and overcrowded urban areas. Making cities safer, more resilient and livable, and more productive requires the right policies, institutions, and investments now, when urbanization levels are fairly low. It is timely for Ethiopian cities to pair risk management with inclusive urban services, robust technologies, and resilient infrastructure development so urban areas are better prepared

to withstand climate- and disaster-related risks. Choices made today about the type, features and location of new and renovated infrastructure can ensure national commitments to resiliency for years to come, reducing future levels of urban vulnerability.

A second reason to invest in urban resilience is to safeguard Ethiopia's hard-won development gains. The Second Growth and Transformation Plan (2014/15–2020) reveals that the share of Ethiopia's urban population living below poverty declined from 35.1 percent in 2006 to 25.7 percent in 2011.¹⁹ But disasters can quickly reverse these gains, affecting not only GDP growth and loss, but exacerbating existing poverty and extending its reach. People living at or near the poverty threshold are already especially vulnerable to shocks (Hallegatte et al., 2017). Many of the urban poor live in highly exposed areas of a city—such as wetlands, floodplains, landfills, garbage dumps, and rocky areas—as these are the only economically viable options available to them (World Bank, 2016). According to the Overseas Development Institute (ODI), by 2030, in Ethiopia, an estimated 20 million extremely poor dwellers (living on less than US\$1.25 per day) are likely to be exposed to multiple hazards, such as drought, flooding, and landslides.²⁰ Disaster impacts are felt directly through the loss of life, livelihoods, and infrastructure, and indirectly through the diversion of funds from development to emergency relief and reconstruction (DfID 2005).²¹ Without systems and services for resilience, disasters can push vulnerable people into—or further into—poverty. Recurrent shocks can undermine past gains and hamper future economic growth, leading to a pernicious “poverty trap” for many of the urban poor (Hallegatte et al. 2016).

¹⁹ Government of Ethiopia, “Second Growth and Transformational Plan (Ethiopian Cities Sustainable Prosperity Initiative)” (2015–2020), Urban Development, Housing and Construction Sector (Draft)

²⁰ ODI, *The Geography of Poverty, Disasters and Climate Extremes in 2030*. Note: The study estimates 20 to 22 million extremely poor people exposed to multiple hazards in Ethiopia.

²¹ World Bank, 2015. *CityStrength Diagnostic Methodological Guidebook*

Beyond a direct impact on incomes, disasters can also lead to long-term setbacks in education, health, and employment opportunities. A study that examined the long-term disaster impacts on children in poor households in Ethiopia, Kenya, Niger, and Zimbabwe found heightened risk of malnourishment, growth stunting, and decreased education in children exposed to drought (Fuentes-Nieva and Seck, 2009). In Ethiopia, the study found that children aged five or under in drought-prone areas are 36 percent more likely to be malnourished and 41 percent more likely to be stunted if they are born during a drought year. This translates into some two million “additional” malnourished children. The consequences of not taking timely action will not only be the loss of social and economic opportunities going forward and of development gains of the past, but also the growing parallel risks of increased impacts from climate variability and natural disasters.

Urbanization Challenges

Ethiopia’s urban center is the capital region of Addis Ababa, with a population of 3.6 million as of 2016 (CSA, 2013b) and housing about 21 percent of the country’s urban population. With 10 times the population of some of the other major regional capital cities, migration and economic activity have polarized in the capital region. To mediate this, the GoE is now focusing on establishing alternative centers to diffuse the benefits of urbanization to different parts of the country. Following Addis Ababa, the nine regional capitals and Dire Dawa City Administration can be categorized into two groups based on their population size and regional location. The first group is comprised of the cities of Adama, Bahir Dar, Dire Dawa, Hawassa and Mekelle, each with a current population between 300,000 and 400,000 people, representing the next tier of cities after Addis Ababa. They are located in the country’s fastest

growing urban regions, including Amhara, Southern Nations, Nationalities, and People’s Region (SNNPR), Tigray, Oromiya, and Dire Dawa, and contribute significantly to the country’s economic growth. The regional capitals in these growing regions are increasingly establishing themselves as industrial and commercial centers. For instance, Adama, Hawassa, and Dire Dawa are the three cities in the country designated as industrial parks as part of a nationwide initiative.²²

At the other end of the population and urbanization spectrum are the cities of Assosa, Gambella, Harar, Jigjiga, and Semera-Logia, which are relatively small, each with a current population between 20,000 and 170,000 people. These cities are, however, experiencing very high rural-urban migration and most are projected to have populations between 100,000 and 400,000 by 2037, except Jigjiga, which will house close to half a million people by then.²³ These relatively smaller regional capitals are found in the emerging regions including Somali, Benishangul, Afar, and Gambella (except Harar, which is in the Harari region). These regions not only have smaller population sizes, but are also relatively underdeveloped and are only recently catching up to the rest of the regions.

Ethiopia’s urban population is concentrated in the regional capitals of Dire Dawa, Adama and Mekelle, followed by Hawassa and Bahir Dar. Urban population growth has been particularly high in Semera-Logia and Jigjiga, with high population growth in Gambella and Assosa between 1984 and 1994. Figures 1.1 and 1.2 show the strong urban population growth that Ethiopia has experienced (CSA 1984, 1994, 2007, 2016). Semera-Logia (12.1%) and Jigjiga (9.1%) had the highest growth rates between 1994 and 2007, while Gambella (14%) and Assosa (10.4%) experienced the highest growth rates between 1984 and 1994. All four cities are in the

²² Note: Information obtained from participants at the CityStrength workshop

²³ Note: Based on the Ethiopian Central Statistical Agency (CSA) and World Bank estimates.

emerging regions and have a relatively small urban population. Their high growth rates could be a reflection of their emergence as regional capitals, but it could also be due to their small base. Aside from these four cities, Hawassa and Mekelle, which are found in the growing regions, also experienced fast growth from 1994–2007 (6.3% and 6.2%, respectively). Migration is a major cause of population growth in the regional capitals. The proportion of migrants in seven cities in 2007 ranged between 52 percent and 72 percent indicating that in the majority of the cities, more than half of the population are migrants (CSA 2007).

By 2037, the major cities (Adama, Bahir Dar, Dire Dawa, Hawassa and Mekelle) will house nearly a

*million people each.*²⁴ The built-up areas of these regional capitals have grown rapidly, such as in Dire Dawa which has witnessed five-fold increase in urban built up area between 1973 and 2016.²⁵ Assosa, Gambella, Harar, Jigjiga and Semera-Logia will comparably house fewer people but are witnessing much higher population growth rate. Urban built up areas in Assosa, Jigjiga and Gambella have noted even more dramatic change with twenty, seventeen and thirteen-fold increase.²⁶ Such a huge increase in population and size must be matched by commensurate services, housing, and jobs. In addition, disaster prevention and mitigation becomes crucial because the impact of any disaster will be greater with the increased urban concentrations of population and economy.

Figure 1.1. Population across Census Periods and Projections for 2016 in Regional Capitals

Source: Source: CSA (1984, 1994, 2007, 2016)

²⁴ Based on the Ethiopian Central Statistical Agency (CSA) and World Bank estimates.

²⁵ Spatial assessment conducted

²⁶ Based on CSA, 2007, GLCF, www.landcover.org/data, libra

Figure 1.2. Population Projections in Regional Capitals ²⁷

Source: Ethiopian Central Statistical Agency and WB estimates)

Growing Impacts from Disasters

All major Ethiopian cities face increasing flooding and fire events, and some have faced earthquakes. In April 2016, a rainstorm caused serious infrastructure damage in Dire Dawa;²⁸ the city already faced floods in 1984 killing 42 people and in 2006 killing 256; in Jigjiga in 2016 28 people were killed and 84 were injured due to floods.²⁹ In Addis Ababa, in 2012 a fire in five-story building in Efoyta Market caused damages amounting to ETB 20 million (US\$1 million). Dessie town is another example where landslides still remain major challenges for the development. Examples of other Ethiopian cities which remain prone to recurrent disasters are: Adigrat, Awassa, Adama, and Bahir Dar. Most recently, an event on March 11, 2017 further confirmed the need to pay attention to disaster events. Repi, Addis Ababa's only dumpsite,

experienced the collapse of a hillside of waste which buried a number of houses. There were 113 casualties and people remain missing.³⁰ This type of event isn't experienced exclusively in Ethiopia. The city of Payatas in the Philippines also experienced the collapse of rubbish at a dumpsite in 2000. Waste buried hundreds of people who perished. The dumpsite was due to be shut down.³¹

Urban Resilience is a Critical National Priority

The Government of Ethiopia is aware and engaged in the challenges of strengthening the urban resilience agenda. Ethiopia's urban development vision is "Creating resilient and livable cities." The Government's Growth and Transformation Plan (GTP) (2014/15–2020) emphasizes the fundamental importance of

²⁷ The population data for each city is based on census results (1984, 1994, 2007), the Central Statistical Agency (CSA) projections (2014–2017), and the projection based on overall urbanization growth rates estimated by the World Bank (2017–2037) (see Annex 1).

²⁸ <http://reliefweb.int/report/ethiopia/ethiopia-dire-dawa-floods-ocha-situation-report-no-1>

²⁹ https://www.diretube.com/articles/the-jigjiga-flood-killed-28-peoples-in-ethiopia_12110.html

³⁰ <http://www.aljazeera.com/news/2017/03/addis-ababa-death-toll-hits-113-rubbish-landslide-170315165759540.html>

³¹ <http://news.bbc.co.uk/2/hi/asia-pacific/830809.stm>

building green, resilient, and well-governed cities to achieve its vision of middle-income country status by 2025. To support implementation of the GTP goals, the Ministry of Urban Development and Housing has prepared the Ethiopian Cities Prosperity Initiative (2014), with Inclusive and Safer Cities Development as a key strategic pillar.

Complementing Ethiopia's urban development policies, the Government of Ethiopia has developed policies to systematically manage its disaster risks, thereby also enhancing urban resilience. In particular, the Government developed the National Policy and Strategy on Disaster Risk Management (NPDRM) in 2013, and has developed the Disaster Risk Management Strategic Programme and Investment Framework (DRM-SPIF). Key goals of the NPDRM include the enhancement of Ethiopia's capacity to withstand the impact of natural hazards at the national, local, community and household level, and to significantly reduce the damages associated with disasters by 2023. The NPDRM recognizes the need to strengthen urban resilience, in light of the growing risks of fire and other hazards associated with rapid urbanization.

The DRM-SPIF is a tool to facilitate the National Policy and Strategy on DRM by addressing existing gaps and limitations in Ethiopia's DRM capacity and establishing an integrated DRM system. The DRM-SPIF explicitly recognizes the importance of urban risks and the necessity

to ensure that land use plans and building codes are risk-sensitive. It is also envisaged to contribute to the goals set out under Ethiopia's GTP II.

Ethiopia's Climate Change National Adaptation Programme of Action (NAPA) further contributes to the enhancement of urban resilience. In particular, Ethiopia's NAPA includes as part of its prioritized projects the objectives of: (i) strengthening drought and flood early warning systems in Ethiopia; (ii) establishing a capacity building program for climate change adaptation in Ethiopia; and (iii) establishing a national research and development (R&D) center on climate change. These activities strengthen urban resilience by creating the foundations for early response capabilities to shocks.

The Government of Ethiopia (GoE) should be commended for its proactive efforts for managing rapidly emerging risks in the built environment. A new Ministry of Construction was established in 2015 and a National Proclamation was passed in 2009³² promoting the development of sound building control practices as well as robust measures to curb rent-seeking practices in regulatory activities.³³ A National Building Code (NBC), currently under development, should soon be completed. This will conclude a five-year intensive effort. Construction bylaws have been prepared and implementation manuals for construction have been developed.

³² Ethiopian Building Proclamation No.624/2009

³³ Idem: Measures to curb corruption are spelled out in Part 6 of the Proclamation on "culpable infringements of building rules"

BOX 1.2.

Key Policies on Urban Development

At the policy level, the Government of Ethiopia has made significant advances towards managing the country's rapid urbanization and strengthening urban resilience. Policies that enhance resilience in urban areas include policies on urban development, disaster risk management and climate change, as outlined below.

Three key policy initiatives on urban development have been adopted: (i) the Urban Development Policy; (ii) the National Urban Development Spatial Plan (NUDSP); and (iii) the Ethiopian Cities Sustainable Prosperity Goals (ECSPGs). The NUDSP and ECSPGs aim to contribute to Ethiopia's progress towards the goals set out in its Second and Third Growth and Transformation Plans.

The Urban Development Policy was developed in 2005 and revised and approved by the Council of Ministers in 2013. Key goals of the policy are to: (i) enable cities to become the center of development, impacting development both at rural and national levels; and (ii) enable urban dwellers to exercise authority and benefit from development so they can enjoy the standard of living experienced in middle income countries. Seven principles govern the policy:

1. Enabling cities to establish a sustainable mutual complementarity with rural centers;
2. Expanding the opportunity for growth to all urban centers;
3. Enabling urban centers at all levels to grow in a mutually complementary way;
4. Making poverty reduction and eradication the central objective of urban development;
5. Encouraging the public to participate in development activities;
6. Establishing strong partnerships with development partners; and
7. Granting urban centers authority and freedom of self-administration through decentralization.

The NUDSP's aim is to provide the MUDHo with a vision of Ethiopia's urban sector in 2035. The NUDSP has been approved by the Ministry of Urban Development and Housing (MUDHo) and is currently under implementation. It considers resilience to flooding, earthquakes, landslides and erosion as among the criteria by which urban scenarios were evaluated. The NUDSP provides for balanced and equitable growth, reducing the primacy of Addis Ababa, with the vision that many large cities will be at the apex of an urban cluster which will consist of a group of variously sized cities and towns that are functionally interlinked. The NUDSP also highlights the importance of linkages between investment in urban infrastructure and economic growth in major towns. The NUDSP is one of the major strategy documents and plans that provided input to the development of the ECSPGs and GTP II.

The ECSPGs look to foster green growth, resilient and well-governed cities that support Ethiopia's progress towards the goal of becoming a middle-income country by 2025. The ECSPGs' ten strategic pillars will contribute to Ethiopia's achievement of middle income country status by contributing to a transformation in the economic productivity and good governance of cities. Economic transformation will be achieved by increased good urban governance and through job creation, with a particular focus on micro- and small-enterprise development.

1.3. Achieving Resilient Urban Development in Ethiopia

While the Government of Ethiopia has identified resilient development as a key priority, development and implementation of an action plan to strengthen urban resilience still remains a challenge, as key information on current and future shocks and stresses in cities, as well as local capacity to manage resilience challenges has not been systematically studied. In particular, the following key questions remain:

- What key shocks and stresses affect Ethiopian cities?
- What hazards are cities exposed to now and in the future, and are cities prepared?
- What is the local capacity to deal with shocks and stresses, and be resilient?
- What critical actions are needed to make Ethiopian cities more resilient?

To answer these questions, a Technical Assistance (TA) program was carried out between 2015 and 2017 to assist the Government of Ethiopia to strengthen urban resilience. The CityStrength diagnostic methodology, piloted

by the World Bank in Addis Ababa in 2015, was used for this assessment. Bolstering this effort, three additional parallel assessments were conducted: (i) *Hazard mapping*: The hazard assessment built on Ethiopia's ongoing national level risk assessment, focusing on national level exposure and risk modeling for seismic, volcanic, flooding, drought, and landslide risk; (ii) *A review of the national legal framework on building regulations for resilient buildings*: The Bank team worked closely with the new Ministry of Construction to identify recommendations for improving national policies on the construction of safe buildings and infrastructure; and (iii) *A review of emergency response and management requirements for urban areas*: One outcome of the review was guidelines to develop cities' capacity for emergency preparedness and response.

Based on discussion and agreement with the Ministry of Urban Development and Housing and the Ministry of Finance, this TA focused on 10 priority cities including the Dire Diwa City Administration and nine regional capitals: Jijiga, Gambella, Semera/Logia, Assossa, Mekelle, Adma, Hawassa, Bahir Dar, and Harari (see Figure 1.3).

Figure 1.3. CityStrength Diagnostic Participating Regional Capital Cities

Source: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

A key part of the assessment was based on the CityStrength Diagnostic methodology, which is a rapid diagnostic engagement process to facilitate dialogue among stakeholders (government, civil society, residents, and the private sector) about risk, resilience, and the performance of urban systems. The tool is used to identify *shocks*, (e.g., fire or flooding) and *stresses* (e.g., housing shortages, high unemployment, lack of public services) that expose urban residents and urban systems to higher vulnerability including to natural hazards and economic and socio-economic impacts. The diagnostic first evaluates resilience on a sectoral basis against five qualities of resilience: robustness, redundancy, reflection, coordination, and inclusiveness (Box 3.1). It then brings the findings together for a holistic view of challenges and needs. The methodology facilitates stakeholders' identification of priority actions and investments to enhance cities' resilience and increase the resilience-building potential of planned or prospective projects (World Bank, 2015a). The technical

assistance builds upon the implementation of CityStrength in Addis Ababa in 2015, which was expanded here to include the ten cities. Three additional analyses were conducted to add rigor to the Diagnostic which included hazard mapping based on an ongoing national level risk assessment, and analysis of building regulations and emergency response management capacity in urban areas. Based on the Government's Ethiopian Cities Prosperity Initiative (ECPI 2014) strategy for urban development, 10 sectors were requested by the government to be included in the exercise: (1) Urban Planning and Housing; (2) Urban Finance; (3) Disaster Risk Management and Climate Change; (4) Environmental Management; (5) Transport and Roads; (6) Water Supply and Sanitation; (7) Solid Waste Management; (8) Energy; (9) Local Economic Development; and (10) Community Development and Social Protection. The tailored stages of the CityStrength Diagnostic that were followed in Ethiopia are presented in Table 1.1. The standard five stages of CityStrength can be found in Figure 1.4.

Photo: Stephan Bachenheler © World Bank

Table 1.1. Five Stages of the CityStrength Diagnostic Methodology in Ethiopia

Diagnostic Stage	Actions
Pre-Diagnostic Review (November 2015 – June 2016)	Consisted of collecting primary and secondary data, reports, and plans; and summarizing key findings on hazard risk, emergency management capacity, building regulations, and main vulnerabilities. A questionnaire and data sheet were sent to each of the participating cities requesting key baseline data such as percentage of solid waste collected in the city and number of people with access to safe water. The different inputs were collected to prepare a prediagnostic report to brief sectoral specialists and city stakeholders participating in the CityStrength Diagnostic.
Inception Workshop (November 2015)	Introduced the concept of urban resilience and CityStrength Diagnostic methodology to stakeholders from the regional capitals and Dire Dawa, which included mayors and technical focal points. There was a discussion on initial findings based on ongoing activities in the country, followed by a preliminary identification of city and sectoral-level shocks and stresses that served as an input to the selection of sectoral modules included in the overall exercise. Focal points from all key ministries and cities were nominated.
City Consultations (April 2016)	Three regional workshops were organized to conduct group discussions, interviews and site visits with stakeholders at national, regional, and city level and academic institutions, to confirm and elaborate on the preliminary findings from previous stages, identify challenges and opportunities for urban resilience, assess performance of urban systems, and exchange information and best practices. Concrete outcomes from the consultations included hotspot mapping of main vulnerabilities in the cities, a confirmed list of shocks and stresses at city and sectoral level, and an initial list of priority actions for enhanced resilience at city and sectoral level. The consultations were facilitated by World Bank technical specialists.
Prioritization Session and National Consultation Workshop (April - July 2016)	A meeting was carried out immediately after the consultations in April 2016 between the World Bank and key stakeholders. There was a discussion about the outcomes of the process followed by confirmation of priorities moving forward, taking into account major threats and alignment with local goals and objectives. The meeting included representatives from the Ministry of Urban Development and Housing; Ministry of Construction; Ministry of Finance and Economic Development; Ministry of Water, Irrigation, and Electricity; the recently established National DRM Commission, and World Bank specialists. A draft summary publication was prepared in the following months which was presented at a national consultation workshop in July 2016 with technical focal points and government officials from the participating cities and relevant line ministries. The purpose of the gathering was to brief stakeholders on the compilation of input from all previous stages, and offer one last round of comments.
National Dissemination Workshop (June 2017)	The finalized summary publication was launched at a dissemination workshop in the presence of national, regional and local leadership, as well as other stakeholders including civil society, academic institutions, and development partners. The launch was followed by a facilitated discussion on next steps to implement the findings.

Note: The process in Ethiopia is adapted from the City Strength Diagnostic Methodology.

Figure 1.4. CityStrength Diagnostic Process

Source: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

1.4. Report Structure and Next Chapters

This report captures the outcomes of the TA on Strengthening Urban Resilience in Ethiopia, including CityStrength Diagnostic carried out in the Dire Dawa City Administration and nine regional capitals of Ethiopia.

Chapter II provides an overview of shocks and stresses in the cities, the growing hazard exposure, the impacts of climate change, and preparedness in terms of emergency response and safe building construction. It also addresses the question of what hazards cities are exposed to (now and in future), and whether they are adequately prepared.

Chapter III focuses on the resilience of urban systems based on assessments in 10 sectors

across the 10 cities. It answers the question whether local capacity exists to deal with shocks and stresses, and if urban systems are resilient. Each sectoral assessment is done against the five qualities of resilience to understand capacity constraints and resilience priorities. This exercise was conducted jointly by the participants in the consultations and the World Bank sectoral specialists.

After determining vulnerabilities at the sectoral level, Chapter IV provides a summary of the priorities at the city level that were determined during the consultation workshops. It provides details of critical actions needed to make Ethiopian cities more resilient. Designed to be accessible to a broad audience, this report presents the most relevant and actionable information that emerged from the diagnostic exercise.

II. RESILIENCE CHALLENGES IN ETHIOPIAN CITIES : SHOCKS, STRESSES AND HAZARD PREPAREDNESS

2. Resilience Challenges in Ethiopian Cities

This chapter provides an overview of shocks and stresses reported by the 10 participating cities in the CityStrength Diagnostic consultation workshops, with a focus on responses to two questions: (i) What key shocks and stresses affect Ethiopian cities? and (ii) What hazards are cities exposed to and are the regional capitals prepared?

To understand future hazards facing Ethiopia's growing cities, an assessment of hazard exposure was undertaken based on globally available data. Two additional assessments were carried out to understand the cities' current capacity to incorporate safeguards against hazard exposure in buildings and infrastructure, and emergency response capacity in case of a disaster. The first of these looked into the broader strategic perspective of improving building safety in Ethiopia. It addressed specific regulatory issues in building standards and building control mechanisms that may typically be addressed in the short- and medium-term through a coordinated reform effort. The review also considered larger institutional perspectives that are key to fostering a culture of regulatory compliance in the longer term. The second assessment looked at cities' emergency response and preparedness capacity in the event of disaster. Assessments in four cities focused on fire response capacity, flood preparedness and response capacity, and earthquake alert, preparedness, and response capacity.

2.1. Primary Shocks and Stresses in Regional Capitals

Shocks are sudden events that impact the performance of a system. There are shocks of different types and scale, including disease outbreaks, flooding, high winds, landslides, drought, or earthquakes. Outbreaks of fighting or violence, or severe economic volatility, could be included in this category as well (World Bank, 2015a).

Stresses are longer-term trends that undermine the performance of a given system and increase the vulnerability of participants within it. These can include natural resource degradation, loss of agricultural production, demographic changes (e.g., aging and depopulation), climate change, political instability, or economic decline (DFID 2011). A significant stress facing many cities in developing countries is urbanization itself, due to the pressures places on urban systems and the delivery of basic services. Stresses can be cumulative, compounding gradually until a tipping point is reached and transformed into a shock (World Bank, 2015a).

Of the 10 cities participating in the CityStrength diagnostic assessment, all nine capital cities and the Dire Dawa City Administration are facing increased exposure to flooding and fire. Many cities are exposed to earthquakes but lack preparation for a seismic event. Moreover, landslides were also identified as a major shock (see Table 2.1). The regional capitals also face a number of diverse urban stresses. All are challenged by housing shortages and water scarcity, while most struggle with unemployment, traffic accidents, and growth of informal settlements. Further, capital city populations and their sprawling built-up areas are each projected to triple by 2037 (World Bank,

2015b). As cities grow larger, more populated, and the center of more infrastructure and assets, they become increasingly vulnerable to the impacts of shocks and stresses associated with rapid urbanization. They need urgent support and investment to manage these existing severe shocks and stresses, which are likely to grow with increased exposure to the impacts of climate change.

Tables 2.1 and 2.2 identify the shocks and stresses (respectively) faced by capital cities. Those that are prevalent in most cities have been highlighted in red as a priority for assessing and finding solutions. See Annex 3 for city profiles, with details on shocks and stresses by city.

Table 2.1 Shocks Faced by Cities

Cities	Adama	Bahir Dar	Mekelle	Hawassa	Dire Dawa	Harar	Jigjiga	Assosa	Gambella	Semera-Logia
Flooding										
Fire										
Earthquake										
Landslide										
High Wind										
Drought										
Disease Outbreak										
Rains/ Storms										

Source: National, regional and local stakeholders participating in the CityStrength consultations

Table 2.2. Stresses Faced by Cities

Cities	Adama	Bahir Dar	Mekelle	Hawassa	Dire Dawa	Harar	Jigjiga	Assosa	Gambella	Semera-Logia
Housing Shortage										
Water Scarcity										
Traffic Accidents										
Unemployment										
Growth of Informal Settlements										
Energy										
Poor Sanitation										
Pollution										
Migration/ Urban Growth										
Inadequate Drainage										
Inadequate SWM										
Lack of Technical Capacity										

Source: National, regional and local stakeholders participating in the CityStrength consultations

Other stresses identified by some cities, though not as prevalent as those in the table, include traffic congestion, poor infrastructure, poor water quality, increased temperature and diseases, and a growing number of homeless children.

2.2. Growing Hazard Exposure

Based on a global data-based hazard mapping assessment (Box 2.1), Ethiopian cities are exposed to a number of natural hazards, including flooding, earthquakes, volcanic activity, landslides, and water scarcity (Table 2.3). The modeling shows that a large majority of regional capitals are exposed to flooding

in or near the city, and fall within the regions exposed to severe agricultural drought. Four of the five larger regional capitals—Adama, Dire Dawa, Hawassa, and Mekelle—are exposed to agricultural drought, flooding, earthquake risk, landslides (especially in Mekelle), and volcanic activity (except in Dire Dawa and Mekelle). Bahir Dar is exposed to severe drought and flooding, as well as landslides. Semera-Logia, one of the relatively smaller regional capitals, is at the highest exposure to earthquakes, and Jijjiga faces high river flooding, and exposure to agricultural drought, earthquakes and landslides. Assosa, Harar, and Gambella are exposed to flooding and drought.

BOX 2.1.

Hazard Mapping for Ethiopian Cities

The hazard mapping described in this report was conducted using hazard data from the Global Facility for Disaster Reduction and Recovery (GFDRR) Innovation Labs' National Multi-Hazard Risk Profiles, developed as part of the ACP-EU program, "Building Disaster Resilience in Sub-Saharan Africa. The mapping illustrates the distribution of hazards in the context of cities, population, GDP, and selected infrastructure networks. At the city level, the data are indicative of hazard; they are not for planning purposes at the city level, and are not a substitute for detailed local hazard mapping. In the maps, city locations are provided for regional administrative capitals and cities with populations exceeding 50,000 people. Data comes from the global Geonames database¹, and refers to population from the 2007 census. Road network data were obtained from OpenStreetMap. Only major roads are shown on city group maps. In all maps, GDP is presented in US\$ million, in terms of Purchasing Power Parity, at a resolution of one square kilometer. Sub-national and sector GDP contributions were obtained from various sources, such as national statistics offices.

A description of each hazard component is given below.

- Seismic hazard: This comprises round shaking only; ground deformation and liquefaction are not included.
- River flood hazard: This comprises riverine (fluvial) flood only; urban surface water flooding is not included.
- Volcanic hazard: Due to data limitation volcanic hazard has been represented using three volcanoes and two volcanic fields in central Ethiopia. It is not an exhaustive assessment of volcanic hazard in Ethiopia.
- Landslide hazard: Seismic activity and rainfall are considered as separate landslide triggers, resulting in mapping of both
- Agricultural drought hazard: Neither hydrological nor meteorological drought, nor water scarcity have been mapped as part of this project.

Table 2.3. Qualitative Simulated Hazard Levels in Regional Capitals

City	River Flooding (100-Year Period)	Agricultural Drought (50-Year Period)	Earthquake (100-Year Period)	Landslide	Volcanic Event
Addis Ababa	Flooding in city	Severe	Moderate	Low-moderate	Flow
Adama	Flooding near city	Severe	Moderate	Low-moderate	Flow
Hawassa	Flooding in city	Severe	Moderate	Low-moderate	Ash and flow
Dire Dawa	Flooding near city	Severe	Moderate	Low-moderate	Not modeled*
Jigjiga	Flooding in city	Severe	Moderate	Low-moderate	Not modeled
Harari	Flooding near city	Severe	Low	Low-moderate	Not modeled
Bahir Dar	Flooding in city	Severe	Low	Moderate	Not modeled
Assosa	No flooding near city	Severe-extreme	Low	Low-moderate	Not modeled
Gambella	Flooding near city	Severe	Low	Low	Not modeled
Mekelle	Flooding near city	Severe-extreme	Moderate	Moderate-high	Not modeled
Semera-Logia	Flooding in city	Severe-extreme	High	Low	Not modeled

Source: Draft report on Hazard modeling for Ethiopian Cities, 2016. (World Bank 2016b)

*Some cities not modeled for lack of data.

River Flooding Hazard

River flooding is a hazard that affects locations close to rivers, including many cities, in all regions of Ethiopia (Figures 2.1 and 2.2). Flood hazard is still not well understood in Ethiopia due to a limited number of hydrology and stream gauging stations. The available modeling indicate the potential for flooding in large cities such as Semera-Logia, Hawassa, and Bahir-Dar. The hazard map (Figure 2.1) indicates that in exposed cities, river flooding up to 0.9 meters in depth would be expected to occur, on average, once every 100 years. River flooding also poses real hazards in nearby rural areas, affecting

rural populations and livelihoods. While the modeling does not show flooding hazard in Dire Dawa and Jigjiga due to limited data, both these cities are highly exposed to flooding. Figure 2.2 provides details of flood hazard exposure in central Ethiopia, around the Addis, Adama and Hawassa corridor, showing GDP exposed to flooding hazard. The available hazard mapping do not cover urban flooding because surface water or drainage challenges prevalent in cities are hard to capture through global data. Higher-resolution, local-scale, flood modeling that includes pluvial flooding should be carried out to gain a fuller picture of urban flood hazard.

Figure 2.1. River Flooding Hazard in Ethiopia as River Flooding Depth

Source: CIMA Foundation and Deltares 2016.

Note: The levels of flooding shown would be expected to be exceeded, on average, once in approximately 100 years. The maps do not include data for urban surface water flooding. The flooding hazard was estimated using global rainfall data and a global river model at a resolution of 1 km².

Figure 2.2. River Flooding Hazard in Central Ethiopia as River Flood Depth

Source: Hazard Mapping carried out by CIMA Foundation and Deltares 2016.

Note: The levels of flooding shown would be expected to be exceeded, on average, once in approximately 100 years. The maps do not include data for urban surface water flooding. The flooding hazard was estimated using global rainfall data and a global river model at a resolution 1 km². GDP is presented in US\$ million, in terms of Purchasing Power Parity, at a resolution of 1km². GDP indicates concentrations of socioeconomic activity (i.e., exposure to the hazard.)

Seismic Hazard

Ethiopia is bisected by the East African Rift, creating significant potential for earthquakes and volcanic eruptions. Seismic hazard is still not well understood in Ethiopia, since there is not systematic documentation of historic earthquakes. Despite facing moderate seismicity,

Ethiopia's urban regions have above normal risk due to weak infrastructure, poor quality of building construction as well as lack of preparedness. The capital Addis Ababa is located close to the western edge of the Ethiopian Rift Valley and is growing very rapidly (3.8 percent per year).

Figure 2.3. Seismic Hazard (Peak Ground Acceleration) in Ethiopia

Source: RED and ERN 2016.

Note: The levels of ground shaking shown would be expected to be exceeded, on average, once in approximately 100 years. This hazard map is similar to that in development for the Ethiopian Building Code (EBCS).

Figure 2.3 shows the area of the greatest seismic hazard in Ethiopia corresponding to the location of the East African Rift fault zone, which runs from the south of Ethiopia into the Red Sea and Gulf of Aden to the north, with a fault junction in the Afar region in northern Ethiopia. Several of the largest Ethiopian cities lie in this zone and are exposed to seismic hazard: Addis Ababa, Hawassa, and Adama (Figure 2.4). Semera-Logia

is located in the region of the fault junction and is therefore the city most exposed to earthquake hazard. Several other smaller cities with population of more than 50,000 are located in areas that would be expected to experience structurally damaging ground movement, on average, at least once in a 100-year period. The west and east of the country have low seismic hazard.

Figure 2.4. Seismic Hazard (Peak Ground Acceleration) in Central Ethiopia

Landslide Hazard

Most large cities and regional capitals in Ethiopia are close to areas with moderate to high landslide hazard, whether from rainfall or a seismic trigger (Figures 2.5 and 2.6). The greatest distribution of high landslide hazard occurs in the Amhara, Tigray, and SNNPR regions, although the regional capitals of Amhara (Bahir-Dar) and Tigray (Mekelle) are located in areas of relatively low to moderate hazard. Several

cities and highways in these regions have high landslide risk and the associated risks of interruption to road networks; these include the cities of Dese and Kembolcha in eastern Amhara, and the entire Addis Ababa–Mekelle highway. Landslide hazard is least prevalent in the region of the East African Rift seismic fault and fault junction in the north, hence there is generally low landslide hazard around Semera-Logia and in the east of the country.

Figure 2.5. Earthquake-Triggered Landslide Hazard in Ethiopia

Source: Arup 2016.

Note: Hazard level reflects the susceptibility of terrain to landslides in each mapped km² cell and the likelihood of landslides being triggered by earthquakes. Very high hazard equates to a landslide occurring once every five to 20 years, on average.

Figure 2.6. Rainfall-Triggered Landslide Hazard in Ethiopia

Source: Arup 2016.

Note: Hazard level reflects the susceptibility of terrain to landslides in each km² cell and the likelihood of landslides being triggered by rainfall. Very high hazard equates to a landslide occurring, on average between once every five years and once every 20 years.

Volcanic Hazard

Volcanic hazard analysis has been carried out only for selected volcanoes and volcanic fields because there is an absence of eruptive history data for many volcanoes in Ethiopia. At the volcanoes for which some data are available,

the relationship between hazard intensity and frequency has been informed by observations at other similar volcanoes in the region. The present analysis does not represent a complete view of volcanic hazard in Ethiopia, but instead shows the potential exposure to volcanic hazards in the country.

Figure 2.7. Volcanic Hazard in Central Ethiopia

Source: Global Volcano Model, British Geological Survey, and University of Bristol. 2016.

Note: Figure shows depth of ash (mm) around Corbetti, Aluto, and Fentale volcanoes, with 0.01 percent annual probability of exceedance. The levels of ash shown would be expected to be exceeded, on average, once in approximately 1,000 years. Volcanic flow hazard (Pyroclastic Density Currents and Lahar) is shown as a topographically derived potential hazard zone, in which flow hazards might occur in the modeled scenarios.

In this limited area analysis, Hawassa, Adama, Addis Ababa, and the smaller cities of Asela and Shashemene are in the proximity of volcanic ash and/or flow hazards (Figure 2.7). Hawassa is the only city falling within a delineated volcanic hazard zone, but there is substantial uncertainty in volcanic hazard modeling of volcanoes with little eruptive history, and any of the cities shown could be at risk in certain eruptions and/

or wind conditions. Ethiopia has many other volcanoes that have been known to be active in the past, and their locations are similar to that of the highest seismic hazard in the country (Figure 2.8). Although the available data on most of these volcanoes are currently limited, work is underway by international and Ethiopian research groups to investigate the hazard posed by these volcanoes.

Figure 2.8. Holocene Volcanoes of Ethiopia and Surrounding Areas

Source: Global Volcano Model, British Geological Survey, and University of Bristol, 2016

Drought Hazard

Any area of Ethiopia can expect, on average, to experience severe agricultural drought at least once in a 50-year period (Figure 2.9). In some areas, a 50-year agricultural drought could be more extreme, particularly in the northwest around the city of Gondar and in the southwest around the city of Gondar and in the southwest

close to the city of Arba Minch. Further analysis incorporating water usage would be required to communicate water scarcity in and around large cities. Apart from water scarcity and food insecurity, drought affects urban and rural migration, and thus drought is an important hazard to monitor around cities as well.

Figure 2.9. Agricultural Drought Hazard in Ethiopia
(2 percent annual probability of exceedance)

Source: CIMA Foundation and Deltares 2016.

Note: The level of drought shown would be expected to be exceeded, on average, once in approximately 50 years. The maps do not include data for meteorological and hydrological drought or water scarcity. White color in the map indicates that data was not available for that area.

2.3. Unsafe Built Environment

With rapid growth comes a significant amount of new construction, much of which will occur in cities with limited capacity to ensure that the structures in which people live, work and gather are built to withstand the chronic stresses (i.e. fire, spontaneous collapse and unhealthful conditions) and disaster shocks (i.e. earthquakes, floods). In many ways, Ethiopia is at a crossroads in its efforts to urbanize and develop towards middle income status. Regulatory decisions made now can have significant impact on the long-term safety, productivity and resilience of the urban built environment.

Recent Regulatory Reforms Impacting Building Safety

The recently established Ministry of Construction (MoC) is the primary regulator of both private and public sector building construction. Established in October 2015 as a standalone federal agency, the Ministry of Construction separated from what was the Ministry of Urban Development, Housing and Construction (herein referred to by its revised name, “Ministry of Urban Development and Housing”). The new ministry was established to consolidate in one entity the previously piecemeal oversight of the construction sector by multiple ministries. This consolidation also enables more dedicated attention to the construction sector, as land management drew significant attention when both portfolios were managed under a single ministry. This focused oversight on building safety is especially needed in light of Ethiopia’s recent surge in construction. The Ministry of Construction draws its responsibilities from what was the Construction Industry Development and Regulatory Bureau, with an objective of “improving the status of the construction industry and making it competitive as well as instrumental in the rapid social and

economic progress of the country and thus expanding its role.”³⁴

Proclamation No. 916/15 assigns a wide range of operational responsibilities to the Ministry of Construction. The MoC prepares and gets approval on short- and long-term programs and projects based upon the policies, proclamations, and regulations prepared by the Ministry and approved by the federal government. Importantly, the MoC is responsible for defining and overseeing implementation of Ethiopia’s building codes and standards, as well as building capacity among public and private sector building professionals. To this end, the Ministry (a) accredits contractors and construction consultants (e.g. engineers, architects), (b) registers construction professionals and firms, (c) grants permits for importing construction equipment, and (d) provides construction sector-related information services, among other responsibilities. Direct oversight of these work streams is delegated to regional construction bureaus, with on-the-ground implementation largely carried out by city-level construction administrations that are directly responsible for plan review, permitting and inspection. To carry out this mandate, the Ministry of Construction is currently undergoing a significant hiring process (roughly 450 individuals) at the federal level.

Currently, two key pieces of legislations regulate the construction sector:

- **Ethiopian Building Proclamation No. 624/2009** was the first building reform introduced since 1987 and determines minimum national standards for the construction or modification of buildings. To this end, the proclamation provides guidance on: (a) administration and implementation of the national building code (i.e. application, planning consent,

³⁴ Ministry of Urban Development and Housing website: http://www.mwud.gov.et/web/guest/construction-industry-development-and-regulatory-bureau?p_p_id=56_INSTANCE_1bZ6&p_p_lifecycle=1&p_p_state=normal

plan review and approval, and permitting processes); (b) provisions for specific land use, design and construction considerations to ensure life and structural safety; (c) guidelines on water supply and sanitation; (d) guidelines on fire safety; and (e) punishment for infringement of building regulations among public and private sector building professionals.

- **Council of Ministers Regulation No. 243/2011** defines the procedures as well as the roles and responsibilities of different entities in implementing the national building standards. The regulation lays out the procedures for: (a) submission of application and plans; (b) planning consent; (c) plan review and approval; (d) construction permitting; (e) inspection procedures; (f) quality assurance of building materials; (f) occupancy permitting; (h) classification and role of construction professionals; (i) governance of appellate boards; (j) service fees for all stages of the regulatory process; and (k) general performance-based standards for water supply and sanitation as well as for fire safety.

Challenges

This section incorporates a review of prevalent risks in the built environment. Based on the review of the national legal framework on building regulations for resilient buildings, four critical sets of challenges currently hamper the development of an effective regulatory process and a culture of compliance.

- I. ***The need to enhance human and technical capacity.*** Regional and municipal building agencies, as well as sub-cities in Addis Ababa, are significantly understaffed and under-resourced. They are increasingly overwhelmed by the influx of building permit applications and the growing complexity of building projects as city centers witness a significant development of high-rise buildings. These new buildings are typically in the range of 10-20 story building structures and are particularly vulnerable to fire risks. With this transformation of pace and complexity in the urban construction sector, there is growing need for construction professionals who are trained, experienced and accredited in order to ensure the safety of the workers and the buildings and infrastructure that they construct (Box 2.2).

BOX 2.2.

Need for Accredited Training and Worker Safety

A common challenge highlighted in stakeholder interviews and focus group discussions was the lack of systematic qualitative capacity assessment of building professionals in the certification process. While significant progress has been made, in that the general public seeks the expertise of certified professionals, there is currently no exam to assess degree of knowledge of professional engineers and architects.

Evaluation are simply based on education and number of years of experience. A balanced mechanism of training and accreditation is needed, which is not limited to academic institutions, but also include private sector specialized organizations or NGOs. The private sector should be engaged in developing a robust on-the-job training system that does not lead to a disproportionately high barrier to entry for practitioners.

Another key challenge relates to worker safety. As a significant and growing proportion of the Ethiopian workforce is and will be working in the construction industry, the issue of worker safety is all the more important. Challenges posed by work-related injuries include lost productivity stemming from illnesses, disabilities and fatalities. Currently, there is limited research on occupational hazard in Ethiopia; but in a 2009 study carried out in Gondar City, the prevalence rate of construction work-related injuries in one year was 38.7 percent—largely attributed to falling, overexertion and/or being struck by falling objects. Youth aged 14-29 years of age represented the overwhelming majority of injuries (75 percent), while women represented nearly 40 percent. A similar study carried out in Addis Ababa in 2016 also found the prevalence rate of construction work-related injuries to be 38.3 percent—with most common injuries being cuts from sharp objects and falling. Women accounted for 37 percent of injuries. The lack of personal protective equipment (e.g. hardhats) and lack of safety training were largely attributed to such injuries.

Source: Assessment carried out under Building Regulatory Review.

II. Concerns with the adoption of new building standards. Ethiopia has embarked on a commendable effort to adopt Eurocode structural design standards. These building standards must be appropriately adapted to the Ethiopian hazard and socio-economic context to ensure that they are disseminated and understood by building professionals. An effective training and outreach strategy to craftsmen and tradesmen will be critical to determine the success of the current transition toward new building

standards and limit the spread of building informality.

III. Limited effectiveness of quality assurance mechanisms. The core functions of land use, building permitting, inspections and testing of building products and materials have received insufficient resources and prioritization in development and reform efforts in the past (Box 2.3). They must be improved in the short term to prevent a rapid accumulation of risks in the built environment.

BOX 2.3.

Key Challenges Related to Quality Assurance Mechanisms

Lack of quality checks in inspection process: Due to a lack of technical and human capacity as well as equipment for testing building materials, building inspections are largely carried out by checking against the approved plan (at the construction permit stage) and not the actual code itself. While the plan would have been approved by a public official, the majority of plans are reviewed against a checklist, leaving room for design errors to go unnoticed. Such a process leaves too much responsibility for ensuring building safety on the architect, when the plan review and inspection process is specifically meant to serve as a quality check to identify potential design and construction flaws on the part of the architect and contractor.

Gaps in required hardware, software and fixed assets: During stakeholder consultations, regional- and city-level building departments noted a lack of sufficient equipment and transportation, and at times, IT hardware and software, to conduct needed plan review, quality oversight and inspection.

Limited soils and building materials testing capacity: In terms of soils and building materials testing capacity, the Building Proclamation stipulates that testing must be provided at the regional level (i.e. testing facility, university), with guidelines, laws and standards (and associated training) provided by the federal ministry. When testing requirements are beyond regional capacity, materials may be sent to Addis Ababa.³⁵ In visiting a local building department, it was noted that private consultants also provide testing. However, the lack of resources for regional testing facilities was highlighted as a challenge, including the lack of adequate equipment to conduct tensile testing of steel reinforcing bars and compressive strength testing of concrete for high-rise construction.

Budget management: Insufficient program budgets at the regional and local levels have often resulted in prioritization of civil works or public housing investments, leaving limited resources for capacity building and fixed assets investments. At the local level, city administrations generally do not have sufficient funding to finance capacity building programs. The majority of operating budgets for regional building departments come from federal transfers.

Lack of coordination among institutional work streams: Uncoordinated land use planning, land leasing and building permitting processes have often resulted in confusion and delays in receiving formal approval to build. Such challenges have often led individuals to build outside the formal, regulated process. The result has been structures built without any form of regulation— whether plan review or inspection.³⁷ A disconnect with Local Development Plans (LDPs) was also highlighted as a challenge. Approved by Cabinet (Council of Ministers), LDPs lay out the long-term city development plan (e.g. building heights, zoning, future roads projects). However, such plans are not updated frequently (and at times, developed by consultants without a full understanding of the local situation), resulting in challenges as LDPs may inadvertently restrict construction of structures currently in demand.

³⁵ In the case of Dire Dawa and Harar, there is one facility for testing concrete and soils. In Jigjiga there are plans for establishing a testing facility, but resources have yet to be secured. In Assosa, there is no such testing facility.

³⁶ Upon receiving a land lease, construction must begin within six months of receiving a construction permit. However, works can experience delays either due to lack of finance or delays in receiving formal utility connection to service networks.

IV. **Lack of hazard and risk information—**

More localized geotechnical and hazard information is required to ensure safe design and construction as well as inform the local contextualization and future revisions of the building codes. For this reason, current construction is seismically very weak, as a detailed understanding of seismic hazard is lacking.

While the above challenges focus on the core components of a building regulatory framework, larger institutional and structural factors in Ethiopia are critical to develop a positive enabling environment for the construction of safer buildings. These factors include the present challenges in accessing land, ensuring acceptable levels of security of tenure, accessing housing and construction finance as well as making funding mechanisms available for building machinery and property insurance services. Informal construction represents the most significant challenge to effective regulatory compliance. The key drivers of building informality are rooted in a wide range of factors that include the functioning of land and housing markets, urbanization policies and broad socio-economic factors that are far beyond the reach of regulatory measures and fixes. Rather than directly addressing building informality, this report helps advance the recommendations already provided in the Ethiopia Urbanization Review (jointly developed by the World Bank Group and Cities Alliance). The Urbanization Review advocates the overall improvement of urban planning and housing quality and an extended investment into informal settlement upgrading.³⁷ A sound building regulation regime can contribute to containing the

growth of informal settlement by reducing compliance costs and making building permits and inspections more effective and transparent.

2.4. Limited Emergency Preparedness and Response

As a part of the Technical Assistance, the World Bank worked with the Government to assess the emergency response and preparedness in four cities in 2016: Addis Ababa, Dire Dawa, Hawassa, and Jigjiga. The goal of the assessment was to provide recommendations to improve cities' emergency preparedness capacity. The assessment focused on (i) fire response capacity, (ii) flood preparedness and response capacity, and (iii) earthquake alert, preparedness, and response capacity. In general, it was found that to improve disaster risk management (DRM) in Ethiopian cities, the federal government's *National Policy and Strategy on Disaster Risk Management (2013)* and the *City of Addis Ababa's Fire and Other Disasters Prevention, Preparedness, Response and Rehabilitation Strategy of Ethiopia (FEPRA, 2015)* must be "translated" for implementation at the city level. Currently, city officials have little knowledge of these national strategies or their roles in implementation. The assessment concluded that significant support is required to enable the cities' implementation of both response and preparedness strategies.

Compared to the other cities, Addis Ababa is considerably better positioned to prepare for and respond to emergencies and disasters. The capital city has significantly more resources at its disposal in terms of trained first responders (e.g., firefighters, police, and medical professionals) and emergency equipment (e.g., ambulances, fire trucks, search and rescue equipment, and emergency communications equipment). Also, substantially more investment has been made in DRM systems in the city than in the other cities included in the assessment. The United States

³⁷ Ethiopia Urbanization Review: Urban Institutions for a Middle-Income Ethiopia. World Bank Group and Cities Alliance (2015)

Agency for International Development (USAID) has funded a number of urban emergency and preparedness response initiatives, including National Incident Management System (NIMS) training, development of a comprehensive risk assessment, development of a city emergency plan, and training for firefighters. In many aspects, Addis Ababa is well on its way towards implementing some of the strategies outlined in the national DRM policy, and could serve as a model for other cities.

The emergency preparedness and response capacity of the regional capitals of Dire Dawa, Hawassa, and Jigjiga is much less developed than in Addis Ababa. All three cities lack basic emergency response resources (e.g., fire suppression, search and rescue, and emergency communications equipment) and qualified personnel. Each also suffers shortages of trained firefighters (primarily due to a low salary scale), personal protective equipment (PPE), and fire suppression equipment (e.g., fire trucks). Dire Dawa and Jigjiga rely heavily on the Ethiopian Aviation Authority fire services based at their local airport.

Emergency response times in these three cities tend to take significantly longer (and in some cases, emergency responders are not able to provide assistance at all) than in the capital, where the average response time to a fire emergency reportedly takes seven minutes. Existing early warning systems that tend to focus on drought and food insecurity in rural areas are not adapted for city use. Emergency communications (e.g., high-frequency radios) that enable emergency responders to communicate and prioritize response activities are largely unavailable. There is a complete lack of knowledge or implementation of NIMS and no capacity for interoperability among emergency response agencies. Finally, the lack of available data with which to conduct a proper risk assessment has resulted in part in inadequate public awareness of personal emergency preparedness.

Key organizational structures (e.g., Disaster Risk Management Councils) that are required to implement national DRM strategies have not been established in Dire Dawa, Hawassa, or Jigjiga. NIMS, a cornerstone of the national DRM strategy, enables a structured, coordinated emergency management system that can effectively plan for, respond to, and recover from disasters and emergencies. At the city level, neither city officials nor first responders have been trained in NIMS and understand how it functions. None of the three assessed cities have established Emergency Operations Centers (EOCs), a critical component of NIMS during a disaster.

Capacity to Implement National Policy and Strategy

Ethiopia's current DRM program is primarily built on rural hazards including drought and famine. In each assessed city, officials noted that the lack of understanding of DRM at an urban level is the most pressing issue. Significant efforts are required to transfer knowledge of general DRM terms, concepts, best practices, and policy direction.

Ethiopia's National Policy and Strategy on DRM (NPSDRM, 2013) originally designated the Ministry of Urban Development and Housing as the lead institution with respect to "urban infrastructure and building and other constructions related hazards and associated disasters and other urban disasters, including fire" (p. 17). According to the policy, the responsibilities of a lead institution include the following: "provide and coordinate response operation when disasters relevant to their respective sectors and they are responsible for occur and affect more than one region and the response operation becomes beyond the capacity of the affected region" and "provide and coordinate response operation when a disaster occurring is likely to spread quickly and cover vast areas" (NPSDRM, 2013).

The policy states that a “structure for the coordination of disaster risk management activities at all levels shall be created” (NPSDRM, 2013) that is “consistent with those duties given to the Federal Coordination structure and they will be prepared by Region States” (NPSDRM, 2013). In accordance with this directive, Dire Dawa has recently established a DRM coordination office that will act as a focal point and resource for all regional offices to compile and mainstream DRM activities and plans. Dire Dawa seems to be unique in its ability to establish this coordination function. Neither Hawassa nor Jigjiga have taken steps to establish this office, indicating that they have not yet received sufficient guidance from the central ministry on how to do so.

The national DRM policy also calls for the establishment of Disaster Risk Management Councils at all levels—national, regional, and municipal. These councils will have “oversight responsibility regarding monitoring and evaluation of the execution of the policy and its implementation strategies” (NPSDRM, 2013). While none of the assessed cities had established this council, all had established a similar body called the Emergency Response Taskforce.

In each city, the Emergency Response Taskforce is the primary emergency management authority. Taskforces are typically comprised of police, health services, a DRM office (if it exists), representatives from the Ministry of Agriculture and Natural Resources, as well as the Ministry of Women’s Affairs, the city manager, the mayor, and the Red Cross. Fire services representatives are typically not involved. Officials in each city reported that the taskforce meets regularly to discuss emergency management issues, including seasonal weather issues and warnings and upcoming major events such as festivals. When there is a disaster, the taskforce is called together by the mayor or the police commissioner to discuss response and recovery,

and if necessary decide on how contingency funds (if available) will be distributed.

Information to Identify and Assess Urban Hazards

In Addis Ababa, a working group has recently completed a comprehensive risk profile. Other cities have not, and most city officials said that they do not have enough information or knowledge about urban risks. The local Bureau of Agriculture does not provide have any information about urban risks and during different consultations, the officials noted the need to provide this kind of information to city officials.

Early Warning Systems at the City Level

Overall, there is no real early warning system at the city level. A highly-organized early warning system established for drought and food insecurity collects information from the rural population, which is channeled through the regional government to the national-level Early Warning Unit. The cities are rarely engaged in this system. However, in Dire Dawa and Hawassa, the local governments have worked with Red Cross to strengthen warning systems at the community level, as presented in Table 2.4.

Flood Warnings

At the national level, the DRM Commission’s Early Warning Unit provides seasonal forecasts for flooding that are circulated to regional governments, but are often not provided to city officials. Cities at risk of flash floods rely on reports of impending problems from upstream *kebeles* (wards) and *woredas* (districts,) usually via mobile phone calls from police stations, as well as weather forecasts from the National Meteorology Agency. Officials from Dire Dawa and Hawassa reported that the current system normally enables them to have at least a 24-hour warning that they might experience a flash

flood.³⁸ Once city officials are warned that there might be a flood, they use sirens mounted in strategic locations in the city to alert the public. However, city officials interviewed during the assessment reported that often the sirens were

not working and would not work in the case of an electricity outage. In addition to sounding sirens, police officers, Red Cross volunteers, and others use megaphones to warn residents in drought-prone areas to evacuate.

Table 2.4. Warning Systems at the Community Level (Based on field assessment carried out in June/July 2016)				
City	Emergency and date	How much advance warning was provided to the affected population?	How were warnings given?	Who gave the warnings?
Dire Dawa	Flash flood, 2016	24 + hours	Sirens, megaphones, weather announcements	Police, Red Cross members
Jigjiga	Flash flood, 2016	2 hours	Ambulance sirens, loud speakers	Ambulances, police
Hawassa	Flood	24 hours	Weather announcements, phone text messages	Police

Earthquake Warnings

No earthquake warning systems exist. Residents do not know what to do in an earthquake.

³⁸ Unfortunately, in April 2016 there was a breakdown in the communication system for the city of Jigjiga. The police station received a message at 12:00 a.m. that a flash flood was headed towards the city and was unable to wake everyone in time. A number of people drowned in the flood that descended on the city two hours later.

Capacity for Emergency Fire Response

In the absence of a national fire authority, the Fire and Emergency Prevention and Rescue Agency (FEPR) in Addis Ababa fills a gap in strategy setting and technical expertise in Ethiopia. The agency's current structure is based on NIMS and uses South African fire standards. FEPR has significantly more resources at its disposal than the country's regional capitals, and includes 38 fire trucks, 38 ambulances, 1,200 employees (of which 650 are firefighters), and 8 fire stations (with two more being added soon) with specific catchment areas (based on interviews conducted in 2016). In addition to fire prevention and suppression, the agency provides emergency medical services and hazardous materials response. FEPR is often asked to send personnel to help other cities due to their lack of equipment and labor power. Often, however, by the time firefighters arrive on scene, it is too late to contain the damage.

According to the *Fire and Other Disasters: Prevention, Preparedness, Response and Rehabilitation Strategy of Ethiopia* (2015), written by FEPR, fire units will take a leadership role in emergency response and preparedness. In reality, with the exception of Addis Ababa, fire services staff at the city level play a minor role in most areas of disaster management and are often uninvolved in any planning, prevention, response, or recovery activities. A majority of fire response units at city levels were found to be unprepared for and ill equipped to respond to fire emergencies. Significant investment will be required to achieve the standards recommended in the strategy.

In each of the assessed cities, the number of trained firefighters and shift supervisors is insufficient. The turnover of firefighters is very high because the working conditions are difficult and the salary levels are too low. There is only one firefighter training academy in Ethiopia,

located in Addis Ababa. In 2015, 2,220 students came through the academy (falling far short of its full capacity of 7,000 per year). To train at full capacity, the facility needs more than 35 instructors, but currently only 14 are available. Instructors from the academy sometimes travel to other regions to train firefighters, but this arrangement is considered insufficient by all concerned.

FEPR has prioritized improving and expanding training for firefighters. According to a FEPR official, due to a lack of training simulators, firefighters are not learning many of the tactics that could be employed to increase safety and fire suppression efficiency. As part of the USAID urban emergency preparedness and response program, a training of trainers was held with the objective of increasing the number of qualified firefighters across the country. FEPR has been exploring the possibility of establishing a new fire training academy on the outskirts of Addis Ababa.

The top priority in any emergency response should be the safety of first responders. The importance of personal preparedness equipment (PPE) is not recognized in Hawassa or Jigjiga, where it was found to be either inadequate or unavailable. In all the assessed cities, firefighters do not regularly use PPE in emergency response, an indication of inadequate supervision and training. While FEPR does have a list providing specifications for a protective bunker suit (see Annex A), no specific guidance on PPE has been issued. It is best practice to wear self-contained breathing apparatuses when an atmosphere immediately dangerous to life or health could develop, or smoke or particulate matter poses a risk during external operations (including overhaul). In Hawassa, self-contained breathing apparatuses are available but not used. In Dire Dawa, none are available. Fire trucks that were examined had basic first aid kits, but did not contain most of the items required.

Table 2.5 provides an overview of the PPE available to firefighters in three assessed cities.

Table 2.5. Personal Protective Equipment Available to Firefighters in the Assessed Cities

Personal Protective Equipment (minimum)	Dire Dawa	Hawassa	Jigjiga
Jacket	Unavailable	Available	NA
Helmet	Unavailable	Available	NA
Breathing apparatus	Unavailable	Available but not used	NA
Safety boots	Available	Available	NA
Gloves	Unavailable	Unavailable	NA
Pants	Available	Unavailable	NA

Source: Based on field assessment carried out in June/July 2016

Note: NA = Information not available

FEPR's *Fire and Other Disasters: Prevention, Preparedness, Response and Rehabilitation Strategy of Ethiopia* (2015) calls for one fire truck for every 100,000 people, a goal that has not been achieved in any of the assessed cities. Table 2.6 provides an overview of the number of fire trucks compared to the population based on the parameters of the strategy.

Table 2.6. Number of Fire Trucks Compared to the Population, Based on Strategy Parameters

Regional capitals	Number of trained firefighters	Current number of working fire trucks	2017 population (CSA)	Current ratio of firefighters to population	Number of fire trucks needed (2017)	2027 population (CSA)	Number of fire trucks needed (2027)	2037 population (CSA)	Number of fire trucks needed (2037)
Addis Ababa	650	38	3,433,999	1: 5,300	34	5,782,892	57	9,509,776	95
Dire Dawa	15	1 (broken down)	293,000	1: 19,500	3	493,415	5	811,405	8
Hawassa	5	4	335,508	1: 67,000	4	564,999	6	929,123	9
Jigjiga	NA	2 (being procured)	169,390	NA	2	285,255	3	469,092	5

Source: Based on CSA (2013c) and author's own calculation and field assessment carried out in June/July 2016

Note: CSA = Central Statistical Agency of Ethiopia; NA = Information Not Available

New fire trucks are maintained by the manufacturer (as per warranties), but no maintenance schedules are available for older fire trucks or firefighting equipment (including CO2 and foam canisters). Fire apparatus and equipment maintenance is a continuous challenge due to a lack of funds, parts, and knowledgeable mechanics. No fire trucks are equipped with functioning radios. Firefighters rely exclusively on mobile phones to communicate with the dispatching police officer and other firefighters. The assessment team was unable to determine whether the water pumps have high ground clearance for on- and off-road use, often necessary in informal settlements. The assessment team was also unable to determine the height of the fire trucks' aerial ladders, a detail not included in the FEPR specifications. Given the construction of industrial parks occurring in Dire Dawa and Hawassa, each city should ensure adequate fire suppression measures are in place for high buildings.

Dire Dawa's 15 trained fire fighters attended the academy in Addis Ababa. In that city, there is one relatively new fire truck (7,000-liter, six-person capacity, designed for fast attack) that is broken down. While the fire truck is being serviced, the trained firefighters must rely on the fire trucks stationed at the airport that belong to the Civil Aviation Authority. If a plane is on the runway, or departing or landing, the fire trucks cannot leave the airport.

In Addis Ababa, the average response time for fire emergencies is 7 minutes. During the assessment, it was clear that average response times in the regional cities routinely exceed 7 minutes depending on the availability of firefighters and fire trucks. A major factor in long response times is inaccessibility to affected areas, particularly in informal settings.

Access to water for fire response is a challenge in all of the assessed cities. In Dire Dawa, most of the observed fire trucks had water and foam capacity. When mixed with water, foam is a

useful fire suppressant and is particularly helpful in areas with chronic water shortage. However, the fire unit was unsure how many fire hydrants existed in the city, and suggested that additional hydrants should be erected in strategic points. It is important to note that in Dire Dawa, the majority of fire response is done by Ethiopian Airlines, which has access to water at the airport. In Hawassa, water is pumped directly from a lake, as the location of city fire hydrants is not known.

Urban Search and Rescue

Urban Search and Rescue (USAR) is the general term for a group of specialized rescue skills supplemented by search, medical and structural assessment resources combined in a mobile, highly integrated team. Most cities requiring Urban Search and Rescue (USAR) trained teams in the local fire department. In Addis Ababa, FEPPRA has 187 staff trained in USAR. Outside of Addis Ababa, no other firefighters are trained in USAR. In Hawassa, which is at risk of seismic activity, there is no USAR capacity.

Fire Warnings

Before major festivals and holidays, Emergency Response Taskforce members try to remind city residents to practice fire safety while cooking big family meals. Residents are also reminded to evacuate their homes and call the police if fire breaks out. There is no formal system to monitor and warn residents of fire threats. Residents experiencing fire emergencies typically contact the police, who then dispatch a fire truck to provide assistance. In some instances, fire units receive calls directly from the public. Methods for communicating a fire department's contact information to the public vary. It is common to see one or two phone numbers painted throughout a neighborhood. There are also radio advertisements, postings in industrial buildings, and so on.

There was no standard dispatch system used in the cities assessed. In many other countries with less developed fire services, basic dispatch systems are used to send resources to fire emergencies. Once notice of a fire is received by the department's dispatch center (which could be as rudimentary as a single cell phone passed between dispatchers), questions need to be asked and decisions need to be made by the call taker in order to determine the nature of the incident and the resources required. Often there are no street names or addresses so the caller provides a general description of the area. In this case, dispatchers must be familiar with the area in order to properly describe it to the responding crews, and may mean that the assigned regions be of a limited size.

The dispatcher may use a metric to autonomously select and send resources or make a personal determination. The dispatcher may be housed in the fire station or somewhere else. Bells, horns, and colored lights may be used to signal to the waiting crews what type of emergency to prepare for. The dispatcher may sound a siren to call pre-trained volunteers to the station.

Coordination with Industrial Parks and Other Large Institutions

Industrial parks are under construction in Dire Dawa and Hawassa. These parks represent large investments in the cities and are intended to contribute to economic growth and stability. According to FEPPRA's *Fire and Other Disasters: Prevention, Preparedness, Response and Rehabilitation Strategy of Ethiopia* (2015), industrial parks and other big institutions (such as the University of Hawassa) will establish "their own fire and other disaster prevention, preparedness, response, and rehabilitation centers, but also will have mutual understanding,

intertwined working relationships and shared logistical standards with other similar institutions within the cities and surrounding areas.” Dire Dawa and Hawassa, however, are unable to provide any emergency response support to the industrial parks or the University of Hawassa, and their city fire units have no capacity to provide the leadership to negotiate a mutual understanding or working relationship with industrial park representatives.

National Incident Management System and the Establishment of Emergency Operations Centers

Consistent with internationally-recommended practices, Ethiopia has developed a National Incident Management System to provide standardized organizational structures, functions, processes, and terminology for use at multiple levels of emergency response. This system addresses the need for coordinated responses to all types of incidents and provides a flexible and scalable model to prepare for, respond to, and recover from emergencies. USAID has supported extensive NIMS training at the national and regional levels of the Ethiopian Government. In accordance with best practices, the implementation of NIMS relies heavily on the use of an Emergency Operations Center (EOC), which provides the space and equipment (e.g., emergency communications, computers, and printers) needed for the coordination of an emergency response.

Outside of Addis Ababa, none of the interviewed city officials or first responders knew about NIMS in 2016. This lack of knowledge could have grave consequences for disaster response. In the event that an emergency exceeds a city’s response and recovery capacity, the NIMS structure would guide how additional emergency response resources and supports would be allocated and

used. If city officials do not understand how to work with NIMS, an emergency response will be far less effective. None of the assessed cities have EOCs, which must be established if NIMS is to succeed.

Public Emergency Awareness and Preparedness Programming

In Addis Ababa, FEPR has 80 staff available to promote community awareness on fire risk reduction. Representatives from the risk reduction division work with the community and through industry to increase emergency preparedness using brochures. Emergency preparedness and fire prevention radio programming is regularly scheduled on FM radio and television spots three times per week. Volunteers who receive training from local development committees provide information on fire incidents to the fire departments.

In Dire Dawa and Hawassa, multiple actors are engaged in public awareness and preparedness activities at the city level. However, all informants noted a lack of general understanding about local hazards and personal emergency preparedness. There is no coordinated approach for ensuring that local residents understand what hazards exist and how to prepare themselves to respond to them. For example, police and the Red Cross do minimal public education on traffic safety.

In Hawassa, the Red Cross has done some public education on fire safety at the city level, as well as flood preparedness in flood-prone areas of the city next to the lake. The DRM office based in the Bureau of Agriculture provides emergency preparedness on drought and food insecurity in rural areas outside of the city.

The Ethiopian Telecommunications Corporation (ETC) sometimes sends out text messages to

subscribers providing weather warnings and other important messages. An opportunity exists to formally link the ETC with DRM authorities to provide more information on emergency preparedness to the general public.

2.5. Improving the Understanding of Hazards and Preparedness in Regional Capitals

Of the 10 cities participating in the CityStrength diagnostic assessment, all nine capital cities and the Dire Dawa City Administration are growing rapidly in the numbers of their population and the footprint of their built up areas. The capitals cities in growing regions such as Bahir Dar, Dire Dawa, Mekele, Adama, and Hawassa are growing as industrial and commercial centers. Each of these cities are expected to at least triple in population and house nearly a million people by 2037 (World Bank, 2015b). All are exposed to flooding, fire and earthquakes, and face growing pressure from water scarcity, housing shortage, unemployment and traffic accidents. Capital cities in emerging regions such as Assosa, Harar, Jijjiga, Semera Logia are experiencing very high growth rates following rural-urban migration. They have similar urban stresses as cities in growing regions, with even less financial and technical capacity to cope.

To answer the question of what future hazards face these cities, a hazard mapping was undertaken. The modeling shows that a large majority of regional capitals are exposed to flooding in or near the city, and fall within the regions exposed to severe agricultural drought. Four of the five large regional capitals—Adama, Dire Dawa, Hawassa, and Mekelle—are exposed to agricultural drought, flooding, earthquake risk, landslides (especially in Mekelle), and volcanic activity (except in Dire Dawa and Mekelle). Bahir Dar is exposed to severe drought and flooding, as well as landslides. Semera-Logia is at the highest exposure to earthquakes, and Jijjiga faces high river flooding, and exposure to earthquakes and landslides. Assosa, Harar, and Gambella are exposed to flooding and drought.

While shocks and stresses are growing, cities are unprepared to plan and respond. City preparedness was assessed at two levels. First, building safety was assessed through a study on building regulatory review. Second, an independent assessment was carried on emergency preparedness capacity in selected cities. The building regulatory review assessment found that there are substantial existing risks in the built environment, especially in informal and non-engineered residential construction sectors and in critical public buildings, including schools and hospitals. Regulatory decisions made now can have significant impact on the long-term

safety, productivity and resilience of the urban built environment. As Ethiopia urbanizes, low-rise building density will nevertheless increase significantly and many more mid- and high-rise buildings will be built. Both of these types of urban settings (dense low-rise and mid- to high-rise) will pose very significant challenges for fire departments, which can best deal with this hazard through modern building codes and regulation. Achieving effective building code compliance is not easy, but can pay many dividends. Many challenges hamper the development of an effective regulatory process and a culture of compliance: (i) institutional capacity constraints, given that regional and municipal building agencies are significantly understaffed and under-resourced.; (ii) limited effectiveness of quality assurance mechanisms; (iii) lack of information on hazard risks which makes local contextualization and revision of building standards challenging; and (iv) new building standards that have been adopted but need support for implementation.

To bolster disaster preparedness, a number of new policies and strategies exist. Dedicated actions and investments are urgently needed to ensure effective early warning capacity and response systems in capital cities. An independent assessment carried out for this study found that capacity and instruments for fire fighting and other emergency response

services are either non-existent or very limited. The importance of personal preparedness equipment is not recognized in cities. In all the assessed cities, firefighters do not regularly use PPE in emergency response, an indication of inadequate supervision and training. There is either no or inadequate warning for different hazards. There is no formal system to monitor and warn residents of fire threats, and there are inadequate instruments and fire trucks for fighting increasing numbers of fire outbreaks in the regional capitals. Regarding flooding, the National DRM Commission's Early Warning Unit provides seasonal forecasts for flooding that are circulated to regional governments, but are seldom provided to city officials. Cities at risk of flash floods rely on mobile phone calls from police stations reporting impending problems from upstream *kebeles* (wards) and *woredas* (districts). Often, the warning comes very late, without enough time to warn residents to safety. Finally, there is no earthquake alert systems in cities, and residents do not know what to do should one occur.

The next chapter looks into local sectoral capacity to cope with these shocks and stresses, and recommended priority actions to mainstream shocks, stresses, and hazard management considerations into urban development.

III. RESILIENCE CHALLENGES IN ETHIOPIAN CITIES: SECTORAL ASSESSMENTS

3. Resilience Challenges in Key Sectors

This chapter presents the findings of the sectoral reviews undertaken by sectoral specialists during the CityStrength diagnostic process. Using pre-diagnostic information, specialists from the World Bank, government and other participants developed a snapshot of the performance of urban systems in each of the 10 regional capitals in relation to the characteristics of resilience presented below (Figure 3.1). Better understanding the strengths and weaknesses in each of the sectors and their linkages with the other systems served to inform the overall prioritization process for recommendations and actions.

Ten sectors were chosen for the review. Their selection was based on the Inception Workshop findings (November 2015) and reflect all pillars of the Ministry of Urban Development and Housing's strategy – described in the Ethiopian Cities Prosperity Initiative (ECPI 2014). Sectoral specialists included the World Bank's specialists and the lead technical officers of the participating city administrations, ULGs, regional bureaus, and local universities. The following sectors were reviewed and the findings are presented here:

I. Urban Planning and Risk Management

- 3.1. Urban Planning and Housing
- 3.2. Urban Finance
- 3.3. Disaster Risk Management and Climate Change
- 3.4. Environmental Management

II. Services and Infrastructure

- 3.5. Transport and Roads
- 3.6. Water Supply and Sanitation
- 3.7. Solid Waste Management
- 3.8. Energy

III. Community and Local Economic Development

- 3.9. Local Economic Development
- 3.10. Community Development and Social Protection

Figure 3.1. Five Key Qualities of Resilience: Robustness, Redundancy, Reflection, Coordination, and Inclusiveness

Source: City Strength Methodology

I. Urban Planning and Risk Management

3.1. Urban Planning and Housing

Sectoral Overview

The regional capitals are growing rapidly and have put in place effective and inclusive urban planning processes and mechanisms. Collaboration across sectors and interjurisdictional levels, however, remains a challenge for developing and implementing a truly multi-sectoral urban plan. Furthermore, systematic consideration of climate and disaster risks in long-term land-use planning processes can be improved upon. Technical and financial resources to manage urban risks are limited, hampering an effective response to risks. For example, cities currently manage their growing flood risk by relocating informal settlements to safer areas and developing retaining walls around waterways, neither of which are effective long-term responses. In this planning context, key recommendations for urban resilience include: improving coordination across sectors, jurisdictions, and governmental levels; developing the institutional structure to

understand and manage disasters and climate change impacts including increased awareness by city officials and the public about hazards, climate, and disaster risks; and improving financial and technical support to regional capitals.

Housing shortage was confirmed as one of the main stresses across all ten cities. Demand for housing is increasing due to population growth and the influx of migrants from the rural areas and from other cities. Supply of housing is unable to keep up with demand. The housing shortages result from constrained access to land, focus on asset ownership and insufficient support to rental housing. Access to land is further limited by the too-infrequent auctioning mechanism, and as a result, prices skyrocket. This has led to expanded informal settlements, often in low-lying and less desirable areas of the cities, increasing residents' vulnerability to flooding, diseases, and other shocks. In response, the cities are taking steps to manage housing shortages, including making housing regulations pro-poor and regularizing informal settlements. All cities will benefit from proactively strengthening rental markets, ensuring access to land for the urban poor, and improving living conditions in existing housing.

Key Challenges and Recommended Actions for Urban Planning and Housing

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> • Expansion of informal settlements • Lack of consideration of hazards and climate impacts in urban planning • Constrained access to land • Focus on asset ownership rather than rental housing 	<p>Urban Planning</p> <ul style="list-style-type: none"> • Strengthen interjurisdictional coordination • Strengthen institutional capacity around DRM and climate change • Strengthen financial and technical capacity • Develop a national urban policy think tank <p>Housing</p> <ul style="list-style-type: none"> • Strengthen city rental market • Build housing cooperatives accessible to urban poor • Increase land supply and access for the urban poor • Improve living conditions in existing housing

Source: CityStrength Diagnostic workshop

Policy and Sectoral Context

The Second Growth and Transformation Plan 2014/15–2020 (GTP II) provides an overarching development framework acknowledging the central role of cities in achieving middle-income status. Access and allocation of land for urban housing differs across scales of governance and intended use. Access is regulated by the federal Land Lease Proclamation (No. 721), revised in 2011. Regional governments have their own lease proclamations and regulations, which contain the details of handling of the expansion and recognition of informal housing. City regulations guide the release of land for residential housing. Further, delivery mechanisms for urban development and housing—allocation, auctions,

and housing cooperatives—differ from city to city, and can depend, in some cases, on plot size. Ethiopia’s Integrated Housing Development Program (IHDP) is the primary government program focusing on home ownership and it features government-built condominiums.

Ethiopia’s urban population is mostly concentrated in Dire Dawa, Adama and Mekelle, followed by Hawassa and Bahir Dar. The proportion of migrants in seven cities in 2007 ranged between 52 percent and 72 percent (Figure 3.2), indicating that in the majority of these cities, more than half of the population are migrants. It is projected that by 2037, the major cities will house nearly a million people each.

Figure 3.2. Migrant Population in Regional Capitals, 2007 (%)

Source: CSA 2007

Informal settlements represent a challenge associated with urbanization, particularly due to the higher vulnerability to fire and other hazards associated with the high density of housing. Informal settlements are found in all the capital cities, with Jigjiga (14.4 percent), Adama (11.6 percent), and Harar (8 percent) each having a

relatively higher proportion of their land area under informal settlements than the other cities (Figure 3.3). Informal settlements are generally found on marginal lands, such as quarry sites, river banks, and precarious areas and are highly vulnerable to disasters such as flooding.

Figure 3.3. Proportion of Land Under Informal Settlement in Regional Capitals, 2015 (%)

Source: (MUDHCo ESCU2015)

Land-use classification provides the basis for urban development. The GoE's Urban Land Development and Management Policy and Strategy, among other regulations, has established land-use proportions in urbanized areas as follows: 30 percent park and greenery, 30 percent roads and infrastructure, and 40

percent built-up area (with a possibility of adopting a 30-25-45 ratio in the case of older settlements) to address problems related to mobility and access to public spaces. On average, regional capitals have 22 percent of their land dedicated to infrastructure and 14 percent to green spaces (Figure 3.4).

Figure 3.4. Land-Use Composition in Regional Capitals, % of Total Area (2015)

Source: (MUDHCo ESCU 2015)

How resilient is the sector?

Resilience Vision: In a resilient city, physical and socio-economic planning processes are well-coordinated, legally enforced, inclusive, and cross-sectoral. Key stakeholders are involved in aligning plans with sector priorities and to ensure that the interests of all societal groups are taken into consideration. Coordination between departments and other agencies enables the use of existing knowledge and data across the city to better understand current and future vulnerabilities. Urban planning and development ensures a holistic and long-term

approach to urban growth, factoring in potential shocks and stresses and encouraging proactive mitigation measures. Multiple strategies are in place to ensure that primary urban development goals can be achieved in the face of changing demographics, urbanization rates, or economic shifts.

Qualities of Resilience: Evaluation on the five qualities of resilience found the regional capitals to be progressing in being inclusive in the planning process, as well as in learning from past experience.

Quality	Description
Robustness	Although every city has prepared plans to address vulnerabilities, technical and financial constraints prevent their implementation. Infrastructure is often vulnerable, with limited local capacity to inspect buildings and infrastructure for consideration of shocks and stresses. Generally, the public and urban officials have limited awareness of hazards and risk, and there is little public demand for preventive action.
Coordination	Overall, coordination is good during plan preparation. However, coordination can still be improved upon during plan revision, implementation, and monitoring. More inter-sectoral coordination is needed on infrastructure planning, implementation and in public consultation on plan revisions.
Inclusiveness	The regional capitals all have mechanisms for inclusiveness in their planning processes. However, there is still room for improvement in translating inclusive mechanisms into practice. Municipalities generally struggle to address informal settlements. This is changing as regional capitals move to regularize informal settlements, which can be seen as a form of upgrading.
Redundant	Generally, the regional capitals do not have the system redundancies essential for managing shocks or stresses. Technical staff and financial resources are limited, and most cities do not have the capacity to handle fire, flood, earthquakes, or losses of power. Several regional capitals have alternative routes to hospitals, but cities' monocentric design can delay emergency response and even minor traffic accidents can cause gridlock.
Reflectiveness	Nearly all the capital cities have revised their urban and structural plans to accommodate rapid urbanization, informed by past experience. Dire Dawa, Harar, Gambella and Jigjiga are working to reduce settlements in flood-prone areas. Other cities, including Bahir Dar and Assosa are building soil barriers and digging ditches to reduce flooding. A fire outbreak in Hawassa led the city to strengthen their fire department, training officers, providing more fire engines, having a DRM plan, and increasing public awareness about earthquake safety. Bahir Dar and other cities changed to non-flammable building materials for market sheds. As cities continue to grow, some regional capitals are becoming increasingly responsive by promoting rental units, adopting pro-poor regulatory policies, and increasing the minimum plot size to accommodate multistory buildings (see Box 3.2).

Source: CityStrength Diagnostic workshops, 2016

BOX 3.2.**Stories of Innovation and Reflection in Urban Development and the Housing Sector**

Three narratives indicate reflectiveness and innovation taking place in urban development and housing.

1. Making urban plans more responsive to a quickly changing environment

Prior to 2006, cities' masterplans were considered too rigid to adapt to the changing urban environment. Improvement came with Integrated Development Plans (IDPs) in 2006, encouraging an integrated, cross-sectoral approach to planning, but still requiring strict vetting at the regional government level. In 2008, the federal Urban Planning Proclamation 574/2008 changed the planning framework again by introducing a two-tier planning framework at the city level—a structural plan for the city that is more flexible because it provides a broad framework for planning, and local development plans where the details are developed for two or three neighborhoods at a time.

2. Encouraging private formal rental units

In Hawassa, the city administration is anticipating a boom in housing demand from a 300-acre industrial zone under development. With 10 companies committed, the city is expecting 50,000 more jobs. To relieve the housing pressure and encourage densification within the city limits, a Hawassa pilot project is encouraging the construction of rental units in one sub-city, Adis Katama. The CityStrength diagnostic revealed that a common but incorrect perception is that there is no developable land inside the cities, hence the horizontal expansion into the peripheral areas. However, as there seems to be no minimum or maximum Floor-to-Area Ratio (FAR) (ratio of built-up area to total plot size) at the plot level, more innovation related to this regulation could be an avenue to explore.

3. Adapting the housing cooperatives regulations to make them more pro-poor

In the city of Assosa, the housing cooperative mechanism is being used to develop pro-poor housing. Any poor person who does not have a residence in the city can form a cooperative with nine other people (minimum 10 people in a cooperative) and request land from the city. Every person in the cooperative receives 260 m² (reduced from the minimum plot size of 350 m² for this pro-poor objective) within which the minimum built-up area within each plot is 16 m². Every person needs clearance from their kebele administration to confirm their eligibility. They pay 20 percent of the land cost upfront and at that point receive a construction permit and a communal title. Once construction has reached 50 percent, each person in the cooperative receives a title deed. Thus far, Assosa has given land to 1,028 people through this cooperative mechanism. The reduction of the minimum plot size is considered pro-poor because it reduces the minimum cost of land available to buy. The challenge is the cost of the land and extent to which a cooperative consisting of the lowest income group can afford the 20 percent upfront fee.

(Source: City Strength Diagnostics workshops)

Recommendations

Urban Planning

1. *Strengthen coordination across sectors, jurisdictions, and government levels during plan implementation, by establishing a representative taskforce to facilitate coordination and improve public consultation in all planning actions.*
2. *Strengthen institutional capacity for resilience across all levels of government by identifying the necessary resources to build capacity in handling multi-hazards and by preparing a strategy to create awareness among citizens and officials.*
3. *Financial resources can be strengthened by: (i) determining budget and investment requirements for enhanced resilience and identifying sources of external funding, and (ii) implementing revenue enhancement plans.*
4. *Develop a national level urban policy “think tank” to incubate, foster, and centralize thinking about low-carbon and resilient urbanization in Ethiopia. The work of the think tank can contribute to the development and updating of master plans.*

Housing

1. *Strengthen city rental markets by supporting rental unit construction at scale, reduce tax on rental income (currently set at 25 percent), and use improved kebele rental housing to meet short-term demand.*
2. *Foster housing cooperatives to increase access to land for housing by the urban poor and reduce speculation, following the practice in Assosa.*

3. *Increase land supply and help meet regularization backlog by using strong control measures, such as kebele verification to prevent misallocation.*
4. *Improve living conditions in existing housing units by in-situ upgrading in kebele housing and informal settlements.*

3.2. Urban Finance

Sectoral Overview

The regional capitals have strong municipal budgeting processes and mechanisms in place to ensure stakeholder inclusiveness. Overall, however, there is limited resilience in municipal finance systems due to weak coordination, no allowance for contingency budgets to deal with shocks and stresses, and a limited ability to collect, improve, and utilize the local government’s own-source revenues. Available data on population, revenue potential, and meteorology are insufficient to effectively inform budget planning, management, and policy-making processes. A majority of the cities face large-scale urban infrastructure deficits, and their resilience is limited by inadequate maintenance of existing infrastructure, weak or no contingency planning, and lack of insurance arrangements for existing infrastructure. In the event of a major shock or stress, typically cities resort to the regional or federal government for help, since they have far greater resources than the cities themselves, and only the federal government has borrowing capacity. The cities will benefit from improved coordination across sectors and levels of government, reserving emergency funds, and collecting more municipal revenue. The regional capitals are doing better in being inclusive and transparent in their budgeting process.

Key Challenges and Recommended Actions for Urban Finance

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> Weak coordination Limited local government's own-source revenues No contingency budgets to deal with shocks and stresses Large-scale urban infrastructure deficits, weak maintenance of existing infrastructure 	<ul style="list-style-type: none"> Establish cross-sectoral coordinating mechanisms for resource prioritization and allocation Improve revenue collection Establish contingency budget and emergency resource mobilization Improve budgeting for capital expenditures and potential municipal borrowing for large infrastructure. Improve the maintenance of existing infrastructure

Source: CityStrength Diagnostic workshops, 2016

Policy and Sectoral Context

The primary sources of revenue at the municipal level are: (1) state revenue collected by municipalities on behalf of the states (this revenue belongs to the states); (2) municipal revenue collected by ULGs, also known as own-source revenue for financing services; (3) fiscal transfer grants from the regions to the ULGs, where the federal government transfers funds to the regions based on certain parameters (e.g., population, sectoral performance); and (4) direct support to ULGs from the federal government through programs such as the Urban Local Government Development Program II (ULGDP-II). Municipal revenues include taxes on real property (land lease, land rent, residence tax), taxes on fuels and utilities, taxes on telephones and other electronic services, environmental protection taxes, and taxes on business. In Ethiopia, municipal revenue assignments are regulated by state legislations and regulations, and vary from state to state. Land lease revenues are supposed to be administered and collected in accordance with a federal proclamation.

There is significant variation in municipal revenue effort and collection across regions, partly because of differences in geographic and

demographic conditions and differences in the economic structure of different regional states in Ethiopia, but also due to other factors. One of the main challenges reported by stakeholders is the limited autonomy over setting tax rates and fees for revenues. Municipal capacity to pursue revenue enhancement is generally weak. Gambella, Semera-Logia, Hawassa, and Jigjiga face weaknesses in municipal revenue collection and may need additional support to cope with urban resilience challenges. ULGDP II is providing incentives for improved municipal revenue management, and results are evident. Large cities such as Dire Dawa, Mekelle, Bahir Dar and Adama, have a relatively large economic base and hence greater potential to generate more revenues.

How Resilient is the Sector?

Resilience Vision: In a resilient city, the municipal finance system is able to withstand large-scale shocks to revenues or unforeseen needed expenditures through reserving and flexible budget reallocation mechanisms. Budget planning, management, and policymaking are based on actual performance data, including information on damage and loss from previous shocks or stresses. A resilient city has a municipal

finance system that has sufficient autonomy to manage its resources and coordinates across departments to ensure spending leads to results towards the city's priorities. It creates a stable and informed investment environment that allows for the involvement of diverse actors and supports an inclusive approach to budgeting,

ensuring that the allocation of city resources reflects community priorities.

Qualities of Resilience: Evaluation on the five qualities of resilience found the regional capitals to have robust municipal budgets, with inclusive budgeting processes.

Quality	Description
Robustness	There are strong municipal budgets that clearly distinguish between operating and capital budgets. All cities allocate at least the minimum 10 percent of their budgets to capital expenditures. As in many other intergovernmental fiscal structures in developing countries, there is a mismatch between expenditure responsibilities and revenue assignments, which are often financed through intergovernmental transfers from the federal government. There is a need to improve the fiscal transfer system by allowing greater autonomy for the local governments to collect, improve, and utilize their own-source revenues.
Coordination	There are weak coordination mechanisms with other sectors across all cities, though Dire Dawa, Bahir Dar, and Adama are relatively better than other capital cities.
Inclusiveness	In all cities, there are well-established mechanisms for inclusiveness in the budget process, and functioning processes allow for participation and transparent planning. The presence of a large informal sector makes tax collection challenging.
Redundant	Though cities have own-source revenue handles available to them, flexibility is limited. Furthermore, municipal taxes appear underutilized as a key funding source. Normally, there is no contingency budget to deal with shocks and stresses.
Reflectiveness	One of the main challenges identified by the local stakeholders is the lack of data on local revenues to enable the cities to establish a reasonable revenue base. Cities have asset management databases though these are not updated and hamper municipal revenue collection. Proper revenue databases are necessary to help the cities enhance their revenue management. There are also inadequacies in data/information collection on population, revenue potential, and meteorology.

Source: CityStrength Diagnostic workshops, 2016

Recommendations

1. Establish cross-sectoral coordinating mechanisms for resource prioritization and allocation.
2. Improve revenue collection from municipal revenue, particularly in large cities such as Dire Dawa, Adama and Bahir Dar that have a large economic base. Train more officials and improve data management to build administrative capacity for revenue management, planning, and budgeting.
3. Improve contingency planning or emergency preparedness in resource mobilization. Develop contingency plan and budget based on better monitoring of shocks and stresses, and a local Climate and Disaster Risk Management Plan.
4. Place more emphasis on budgeting for capital expenditures and potential municipal borrowing for large infrastructure. Improve maintenance of existing infrastructure.

Federal government actions can support intergovernmental fiscal systems by improving clarity of the revenue and expenditure assignments across levels of government, and creating incentives to collect state revenue by establishing clear guidelines of how cities will benefit from it. The regional governments can support this by: (1) providing backstopping and capacity building support for revenue enhancement; (2) putting in place a legal framework for municipal finance; (3) supporting revenue administration and enforcement; (4) supporting creation of sector-specific strategy, management, and implementation plans; and (5) disbursing fiscal transfers to city administrations on a timely basis, including reporting on time.

3.3. Disaster Risk Management Sectoral Overview

The cities are inclusive in their emergency response and have been learning partially from past disaster events. More efforts are needed to keep pace with growing populations and an increasing number of disaster events. The cities are trying to identify and plan for settlements at risk of flooding, but the current approach relying mostly on relocation and retention walls is not effective in the long run. There is no dedicated budget for DRM. The biggest

challenge facing regional capitals is that there is no DRM institutional framework at the urban local government level. Key DRM functions are found at regional levels including warning systems (especially for drought), response to drought-affected areas, contingency planning, earthquake resistant damage (ERD) assessments, and awareness building. However, such efforts focus primarily on rural areas, with no or very limited support for urban areas. The cities will benefit from undertaking systematic disaster and climate risk assessments, risk mitigation, and preparedness activities.

All the regional capitals face growing impacts from urban flooding, mostly due to clogged drains and obstructed natural drainage patterns of the cities. Water scarcity, in spite of being categorized as a stress, has reached a level of “shock” in cities such as Harar, which is spending a majority of its local revenue on bringing drinking water from Dire Dawa and whose residents’ survival now depends on finding other sustainable sources of drinking water supply. All the regional capitals also face growing incidents of fire, especially in informal markets, and have very limited capacity to manage fire response. Mekelle, Hawassa, Adama, and Semera-Logia face seismic risk but are not prepared for earthquakes. Adama, Jigjiga, Assosa and Semera-logia all face landslides. Volcanic activities occur near Adama and Hawassa, which can put their access to Addis Ababa at risk during volcanic eruptions.

Key Challenges and Recommended Actions for Disaster Risk Management

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> • Growing flooding, fire and other disaster impacts • No DRM institutional framework • No systematic collection of disaster and climate data • Risk information is not considered in land use, services and infrastructure planning 	<ul style="list-style-type: none"> • Develop risk mitigation actions for city's key risks • Establish DRM units in cities • Develop a dynamic risk information system and improve early warning and response • Incorporate climate and disaster risks into integrated land use and infrastructure master plans

Source: CityStrength Diagnostic workshops, 2016

Policy and Sectoral Context: Details on the DRM policy context are included in Chapter 2.

How Resilient is the Sector?

Resilience Vision: In a resilient city, the disaster risk management system combines a well-functioning and inclusive disaster preparedness and emergency response mechanism with effective disaster prevention infrastructure.

Such a mechanism and infrastructure is based on an integrated citywide risk assessment and is developed to prepare for, limit, and recover from expected shocks. In a resilient city, risk information is a necessary foundational element for institutional decision making across sectors and in particular for budget and strategic decisions for territorial planning and management of the built environment.

Qualities of Resilience

Quality	Description
Robustness	There are no systematic DRM interventions in the cities and no institutional DRM framework in the cities.
Coordination	Overall, coordination is weak across all cities, horizontally across sectors, and vertically from national to regional and local levels, constraining effective planning and implementation of DRM actions at all levels.
Inclusiveness	All cities mentioned that the most poor and vulnerable get fair support during post-response crises. Stakeholder participation in risk mitigation activities is limited.
Redundant	There is no consideration to develop redundant infrastructure for critical buildings such as hospitals and emergency operation centers. Many informal settlements and markets have no access roads, making emergency response difficult.
Reflectiveness	Many cities mentioned that they have learned from past flooding events to prepare before the rainy season or relocate at-risk populations to safe grounds.

Source: CityStrength Diagnostic workshops, 2016

BOX 3.3.

Disaster Risk Management Pillars

The regional capitals focus on post-disaster response, with many of the cities establishing a coordination committee under the mayor after an emergency such as flooding occurs. The cities take some preventive activities that are limited to cleaning the drains before the rainy season, but that strategy is not very successful given the variability of rain. Below is an assessment of cities across five pillars of DRM:

1. *Risk assessment:* Cities prepare obstruction maps showing areas prone to historical flooding for planning purposes, but hydrological modeling showing floodplains are not prepared, and maps showing areas facing recurrent flooding are not updated, for example, in Dire Dawa and Jijiga. Seismic, landslide, and volcanic risk maps are not available in any of the cities.
2. *Risk mitigation:* Areas prone to flooding are considered in urban and sectoral planning in principle, though constraint maps do not reflect the current rapidly changing urban landscape. The most popular preventive activity is to relocate at-risk populations (settled in buffer zones/flood plains) to safer areas, though in almost all cases, the affected population returns to risk areas because of their livelihood. Other popular initiatives in cities such as Dire Dawa are to create flood retention walls, but these are costly to build and maintain, and it is uncertain if they can perform well without an integrated solution looking into better solid and liquid waste management.
3. *Disaster risk finance and insurance:* In urban areas risk insurance is not available to businesses, and the cities do not provide for contingency budgets. By contrast, in rural areas crop and livestock insurance programs are available, such as the HARITA/R4 crop weather index insurance, the EPIICA crop weather insurance, RREP crop weather index insurance, and IBLI livestock index insurance. Moreover, a meso-level livestock insurance program is planned for 2017.
4. *Preparedness and response:* Contingency plans do not exist at the local government level, and the most popular approach to flooding or other emergency response is to set up steering committees under the mayor to coordinate post-disaster relief and recovery. Some cities, such as Dire Dawa, were able to set up an effective early warning system with the help of NGOs but are now facing budget constraints.
5. *Recovery and reconstruction:* The focus has been on relief after a disaster. The cities divert budgetary resources from other sectors to support relief and in some cases to provide recovery support.

Source: CityStrength Diagnostic workshops

Recommendations

1. Establish DRM units under the capital city mayors to strengthen DRM planning for all phases of DRM (risk assessment, risk mitigation, risk finance and insurance, preparedness and response, recovery and reconstruction).
2. Develop a dynamic risk information system, including strengthening early warning systems.
3. Incorporate climate and disaster risks into integrated land use and infrastructure master plans.
4. Develop risk mitigation actions for city's key risks:
 - Pay special attention to water scarcity crisis such as in Harar, with a view to developing sustainable water supply and avoiding water stress.
 - Develop integrated flood risk management program and raise awareness on flooding. This should include developing flood risk maps.
 - Develop better seismic risk maps, and

incorporate seismic risk mitigation in buildings and infrastructure.

- Improve fire response capacity by providing financial and technical support to fire services.

3.4. Environmental Management

Sectoral Overview

In all the cities, the environmental protection authorities are faced with big challenges to implement the mandate because of limited institutional capacity, budget and human resources. This has resulted in projects without appropriate consideration of their adverse impacts on the environment and the public. In addition, there is an absence of regulations and standards. The capacity to measure levels of pollution and fine those who are impacting the environment significantly will be of paramount importance for cities that will house industrial parks. There are significant coordination challenges between government levels, particularly, between regional authorities and the municipalities. There is also room for improvement in the engagement of community members when carrying out planning activities.

Key Challenges and Recommended Actions for Environment

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> • Limited capacity to implement environmental regulations • Technical and financial constraints, data management • Lower priority accorded to environmental considerations 	<ul style="list-style-type: none"> • Increase capacity to enforce environmental regulations at all levels • Establish a protocol to enhance coordination between environmental protection bureaus with other sectoral bureaus • Awareness creation

Source: CityStrength Diagnostic workshop, 2016

Policy and Sectoral Context

The Ministry of Environment, Forest and Climate Change (formerly the Environment Protection Authority) is responsible for implementing Proclamation 299/2002 at the national level which calls for the mainstreaming of environmental and social concerns into development projects and introduces Environment Impact Assessments as a tool to fulfill the mandate. Regional Environmental Protection Authorities are responsible for implementing the Proclamation at the regional and city level. Woreda environmental protection offices are charged with the responsibility of integrating environmental concerns at the local level. In addition, the Proclamation was designed as a tool to help promote administrative transparency and accountability, involve the public and more importantly to give a voice to communities impacted by initiatives

in development and city planning and decisions which may affect them and their environment.

How Resilient is the Sector?

Resilience vision: In a resilient city, environmental considerations are effectively mainstreamed into sectoral plans, programs and investments. Stability of the urban ecosystem is maintained through guided growth and implementation of environmental regulations. Environmental protection agencies monitor changes to the environment and are able to take early action to prevent environmental degradation. In a resilient city, natural resources and ecosystems are managed as public goods, including beyond municipal boundaries, and are used to buffer impacts of shocks and stresses. Accessibility and knowledge about effective use of ecosystem services is encouraged among the poor as a means of reducing food scarcity and improving livelihood options.

Qualities of Resilience

Quality	Description
Robustness	Participants reported that the robustness of the environment sector is challenged by the weak enforcement at the city level of the Proclamation that introduced environmental impact assessments. Furthermore, there is inadequate funding for effective functioning of the sector.
Coordination	The level of coordination among the regional capitals varies. There is a need to improve coordination with sectoral offices such as transport, water and sanitation, and energy agencies, as well as coordination between the municipalities and regional EPAs.
Inclusiveness	The Proclamation that introduced ESIs requires the consultation of stakeholders in the impact evaluation process. However, public participation is limited due to barriers in access to information and inadequate financial resources. Some efforts are being undertaken in different cities: Adama established a mechanism to receive feedback from stakeholders, particularly from project-affected communities. Dire Dawa, Harar and Jigjiga also involve some stakeholders in decision-making processes.
Redundant	In all the cities consulted, there were limited alternatives in the provision of services related to the environment sector. For example, if the regional EPA is unable to provide support to projects, sectoral offices were not equipped to cover the gap.
Reflectiveness	In all the cities, planning processes are hampered by lack of information/data. There is no baseline data or measures to assess changes in the pollution level and thus, no action is taken against industries that pollute.

Source: CityStrength Diagnostic workshop, 2016

Recommendations

1. Enforce environmental regulations. This should be given a high priority due to the role of the environment in the resilience of the city. For example, the discharge of industrial waste into the main lake in Bahir Dar affects a valuable resource for the functioning of the city.
2. Allocate sufficient resources to make the sector robust and reflective. Baseline data is not available to measure changes in pollution levels. Adequate funding will allow the establishment of laboratories in each of the regional environmental protection authorities for the purpose of monitoring pollution and changes in the environment on a regular basis. Additional staff is also needed for effective monitoring of the environment, which also requires capacity building efforts.
3. Establish a protocol to enhance coordination between environmental protection bureaus with other sectoral bureaus. Even though coordination can also be improved between the Regional EPAs and different line Ministries, particular attention should be given to the coordination between the municipalities and regional EPAs. Cities can consider the creation of an environmental oversight body to examine environmental integration in all major infrastructure initiatives. It is highly recommended that sectoral institutions in the cities establish environmental planning units in the long run, to ensure the mainstreaming of environmental considerations in all activities.
4. Increase awareness among policy makers so they give the environment sector enough attention. Awareness creation should focus on the importance of mainstreaming environmental concerns upstream in saving the scarce resources of the country and enable projects to be sustainable and resilient. All stakeholders in cities should be actively engaged in the Environmental and Social Impact Assessment (ESIA) process, and more broadly in the ESIA dialogue from the bottom up, given that it's essential in decentralizing control over the environment and improving resilience.

II. Services and Infrastructure

3.5. Transport and Roads

Sectoral Overview

All the regional capitals face poor traffic management and a high rate of traffic accidents. Different and viable modes of transport (as an alternative to the traditional three-wheeler transport) are not available for basic intracity mobility, exacerbating the rate of traffic accidents, congestion, and complicating emergency response. Limited storm water drainage and burgeoning informal settlements also affect traffic congestion. A number of cities such as Mekelle and Harar have old, historic centers or market areas with street patterns that

do not facilitate access, especially during fire or flooding for emergency vehicles. Most of the cities have a monocentric form, which increases traffic congestion and accidents. Another growing stress is related to increasing heat-related impacts on drivers, which are causing greater numbers of accidents in at least one city, Semera-Logia. Planning for the transport and roads sector is currently not based on risk assessments or effectively aligned with land-use plans. Nearly all cities are in need of improved traffic management, public transport provision, improved management and oversight of public transport services within the city, improved and comprehensive approach to drainage, and improved urban planning and development control.

Key Challenges and Recommended Actions for Transport and Roads

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> Poor traffic management and lack of emergency access to most vulnerable areas High rate of traffic congestion Poor storm water drainage and flooding 	<ul style="list-style-type: none"> Establish traffic management units, and improve emergency access in most vulnerable areas Develop a public transport program Develop geocoded drainage master plans for all cities

Source: CityStrength Diagnostic workshops, 2016

Policy and Sectoral Context

Transport connectivity across Ethiopia increased substantially during the Road Sector Development Program (RSDP) (1997-2014). The capital cities have substantial road coverage, but the proportion of paved roads varies from 7.3 percent (Jigjiga) to 49 percent (Harar). The impact of the RSDP on regional cities is less well understood. There is some evidence that the cities have benefited economically from that investment, particularly in the growth of the manufacturing sector (Shiferaw et al. 2013).

However, it is unclear what net effect these investments have had on the cities' resilience. It is likely that the development of the roads has had mixed effects. Most of the regional capitals are struggling with by-products of traffic congestion such as traffic accidents. For all the economic benefits, it is likely that the RSDP has also contributed to these stresses in at least some, if not all, of the regional capitals.³⁹

The length of roads in the regional capitals indicates that Bahir Dar, Jigjiga, Adama, Hawassa, and Dire Dawa have substantial road

³⁹ For example, the team heard that in Mekelle, a town with substantial and chronic water table shortages, some water-intensive manufacturing industries, including soft drink and beer manufacturing, have either set up operations or are looking to do so. It is likely that improved road access resulting from the RSDP was a major factor in these locational decisions.

coverage, while on the other end of the spectrum are Mekelle, Assosa, and Gambella (Figure 3.5). The proportion of paved roads in the regional capitals varies significantly (Figure 3.6). The

average proportion of paved roads in the regional capitals is 32 percent, which is lower than the proportion of paved roads in middle-income countries (49 percent) (MUDHCo ESCU 2015).

Figure 3.5. Length of Total Roads and Paved Roads (Km)

Source: (MUDHCo ESCU 2015)

Figure 3.6. Proportion of Paved Roads

Source: (MUDHCo ESCU 2015)

How Resilient is the Sector?

Resilience Vision: In a resilient city, the transport system offers multiple modes of transport to its users to ensure the continuity of mobility in the event of disruptions, and to ensure access to transportation for all population groups. It takes a flexible approach and proactive coordination with other agencies to be able to divert user traffic to different modes of transport based on changing conditions. In a resilient city, the planning for and investments in the transport

sector are based on an assessment of past shocks and stresses and are closely aligned with other departmental plans and overall key priorities of the city.

Qualities of Resilience

An assessment on the five qualities of resilience shows that the sector is comparatively inclusive and reflective in planning and learning from experience. However, the system is less resilient to growing hazard exposure and climate impacts.

Quality	Description
Robustness	Transport infrastructure and operations are constrained by limited management, maintenance, and operations, hampering the ability of the sector to withstand shocks and stresses and to provide services throughout the city and informal settlements. Poor traffic management in most of the cities included in the assessment results in high rate of traffic accidents, high levels of congestion (for size of city and number of vehicles), at-risk emergency response, and a perception of greater need for investment in additional road infrastructure than may be warranted. Most cities identified flash flooding associated with heavy rains and poor drainage as a significant issue. The highly monocentric form of nearly all of the participant cities which feature a central area of economic and cultural activity while residential and industrial zones develop in concentric circles around it, already creates challenges for transport service provision. With the expected future growth of the cities, if the monocentric form remains uncorrected, these challenges will get worse.
Coordination	Responsibility for road construction and maintenance in Ethiopian cities is split among federal, regional, and municipal authorities. The challenge of this arrangement is not the multiplicity of agencies involved per se—but rather the decreasing degree of interaction with local stakeholders at the higher-level jurisdictions. Weak traffic management seems to be influenced by the fragmentation of traffic management functions among different agencies.
Inclusiveness	Inclusiveness in transport contains a spatial component (service to different parts of the city) and a social component (service to different kinds of people) and how well transport users' needs are met by the infrastructure and services provided. Pedestrians make up the largest share of urban transport in Ethiopian cities, but pedestrian accessibility and safety have not been sufficiently factored into road design, particularly by the non-municipal road authorities.
Redundant	The transport and road systems in the regional capitals are insufficiently redundant for effective disaster management. A monocentric city design and street patterns in informal settlements, old historic centers, and market areas make fluid access through the city challenging, especially for emergency vehicles. These areas are all at risk of fire, so the lack of emergency access is a key stress. This leaves sections of the city vulnerable to high impact from shocks, more so as their populations continue to increase. Heavy reliance on three-wheeled vehicles and lack of viable intracity alternatives exacerbates accidents and congestion, complicating emergency response.
Reflectiveness	Roadside drainage in cities is traditionally follows a piecemeal approach and as a result, many areas in the city are underserved and especially vulnerable to flooding. Local governments are developing asset management systems and will undertake drainage master plans and other activities that lead to reduced flood risk.

Source: CityStrength Diagnostic workshops, 2016

One important stress that emerged for a number of the cities, but which had previously received scant attention, was the impact of heat-related stress, which would likely get worse as climate change advances. In Semera-Logia, heat stress manifested itself in the accident rate (especially relative to the population). Apparently, heat-related delirium and stress may be an important contributing factor to the high rate of road traffic accidents within town, particularly in the stretch of road separating Semera from Logia. If borne out by evidence, this may be a factor in accidents all across the Adama to Djibouti corridor. In Gambella, heat was mentioned as a factor in health clinic and hospital visits by public transport passengers.

Recommendations

The commonality of transport challenges found across regional cities in Ethiopia suggests that developing solutions should be seen not only as a priority of the cities themselves, but also for the national government. In addition, a number of the cities (including Dire Dawa, Jigjiga, and Adama) highlighted the need for further network development investments to enhance redundancy of the network.

City administration priority recommendations

1. *Authorize and establish traffic management units* to oversee management of road and street space, conduct analyses, and organize training and capacity development. This should also include designation and marking of emergency evacuation routes and influence on the building permitting process as it relates to traffic impact.
2. *Pilot test a public transport executive authority* and develop a public transit program in one city, with roll-out of lessons learned for other cities. None of the cities have direct regulatory authority over licensing commercial transport operations; that authority is usually exercised through

regional transport authorities operating under delegation from the Federal Road Transport Authority (FRTA). But the mandate of the FRTA and the regional transport authorities is substantially broader than the urban areas in question. So although the cities may own and operate small public transport operations, the regions regulate other transport services, but often not in a way that is coordinated with the aspirations of the city. A public transport executive authority is a potential solution.

3. *Develop geocoded drainage master plans* for all cities, with detailed five-year implementation program, cost estimates, and finance-gap contingencies.

Federal level priority recommendations

1. *Strengthen traffic management capacity:*
 - a. Develop urban transport management programs at Ethiopian universities for increased capacity.
 - b. Establish a traffic management funding program, providing resources to local governments to engage consultants and implement recommended improvements, subject to competitive application and meeting certain criteria.
2. *Undertake a nationwide GIS master plan and implementation program*, accessible across agencies, jurisdictions, and cities, to help manage shocks and stresses. Many local governments are developing asset management systems and other important systems such as cadaster and sector-specific master that would greatly assist in managing shocks and stresses and would benefit from a harmonized GIS approach. These activities should all be geocoded, and that geocoding should follow standards and platforms that allow interoperability across agencies, jurisdictions, and cities.

3.6. Water Supply and Sanitation

Sectoral Overview

A majority of the cities are facing severe water shortages following source depletion, prolonged drought situations, and deteriorating water quality. The cities are unable to provide water supply and sanitation to all residents. Although plans exist, there is limited coordination with other developments or are underfinanced. Sanitation coverage remains low. There is an absence of coordination with other sectors, which often costs utilities a substantial amount

of resources and undermines their services. The cities lack an adequate information management system that generates key data to improve the performance of the sector, including reducing unaccounted water. The water utilities do not have robust operational and investment plans that enable them to address fast-growing urbanization. They also face limited technical and financial capacity to perform and achieve their targets. Water is essential for sustainability and fast economic growth, and the rapidly growing urban population requires massive natural resources management and water supply and sanitation development.

Key Challenges and Recommended Actions for Water Supply and Sanitation

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> Severe water scarcity and worsening water quality Inadequate access to water supply and sanitation facilities Limited coordination, technical, financial, and data management capacities 	<ul style="list-style-type: none"> Resolve water scarcity and impacts from climate variability Improve water supply and sanitation coverage Improve capacity for coordination and strengthen information database

Source: CityStrength Diagnostic workshops, 2016

Photo: aleksander hunta © Shutterstock.com

Policy and Sectoral Context

The Ministry of Water, Irrigation, and Electricity (MoWIE) provides national guidance and sectoral oversight, with responsibility to plan, develop, and regulate Ethiopia’s water resources as well as implement trans-regional development programs. At the regional level, bureaus oversee development of regional water resources, including improvement of the urban water supply. Complementary to the regional structure, basin authorities are responsible for monitoring and regulating the development and utilization of surface water and groundwater. They are managed by the Ministry and accountable to a Basin Higher Council chaired by the Deputy Prime Minister. Based on a national-level policy, all cities have adopted progressive tariffs that increase as the consumption increases and a flat rate for public taps.

Water supply coverage remains insufficient in many regional capitals in Ethiopia. The water coverage rate varies from 40 percent in Jigjiga to 90 percent in Hawassa (Figure 3.7). This large variation indicates that water supply coverage is a major problem of the regional capitals with its implications for health and productivity. Further it should be noted that water coverage is not the same as access to private piped water. For instance, though Hawassa city has a 90 percent water coverage, the proportion of people with piped water into their premises is only 25 percent. This indicates that the bulk of the city population use a common water source for their water supply. In many cities it is also reiterated that in general the city water supply is insufficient because of high demand and also shows variations within the city itself.

Figure 3.7. Improved Water Supply Coverage (%)

Source: City-level data and the World Bank (for Bahir Dar, Dire Dawa, and Addis Ababa).
No data for Semera, Assosa, and Adama

All cities are currently unable to provide continuous water service (24/7). Currently, the net per capita water supply that reaches each household is as low as 26l/c/d (Adama), 30 l/c/d (Mekelle) and 33 l/c/d (Harar). Within the regional capitals, the availability of sanitation infrastructure remains challenging, exposing

residents to disease outbreak. Sanitation facilities in the regional capitals are dominated by households' use of pit latrines. Mekelle and Jigjiga are the two cities with a significant proportion of the households using flush toilets (Figure 3.8).

Figure 3.8. Types of Toilet Facilities in Regional Capitals in 2011

Source: CSA Welfare Monitoring Survey 2011.

How Resilient is the Sector?

Resilience Vision: In a resilient city, potable water and sanitation services are accessible to all segments of the population. Water and sanitation infrastructure is planned with a holistic approach taking into account social, economic, and environmental risks and vulnerabilities. Planning for and investment in the sanitation and water systems is driven by demand and supply data, participatory engagement, and is based on cross-departmental collaborations that support

coordination with existing urban development plans and priorities. In a resilient city, there is sufficient human and technical capacity to ensure sustainable operation, maintenance and financial management of water and sanitation infrastructure and services.

Qualities of Resilience

When evaluated on the five qualities of resilience, the cities are doing better on coordination, reflectiveness, and inclusiveness, but need to take more steps to ensure robust functioning of the water supply and sanitation:

Quality	Description
Robustness	Most of the regional capitals consider robustness to be the weakest characteristic of the water and sanitation sector. Access and quality can be improved.
Coordination	Cross-sectoral coordination is not well-established and functioning in the water sector as cities and sectors tend to operate separately without much information exchange or partnership. Different cities have their own modalities of coordination with other sectors, in some cases via quarterly meetings. Responsibility is fragmented between municipalities, water utilities, and the offices of health and of environment.
Inclusiveness	There are policies in place calling for the provision of water supply services to all Ethiopians, including poor and vulnerable sectors. ⁴⁰ Implementation of these provisions is more complicated in operation, requiring dedicated training, information, and resources, which are barely available on the ground.
Redundant	Redundancy is weak in all the capital cities. Both water supply and sanitation are deeply vulnerable to shocks such as earthquakes, landslides, flooding, and drought. There are already stresses on existing systems, and any shock affecting the water supply systems would cause significant impact. Adama experienced a landslide that affected the main, raising it 500 mm, which affected the entire supply to the city in two consecutive years of flooding.
Reflectiveness	There is significant room for improvement in reflectiveness of WSS across all regional capitals. Most cities do not have robust documentation and analysis of their past and current operations to inform planning for the future. Harar is the only city that reported use of a GIS system for main line maintenance.

Source: CityStrength Diagnostic workshops, 2016

⁴⁰ FDRE (2015): State of Ethiopian Cities Report. Federal Democratic Republic of Ethiopia Ministry of Urban Development, Housing and Construction and Ethiopian Civil Service University.

BOX 3.4.

Water and Sanitation Challenges facing Regional Capitals

Water scarcity: Dire Dawa, Harar, Jijjiga, Semera-Logia, Adama and Mekelle are among the cities where water scarcity is a serious problem. If no actions are taken, the same challenge is expected to come shortly to other cities as well. Bahir Dar and Assosa are already giving some signs that water scarcity could become a serious issue. The problem is exacerbated when considering the poor aquifer recharge mechanism and the impact of climate change. Other factors are: (i) Sources are depleting over time, (Harar, Jijjiga, Adama, Semera-Logia, Mekelle, Bahir Dar and Assosa are towns experiencing this problem); and (ii) drought is affecting all towns, except Gambella and Hawassa which did not report that water utilities had been affected at least twice following long dry seasons.

Worsening water quality: Water quality is worsening due to pollution, flooding and sedimentation, and deteriorating infrastructure, despite water quality monitoring and treatment systems in each of the capital cities. The type and intensity of quality control and treatment vary from town to town. Mekelle and Dire Dawa often face an internal corrosion of still pipes due to the hardness of water that compromises even a proper supply of water. Gambella, Bahir Dar, and Adama have a serious problem of surface water pollution because of poor upstream management. Furthermore, whenever there is flooding, the treatment capacity is constrained because of high turbidity and sedimentation. Semera-Logia faces a unique challenge, which is associated with the high temperatures of the water at the sources, which reach above 40°C. The utility is forced to have different types of pumps and accessories that often are not available on the market.

Substandard sanitation facilities: More than 75 percent of capital city households use either a traditional or improved pit latrine. There are also public and shared latrines which are in poor condition. Latrines are commonly connected to a drainage system, including natural drains, rather than a conventional sewerage system (with a slight difference in Hawassa), and there is no strong regulatory and enforcement mechanism for improvement. Most cities do not consider sanitation a priority concern, and professionals estimate that less than two percent of city resources are assigned to the sector, since more attention is given to solid waste management.

Lack of technical and financial capacity: Water utilities in the regional capitals do not have the operational and investment plans to address the challenges of fast growing urbanization. They also lack the in-house technical capacity to meet the new and growing demands, and the financial capacity to afford outsourced expertise. Often, cities get limited technical assistance from a consultant that is contracted for a single output, which is often constrained by limited data. Further to the planning problem, all cities have limited financial resources to cover their cost. Mekelle, Hawassa, Bahir Dar, Dire Dawa, Harar and Adama are on a better situation compared to others.

Weak data management system: Many of the oldest capital cities' water utilities lack maps of their distribution systems (with the exception of Harar which has a GIS monitoring system, Mekelle and Hawassa) and some have no reliable systems data on production or distribution (including Dire Dawa). Without accurate records and groundwater monitoring data, utilities cannot plan for future supply or regulate non-revenue water. Utilities also lack a complete inventory and map of public tap locations, flood-prone areas and magnitude of the potential effect, and the location of slum areas that need special attention. Similarly, reliable sanitation data is not available, making substantive analysis difficult. The absence of a dedicated focal unit or person responsible for compiling data or monitoring information exacerbates the challenges of data collection and management.

Source: Citystrenght Diagnostic Workshops

Recommendations

1. Resolve water scarcity and climate variability impacts: Improving monitoring and groundwater recharging should be the priority in the medium and long term, by adopting integrated urban watershed management, increasing water percolation, and identifying alternative sources that will address growing demand and climate variability impacts.
2. Improve sanitation and water supply coverage by:
 - *Improving capacity of water utilities:* All WSS utilities have capacity limitations that prevent them from managing existing problems and preparing for future challenges. To improve the quality of service and meet future demand, utilities need to: (i) improve management systems; (ii) revisit institutional structures; (iii) develop in-house technical skills to manage both water supply and sanitation services; (iv) review the existing tariff structure and financing system to ensure adequate resources are in place; (v) improve operational and investment plans, and (vi) seek increased private sector participation.
 - *Improving quality of service:* Possible medium- and long-term interventions by utilities to increase water production and improve services include: (i) establish sound information management systems on the distribution system; (ii) increase water production and distribution capacity; (iii) reduce non-revenue water (NRW) to the minimum possible; and (iv) create a sanitation services management system.
3. Improve coordination among different actors: Improve collaboration and integration among the agriculture, urban development, energy, health, environmental and climate change entities. Multisectoral collaboration is essential for water utilities to secure short- and long-term water supplies and ensure safe waste management and removal.
4. Strengthen information databases: Utilities should be required to keep and analyze data—on water production, variation on yield and quality of each of the boreholes, and water distributed to different types of customers, including the segment of poor people benefiting from the system—to inform planning and decision-making processes.

3.7. Solid Waste Management

Sectoral Overview

There are inadequate waste collection systems in all the cities, leading to disposal of solid waste in drainage systems and open spaces, exacerbating flooding and associated public health risks.

Assosa, Semera-Logia, and Jigjiga have minimal waste collection systems in place. Bahir Dar, Dire Dawa, and Mekelle are performing better but still need to increase collection coverage, particularly for informal areas. Inappropriate waste disposal practices also cause ground and surface water pollution, methane emissions, and landfill fires. Semera-Logia, Assosa, and Harar

have no organized disposal sites, and Hawassa's dump site now lies within the residential area of the city. Dire Dawa, Adama, Bahir Dar, and Mekelle have engineered dump sites outside the city, but lack sufficient operating capacity and appropriate equipment and vehicles. Overall, coordination of Solid Waste Management (SWM) services in these cities appears to be good, but further integration and closer liaison between SWM and different services (e.g., construction, public health), is critical to improving sectoral resilience. There is also a lack of public awareness on the dangers of improper disposal of wastes.

Key Challenges and Recommended Actions for Solid Waste Management

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> Inadequate waste collection systems leading to clogged drains, flooding, and associated public health risks Inappropriate waste disposal practices causing ground and surface water pollution, and also methane emissions and landfill fires 	<ul style="list-style-type: none"> Provide solid waste management collection services for all Ensure appropriate disposal of solid wastes by developing appropriate disposal sites for all cities. Develop integrated solid waste management plans as a part of overall flood management

Source: CityStrength Diagnostic workshops, 2016

Photo: Stephan Bachenheimer © World Bank

Policy and Sectoral Context

The Ethiopian Government has established a National Solid Waste Strategy. The standards define clear requirements and targets for municipal solid waste management, introducing source separation for composting and recycling wastes. Since publication of the national strategy and the standards, there has been clear improvement in municipal SWM, particularly in cities that received direct support from the Ministry (e.g., Dire Dawa). Yet 10 to 40 percent of wastes remain uncollected (Figure 3.9), and considerable further improvement is needed to address the significant negative impact of existing practices.

Operational responsibility for SWM in the regional capitals sits with the municipalities’ Sanitation and Beautification Department. Household solid waste is collected by micro- and small enterprises (MSEs), delivered to municipal containers, and transferred by the municipality to the city landfill or dump site (especially in Hawassa, Dire Dawa, Harar, Jigjiga, Bahir Dar, and Assosa). Availability of sanitary landfills is limited to a few cities, namely, Dire Dawa and Harar. Most cities use temporary dump sites. Regional capitals still need to develop sanitary landfills and improve upon the collection of their wastes.

Figure 3.9. Solid Waste Collection Rates in Regional Capitals

Note: No data available for Adama, Jigjiga and Semera-Logia
Source: City-level data and World Bank.

How Resilient is the Sector?

Resilience Vision: In a resilient city, the solid waste system offers affordable collection services to all residents, irrespective of their tenure status. Regulations for waste collection, disposal and treatment, especially of hazardous waste, are enforced to protect human health and safety, and the environment. Performance of waste facilities and collection services are regularly evaluated and the recorded (and

potential future) vulnerabilities during shocks and stresses inform maintenance and upgrading decisions. After a disaster event, the city has resources and procedures for dealing with large quantities of debris and/or cleanup of hazardous waste.

Qualities of Resilience

When evaluated on five qualities of resilience, cities' coordination around SWM services is stronger than in other areas of resilient practice.

Quality	Description
Robustness	<p>The level of robustness of the SWM systems in each of the regional capitals is variable. Some cities lack the capacity, budget, identified disposal sites, or public awareness to support even minimal waste collection systems. Open dumping of solid waste around cities and in drainage ditches is still common, creating public health risks and reducing the effectiveness of drainage systems, leading to serious flooding during heavy rainfall (e.g., Semera-Logia, Hara, Jijjiga, Hawassa and Assosa).</p> <p>Where engineered landfill facilities do exist, they are not maintained or operated appropriately due to a lack of capacity and appropriate machinery (e.g., Dire Dawa, Mekelle, Adama and Bahir Dar). These disposal practices are causing surface and ground water pollution and air pollution in the form of methane emissions and local air pollution created by landfill fires.</p>
Coordination	Overall, coordination of SWM services in the capital cities appears to be good, for example, between the Sanitation and Beautification Department and Construction and Urban Planning. However, closer collaboration, e.g., with the construction, public health, and urban planning departments, could further integrate SWM services and objectives into other activities of the city.
Inclusiveness	Engagement with residents and other stakeholders is limited, as evidenced by the high levels of dumping of wastes and the low level of participation in some source separation schemes. Engaging stakeholders will require a concerted effort on public awareness raising, at both the local and national levels. All the regional capitals need to increase their coverage, particularly for informal areas.
Redundant	There is very little redundancy of SWM services in the capital cities. None have spare vehicles or capacity to manage waste in the event of a disaster (e.g., earthquake or flood). Several of the cities experience frequent breakdowns of the vehicles; only two of Mekelle's six vehicles are currently operating, and Adama's landfill site bulldozer has been out of commission for more than two years.
Reflectiveness	A number of the regional capitals have integrated solid waste management (ISWM) plans that take into account future service requirements and are informed by data on waste quantities and composition. However, several of the cities do not have ISWM plans and do not collect the necessary data to inform their planning and provide appropriate reflection.

Source: CityStrenght Diagnostic Workshops, 2016

Recommendations

Priority and short term recommendations include:

Short Term:

1. Provide solid waste management collection services for all by increasing collection coverage (including informal areas):
 - Ensure all areas of cities have access to house-to-house collection of wastes by, for example, micro enterprises.
 - Raise public awareness of solid waste management issues to reduce dumping of wastes by residents. Implement awareness campaign. Engage with residents on SWM issues.
 - Consider SWM issues in municipal construction permitting processes, to (i) reduce the quantity of construction waste dumped around the city (particularly in drainage channels), and (ii) use inert construction waste as construction fill or as daily cover at the disposal site.
2. Ensure appropriate disposal of solid wastes by developing appropriate disposal sites for all cities.

Provide regional- or federal-level support to cities to: (i) identify and develop appropriate landfill disposal sites, and (ii) develop the skills and resources for their proper, long-term operation. Several cities were identified as needing critical support

in terms of providing disposal capacity, including Semera-Logia, Hawassa, Gambella, and Jigjiga.

3. Develop integrated solid waste management plans as part of an overall flood management plan for each city which considers future SWM
 - *Ensure all cities have an integrated SWM plan* that is evidence-based and provides for the cities' long-term growth.
 - *Prepare integrated flood plans* that take into account SWM issues to ensure that drains do not become blocked during heavy rainfall.

In Medium Term: (i) *Increase investment in city-wide waste collection and appropriate disposal activities.* This will require additional capital investment (e.g., from national sources), increasing the budget allocation at the local level for operational budgets and associated technical support; (ii) *Establish a market for recyclables,* particularly discarded plastic polyethylene terephthalate (PET) bottles, to incentivize their collection, alleviate visible waste, and reduce blockage of drainage channels and subsequent flooding. For example, a working partnership with the drinks industry could be established to encourage materials recycling; and (iii) *Develop source separation schemes* for organic waste, recyclables, and inorganic waste, complementary to the planned UNDP "COMPOST" program.

In the longer term, consider application of other appropriate SWM technologies.

3.8. Energy

Sectoral Overview

The main challenge for the energy sector is to find financial and human resources to meet the rapid growth in demand for modern energy services in rapidly growing cities. The Ethiopian Government is investing in much-needed additional generating capacity, though investment in most of the regional capitals' networks is lagging behind. Upgrading and expansion of the distribution system is essential. Even though the access to electricity is much

higher in regional capitals, the quality of service is poor because of overloaded distribution networks creating low voltage levels and voltage fluctuations beyond acceptable standards, frequent breakdowns, and delays in restoring supply after a breakdown. In addition, households are on a waiting list for a connection because of network constraints. There is no or limited collaboration between the utility and the city administration in the preparation of city integrated development plans, and no specific plan of collaboration in the event of an emergency.

Key Challenges and Recommended Actions for Energy

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> • Quality of service is relatively poor • Coordination challenges • Limited emergency preparedness 	<ul style="list-style-type: none"> • Improve connection and expand coverage • Improve integration of planning and coordination with other sectors • Improve emergency preparedness

Source: CityStrength Diagnostic workshop, April 2016

Photo: Stephan Bachenheimer © World Bank

Policy and Sectoral Context

The GoE places electrification at the core of its development agenda. The GoE continues to reform the sector to manage new complex challenges and meet its GTP II goals. The sector is managed by several federal institutions including the Ministry of Water, Irrigation, and Electricity (MoWIE), the Ethiopian Electricity Agency (EEA), Ethiopian Electric Power (EEP), and the Ethiopian Electric Utility (EEU). The generation and transmission responsibilities are managed by EEP, and distribution service is provided by EEU. EEA regulates the sector, and the MoWIE is in charge of policy and planning issues and has a supervisory authority over the power sector entities.

Access to electricity in urban areas in Ethiopia is high. The 2011 monitoring survey indicates that a significant proportion of households in

regional capitals have an electricity connection, though the bulk of the households have a shared meter connection (Figure 3.10). Harar and Addis Ababa have a higher proportion of households with a private meter. Jigjiga and Gambella have relatively fewer households with an electricity connection. Despite high electricity coverage, power outages and disruptions are the main problems that households and businesses face in many cities. According to SECR (2015) distribution-related problems, the predominance of wooden electric poles that get damaged easily, and the quality and state of repair of transformers constrain reliable electric power supply in many cities. The exploitation of alternative sources of energy such as solar and wind may forge a way out of the current electric challenges in many cities. Mekelle and Adama have wind-harvesting projects that could boost alternative energy sources.

Figure 3.10. Household Electricity Connection

Source: CSA Welfare Monitoring Survey 2011.
Note: No data available for Semera

How Resilient is the Sector?

Resilience Vision: In a resilient city, the energy system offers a secure supply of power that ensures the continuity of services in the event of disruptions. It has spare capacity to provide power to the city under any circumstances, especially to ensure continuity to the functioning of critical infrastructure like hospitals and government buildings. The planning for and

design of energy infrastructure is informed by an integrated risk assessment taking major shocks and stresses into consideration. A resilient energy system provides access to electricity to all societal groups, and embraces both centralized and decentralized approaches as appropriate. Management of the energy system, including decisions regarding distribution and pricing, is inclusive of local departments and stakeholders.

Qualities of Resilience

Quality	Description
Robustness	The energy sector is challenged by aging and overloaded infrastructure. Despite high coverage, power outages and disruptions are the main problems for households and businesses. In addition, old wooden electricity poles in the network are easily damaged and particularly susceptible to fire risk. Lack of municipal capacity and professional expertise at local levels severely constrain regular maintenance of distribution networks and implementing a strategy for increased access and customer service.
Coordination	There is no collaboration between the utility and the city administration in preparing and updating City Local Development Plans and utility's Electric Distribution Master Plans, which is needed to ensure timely service delivery and prevent further stress on the system. There is no clear definition of the Ethiopian electrification program's objectives, shared data management among program principals, or clear and transparent planning platform used to integrate the planning and program management functions between agencies.
Inclusiveness	Despite tangible progress in infrastructure expansion and institutional transformation, this rapid double-digit growth created many challenges, and the power sector is still unable to ensure reliable supply and services to households and commercial and industrial customers. There is a backlog of people who have submitted requests for connection, and delays are due to technical issues and network capacity. Informal connections are common, particularly in informal settlements.
Redundant	In the event of an emergency, there is no specific plan of collaboration in place between the utility and the city administration. The cities do not have any specific contingency plan or funding in place to cope with severe disruption of the system or unpredicted events that may cause dysfunction or damage to the equipment. The GoE has now committed to diversify its power generation sources by scaling geothermal, wind, and solar power energy sources as mitigation measures against power shortages.
Reflectiveness	There is improvement of standards and design in new projects driven by experience, but there is a need to improve connections, households' internal wiring to prevent urban fires, customer management, and agreed-upon contingency plans in case of emergencies.

Source: CityStrength Diagnostic workshops, 2016

Recommendations

1. *Increase connection and expand distribution network:*
 - (i) Significantly increase focus on connecting households and businesses: A significant increase of connection rates will require a programmatic shift from medium voltage-only investments to one that includes low-voltage and service connections. The cities should ensure that the residential electric wiring systems meet minimum safety standards. Wooden distribution poles in the network are planned to be replaced by concrete ones to address fire risk.
 - (ii) Rehabilitation and Expansion of Distribution Networks: The substations and distribution networks are in urgent need of rehabilitation and expansion to keep up with the current load essential for anticipated future demand. Upgrades are also necessary to create needed redundancy, improve efficiency, and reduce system losses. The government is already addressing these issues. Specific IDA funded urban distribution projects⁴¹ are under implementation since 2012. This involves network upgrading/ expansion and connection of 150,000 households in six out of the ten towns covered by this exercise. This should be scaled up by creating the capacity within EEU to undertake in coordination with local governments the short and long-term expansion planning for distribution systems (in line with urban development plans) and facilitating access to electric service and other modern energy services.
2. *Improved integration of planning and coordination:* Optimization of the Ethiopian electrification program resources requires a clear definition of program objectives; shared data management among program principals; and a clear and transparent planning platform used to integrate the planning and program management functions between agencies. This set of conditions does not yet exist for the Ethiopian electrification program. It should include the following:
 - Developing a master geospatial planning framework for more effective distribution network expansion.
 - Establishing an information sharing framework: Coordination among EEU, city administration, and other stakeholders will be significantly enhanced by creating an information-sharing platform to allow all credentialed users to view and query the GIS planning platform, the master plan for each city, and priority projects selected for implementation.
3. *Improve emergency preparedness and coordination:* Develop a contingency plan in energy sector to cope with severe disruption of the system or unpredicted events that may cause dysfunction of the system or damage to the equipment. The plan should prioritize schools, hospitals, and other critical infrastructure. Develop redundancy of energy supply and remote control to improve operational flexibility in all towns.

⁴¹ ENREP (P119893 & P155563) will provide \$140 million to urban network upgrading and expansion as well as connection program in the 14 following towns are covered Addis Ababa, Mekelle, Bahir Dar, Dessie, Adama, Dire Dawa, Hawassa, Jimma, Harar, Adrigat, Debre Markos, Sashemene, Gonder and Woleyta Sodo.

III. Community and Local Economic Development

3.9. Local Economic Development

Sectoral Overview

All the regional capitals have high unemployment, especially youth unemployment. They lack the necessary economic development infrastructure, and regions have technical and financial capacity constraints in implementing their master plan, properly supporting micro and small enterprises (MSEs), and attracting investment.

Policy and Sectoral Context

The federal and decentralized structure of Ethiopia recognizes cities and woredas as local governments with the authority to lead local economic development in their own jurisdictions. However, most cities have a weak economic base. The national Growth and Transformation Plans I and II focus on broad-based, fast, and equitable growth, with structural change emphasizing manufacturing and industrialization. Cities, particularly regional capitals, are expected to play a major role of not only catering to their citizens but also stimulating the national economy.

Key Challenges and Recommended Actions for Local Economic Development

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> • High unemployment • Lack of infrastructure • Financial and technical capacity constraints 	<ul style="list-style-type: none"> • Provide strategic local infrastructure to attract firms • Improve institutional coordination and capacity • Strengthen and enhance the municipal revenue collection capacity • Promote dialogue and strengthen collaboration between the public and the private sectors

Source: CityStrength Diagnostic workshops

Regional capitals are associated with diverse employment opportunities, particularly in the wholesale and retail and construction sectors. Wholesale and retail trade is the largest employer, with more than one third of the labor force in Harar (36 percent) and Jigjiga (34 percent) earning a living in this sector. Employment in the capital cities is diversified across almost a dozen sectors, but primarily concentrated in a few (Figure 3.11). Construction

is the second largest sector, employing more than 10 percent of the labor force in most cities. Manufacturing is third, concentrated especially in Adama (17.5 percent), Mekelle (17 percent), and Hawassa (10.8 percent). Industrial parks offer local economic promise, with 50,000 to 80,000 expected jobs in Hawassa and Adama. Dire Dawa will also benefit from an industrial park. Other cities have comparative advantages in tourism, agro-processing, mining and related industries.

Figure 3.11. Employment Composition in Regional Capitals (2014).

Source: CSA 2014.

Note: Data not available for Semera-Logia.

Cities pursue different strategies to stimulate their economy and generate employment. Almost all the capitals have adopted Ethiopia's Micro and Small Enterprise (MSE) Development Strategy to reduce poverty and create employment opportunities, offering training, market access, and credit for MSEs nationwide, with some cities establishing sub-contracting arrangements with industry giants. In some cities in the emerging regions, the MSE strategy is not well implemented. For instance, Assosa does not have an MSE office. Meanwhile, the MSE sector in Semera-Logia is not strong enough to support the unemployed. Cities also offer investment incentives, providing land and identifying potential areas of investment. Urban infrastructure provision, particularly under the Urban Local Government Development Program (ULGDP) program, also creates employment opportunities. Even with available employment opportunities, the capital cities tend to have

high unemployment rates, ranging from 8 to 23 percent in 2014. Dire Dawa (22.8 percent), Adama (19.6 percent), and Mekelle (18.8 percent) have the highest level of unemployment among the 10 regional capitals. The unemployment dynamics show that Adama, Assosa, and Harar experienced increased unemployment between 2009 and 2014, while other cities either showed no change or experienced a decline during the same period (Figure 3.12).

Employees in the informal sector are particularly vulnerable, as many are unable to cover expenses when there is a major shock. Regional capitals have significant levels of employment in the informal sector, at more than 30 percent in some cities, such as Gambella and Harar (Figure 3.13). Such high levels of informality imply that the income derived is irregular and small, leading citizens into high levels of poverty.

Figure 3.12. Unemployment Rate in Regional Capitals (%) (2009 and 2014).

Source: CSA 2009, 2014.

Figure 3.13. Proportion of Informal Jobs in Regional Capitals (%) (2009 and 2014).

Source: CSA 2009 and 2014.

How Resilient is the Sector?

Resilience Vision: In a resilient city, the local economy is diverse and youth unemployment is low. The city consciously uses infrastructure investments to steer and encourage economic growth. The city invests in education, introduces

employment policies and technical assistance programs to promote growth and a strong local economy. In a resilient city, the local government is capable of analyzing regional economic trends, and making necessary policy and industry adjustments to improve the local economy’s overall shock-resistance.

Qualities of Resilience

Quality	Description
Robustness	The local economies in the capital cities have significant room for improvement in their robustness. All the cities, except Semera-Logia, have economic and project development plans, but in all cases, the plan implementation is limited for several reasons including budget constraints. Key Challenges include: unemployment, particularly youth unemployment; lack of infrastructure, particularly the shortages and outages of electric power and water supply; and limited financial capacity to support MSEs, medium industries, and create employment opportunities.
Coordination	Cross-sectoral coordination on local economic development varies among the capital cities. Some cities (Dire Dawa, Harar, Hawassa) have clear coordination structures in place: agencies meet regularly, sectors provide collaborative leadership on investment, job creation, and poverty reduction, or work together in plan preparation and implementation.
Inclusiveness	Nearly all the capital cities are inclusive in policy and strategy, having mainstreamed women, youth, and vulnerable populations in employment creation and MSE strategies. The inclusiveness in policy is not yet translated into practice.
Redundant	The economy in almost all cities is acknowledged to lack diversification, with no clear strategies in place to ensure redundancy in alternative employment opportunities during sectoral shocks or failure. Some capital city experts believe that city master plans could be used as a basis for diversification. Alternatives to waged employment are few.
Reflectiveness	Many cities have been informed by past experience, taking actions following physical damage caused by some shocks. This includes strengthening marketplace electrical systems when rebuilding after a fire, and erecting retention walls and relocating people to higher areas to prevent economic losses from future flooding. In terms of economic performance, many cities agree that they undertake evaluations for purposes of learning, but there is a challenge of incorporating the results for future work.

Source: CityStrength Diagnostic workshops, 2016

Recommendations

1. Strengthen institutions and provide strategic local infrastructure needed to attract firms and create employment opportunities.
2. Leverage land use planning to attract investment from firms and give incentives to owners to prepare, insure and adapt against future hazards, to avoid future damage to the economy.
3. Strengthen and enhance the municipal revenue collection capacity, which can then be invested in mitigating market failures (such as lack of information or missing insurance market).
4. Promote dialogue and strengthen collaboration between the public and the private sectors.

3.10. Community Development and Social Protection

Sectoral Overview

Unemployment and poverty are high in the regional capitals. There is inadequate coordination among people-focused institutions, and no warning is provided to the groups most vulnerable to flooding risk. Limited baseline information on the vulnerable segments of the society hampers proper planning for better inclusiveness. Women, children, people with disabilities, the elderly, the unemployed, and people exposed to risk due to various social, natural, and other pressures are the most vulnerable and affected segments of Ethiopian society.

Key Challenges and Recommended Actions for Community Development and Social Protection

Key Challenges	Priority Recommendations
<ul style="list-style-type: none"> • High unemployment and poverty • Lack of institutional coordination • Vulnerable groups (e.g. elderly, unemployed) are the most exposed to social, natural, and other pressures 	<ul style="list-style-type: none"> • Addressing the problem of unemployment • Ensure that the inequality to accessing basic services and housing are addressed • Launch city-level systematic awareness raising programs on shocks and stresses and include how to prepare and cope.

Source: CityStrength Diagnostic workshop, April 2016

Policy and Sectoral Context

The Ethiopia Constitution protects the right to social protection for all citizens, acknowledging that social protection interventions can contribute to overall economic and human capital development. As a result, the Government developed and endorsed the National Social Protection Policy in October 2014.

Responsibility for social protection and community development in the regional capitals sits primarily with the municipality and, specifically, the Offices of Labor and Social Affairs, and Women and Children's Affairs. In the last decade, Ethiopia implemented a series of successful poverty reduction programs that resulted in registration of remarkable economic growth. From 2011 to 2013, the proportion of poor people in the country fell from 29.6 percent to 26 percent, reflecting the previous two years of economic growth, though the numbers of

poor and vulnerable people remain significant. Even as levels of poverty fell, the proportion of food-poor people was estimated at more than 33 percent.⁴² In all the capital cities, efforts are in place to establish and strengthen community support mechanisms called "Community Care Coalitions" (CCCs). CCCs are coalitions of community stakeholders, civil servants and the business community that came together to mobilize resources to support vulnerable groups. In Mekelle and Bahir Dar, CCCs are well-established and functioning in all of the city's kebeles.

Poverty rates vary across the regional capitals, with Dire Dawa and Hawassa having particularly high poverty rates (Figure 3.14). Though poverty has declined in all cities except Dire Dawa since 2011, and many of the cities have poverty levels lower than the national average in 2011, poverty creates a critical vulnerability for people in each of the regional capitals.

Figure 3.14. People Living Below the Poverty line in Regional Capitals (%) (2005 and 2011)

Source: For Mekelle 2011—GTPII of Mekelle city. For all other data—MoFED (2013)

Note: No data for Semera Logia

⁴² National Social Protection Policy of Ethiopia, 2014

How Resilient is the Sector?

Resilience Vision: In a resilient city, residents, including vulnerable groups, are given equal and fair access to basic services. Support structures, such as safety net programs, target all vulnerable segments of the society and effectively deliver their services under any given scenario. All residents have equal opportunity to engage in

the formal economy and have sufficient capacity to deal with and bounce back from shocks and stresses. Decision-making and planning is inclusive and reflects community priorities and needs. A resilient city creates opportunities for a thriving civil society that supports the representation of society, including fair and effective crime prevention and justice systems.

Qualities of Resilience

Quality	Description
Robustness	The level of robustness of the community and social protection system in each of the regional capitals is variable. Unemployment is a critical stress across all of the regional capitals, especially for youth, the very poor, and persons with disabilities. In some cities, lack of municipal capacity and operational infrastructure for social services limit the ability to reach out to the unemployed, socially disadvantaged, and vulnerable populations. There is also lack of a strong post-disaster beneficiary system.
Coordination	Coordination of community development and social protection in the capital cities requires improvement and closer liaison among different services. There is a need for a well-developed system for collaborative planning, implementation, and information sharing.
Inclusiveness	Inclusiveness can be strengthened. In almost all cities, there is a strong view that the community is consulted and involved in the development of infrastructure plans and projects. However, when it comes to plan implementation and accessibility of services, the representation or engagement of the poor and vulnerable in the community is significantly limited. Almost all of the cities noted that, to a certain degree, there are no adequate services for people with disabilities, the elderly and street children, such as feeding centers or spaces for socialization.
Redundant	The Government's Productive Safety Net Program covers woredas in food-insecure rural areas. The Government's Urban Productive Safety Nets Program is currently being phased in in 11 cities across Ethiopia and will help with improving access to the food insecure population.
Reflectiveness	A number of the regional capitals reported that they are in better shape due to reflectiveness of efforts, especially in the area of preventing conflicts and social unrest. Across all cities, there is a lack of updated baseline information on the vulnerable segment of the society, their whereabouts and characteristics. The cities have worked towards preventing illegal immigration.

Source: CityStrength Diagnostic Workshops, 2016

Recommendations

1. Establish a strong coordination system of institutions working on the wellbeing of the society to effectively plan and implement social protection programs:
 - Build the institutional, human resource, and financial capacity of institutions in the community and social protection sector;
 - Establish a strong monitoring and evaluation and information sharing system among these institutions.
2. Addressing the problem of unemployment by:
 - Introducing infrastructure development projects in which the youth and workforce of the city become economically active and engaged in gainful employment;
 - Promoting productive safety net programs in which the socially disadvantaged segment of the population can participate and improve their livelihood and access to basic services.
3. Ensure that unequal access to basic services and housing is addressed by:
 - Resuming the construction of condominium houses and land distribution (Mekelle);
 - Introducing a fee waiver for basic services targeting the socially disadvantaged segment of the population.
4. Launch city-level systematic awareness-raising programs on the negative effects of harmful traditional practices and poor work culture, using different communication media channels (including social media, youth clubs, associations).

5. Develop regional and municipal programs to translate national policies into implementable actions, and establish a system of coordination and financial support among relevant institutions at all levels of government.

3.11. Improving Resilience Considerations at Local and Sectoral Levels

Sectoral assessments confirmed stresses and shocks faced by cities, and identified a number of measures for improving resilience. Many common challenges were noted in sectoral assessments. First, inter-sectoral and inter-jurisdictional coordination came out as a most pressing concern. Second, data collection and management in all sectors is relatively weak and require urgent attention. Third, local technical and financial capacity remain weak to plan, implement and monitor actions. All these challenges affect the overall resilience of cities and need to be addressed urgently.

Sector specific recommendations are critical for managing critical shocks and stresses. Reducing impacts from flooding, fire, and earthquakes requires actions across all sectors. Specific actions include: incorporating hazard information in urban planning and management, implementing hazard-resilient building codes, establishing a contingency budget for emergency response, developing emergency access roads to vulnerable areas of cities, and addressing housing shortages and informal settlement growth challenges through improvements in rental markets, housing cooperatives, and land supply. The development of a local climate and disaster risk management strategy and setting up local DRM units will be critical to strengthening resilience - as need noted by many sectors.

To resolve growing urban stresses, a number of coordinated actions are required in many sectors. The largely monocentric form of

many cities need to balance with additional growth centers to reduce traffic congestion, while making space for new areas to grow and absorb an expanding future population. An integrated urban watershed management approach is needed to improve water scarcity and flooding. Poverty and unemployment need to be addressed by improving strategic local infrastructure to attract firms, diversifying the economic base, and improving the dialogue between public and private sectors. It will be important to target efforts towards specific vulnerable groups who are more exposed to shocks and stresses and have less capacity to cope. Enhancing inclusion is needed to ensure community empowerment and development.

City level assessments, carried out during the CityStrength Diagnostics workshop, identified similar priorities (See Annex 3). The key priorities are to develop or revise the integrated land use

masterplan based on a growing population as well as a climate and disaster profile. Across all cities, it also came out as a priority to incorporate in the living master plan all services and infrastructure. Within a majority of cities, addressing housing shortage and improving DRM capacity, including the development of a DRM unit and local DRM strategy, came out as priorities. Bahir Dar and Mekelle identified pollution management as a key priority, while addressing unemployment and poverty through local economic development came out as a priority in four cities.

While many actions were identified in sectoral and local assessments to improve resilience, a number of these can be consolidated into five key areas of priorities. The next chapter details these priorities in an actionable format, identifying next steps for different implementing agencies.

IV. PRIORITY ACTIONS AND INVESTMENTS

4. Priority Actions and Investments for Urban Resilience in Ethiopia

Ethiopia's regional capitals are at a crossroads. Decisions made today about the type and location of infrastructure, services, and buildings will affect the overall safety of the cities in the years to come. How they manage and support the poorest and most vulnerable groups will also affect their overall long-term resilience. The unprecedented population growth in these capitals provides an opportune moment to strengthen preparatory planning and management of disaster and climate risks. Working toward the safe and resilient agglomeration of people and economic activity can ensure that cities' local goals are achieved as well as Ethiopia's national goal of becoming a middle-income country. To do otherwise, by adopting a business-as-usual approach to urban growth, could exacerbate impacts from shocks and stresses and undermine efforts to achieve these goals.

Based on sectoral and cities priorities, the following key objectives were identified:

1. Effectively manage rapid urban growth in a risk-sensitive manner, focusing on the most vulnerable populations;
2. Better manage flooding and water scarcity;
3. Improve disaster preparedness, including fire safety and response;
4. Strengthen the building regulatory framework to mitigate seismic risk and ensure overall safety; and
5. Support implementation of urban planning and key sectoral priorities.

This chapter describes the priority actions and investments identified to meet the above objectives. These recommendations are based on the detailed sectoral and citywide priorities identified during multiple CityStrength diagnostics workshops conducted from 2015-2016.

4.1. Effectively Manage Rapid Urban Growth in a Risk-Sensitive Manner Focusing on the Most Vulnerable

Rationale: Population in the 10 regional capitals is going to increase by nearly four million people in the coming 20 years, almost doubling each city's population and adding more than half a million people in five of the bigger cities (Adama, Dire Dawa, Hawassa, Bahir Dar, and Mekelle). Effectively managing urban growth on this scale requires proactive, coordinated, and integrated planning and implementation of plans, taking into account disaster and climate risks. Dedicated support for implementation and coordination is needed. Although every city has prepared master or structural plans, implementing the plans remains a challenge because of financial and technical capacity constraints and interjurisdictional coordination issues. More needs to be done to proactively manage informal settlements and avoid obstruction of cities' natural drainage systems.

Actions and Investments

1. *Develop integrated, coordinated, and risk-sensitive urban planning, implementation, and monitoring processes.*
 - a. *Strengthen risk-sensitive planning, coordination, and implementation across sectors, jurisdictions, and government levels:* This will require (i) identifying, mapping, and incorporating hazard risk factors into land-use and structural plans (see Priority 4 above), (ii) establishing a taskforce to facilitate coordination during the planning and implementation, and (iii) improving stakeholder consultations in all planning actions.
 - b. *Develop a central information system on planning and risk data:* Nationally, there is a strong need to ensure that spatial and temporal data management in different sectors follow standards of coding and platforms that allow interoperability across agencies and jurisdictions. It would be particularly useful to develop a common network of geocoded information available to different agencies in real time. It is recommended, therefore, that a

nationwide geocoded data master plan be developed.

Apart from local measures to improve coordination and data management across sectors, strengthened coordination and excellence in urban planning are critical at the national level. Cities across Ethiopia will grow rapidly in the coming decades, but individually, they lack capacity to plan for and manage that growth. This includes aspects such as where to site expansion areas, how to develop polycentric urban forms, where and how to develop transport networks and other infrastructure, how to manage water resources over time, and a myriad of other issues. These challenges are too great for city administrations to address on a day-to-day basis, but also too daunting to be considered only every ten years during a master plan exercise. Rather, they require ongoing analysis, especially as the understanding of the changing climate develops. City administrations also require specialized expertise that may not be available in each city, or, indeed, in the locally-affiliated university. It is proposed, therefore, to develop new think-tanks—or strengthen existing academic institutions—at the national level (See Box 4.1).

BOX 4.1.

National Urban Policy Think Tank for a Resilient Ethiopia

A new applied national policy research institution—or strengthening existing research institutions—would serve as a think tank to incubate, foster, and centralize thinking about low-carbon and resilient urbanization in Ethiopia. This national-level initiative would include ongoing analysis and evolving expertise, especially as our understanding of climate change develops. The institution can provide services to cities throughout Ethiopia, such as strategic studies, modeling and performance scenario analyses in a variety of subjects such as land use and mobility. It might also function as an urban observatory to track key benchmark data, foster collaborative research, and support pilot practice around the country. A number of Asian countries, including the Republic of Korea and Japan, have established similar types of think tanks, which might serve as useful models for moving forward.

2. *Resolve housing shortages and support the most vulnerable community groups:*
 - a. *Strengthen the rental market* in cities by encouraging owners to rent their units, and incentivizing property developers to construct rental units.
 - b. *Increase access to land* to build housing that is accessible by the urban poor and increase supply of land to meet the regularization backlog. The access to land should be carefully planned to incorporate hazard and climate change considerations as well as overall accessibility during any emergency.
 - c. *Improve living conditions* of existing housing units by in situ upgrading in kebele housing and informal settlements. Taking an integrated and comprehensive development approach, this will include measures to improve flood and fire preparedness in existing settlements, including investment in streets, drainage, solid waste management, community-based awareness raising, and flood warning and response (see Box 4.2). It will also include measures to improve skills and employment opportunities on one hand, and health and education on other hand.

BOX 4.2.

Flood Management as Part of a Holistic Approach to Informal Settlement Development in Indore, India

Indore's Slum Network Project (SNP) in India is a project that adopted a holistic approach to urban improvement in which slums are an integral part of the city. Instead of ignoring and denying the reality of slums, they were viewed as urban nets to upgrade the whole city in an integrated way. The SNP worked at two broad levels: the slums and the city. In the slums, the SNP substantially upgraded the quality of life by engineering innovations, notably the creation of household infrastructure and improvement in the overall slum environment. Across the city, instead of upgrading slums one at a time, the SNP approached the matrix of slums as an opportunity for augmenting infrastructure city-wide. This is because watercourses, which are central to major locations of slum settlements, also represent the most efficient lines for infrastructure provision. New infrastructure provided in individual slums was linked to that of other slums and to the existing city systems in order to bring about significant improvements to the city as a whole. In doing so, the SNP generated economies of scale: the cost of underground sewerage and centralized treatment under the Slum Networking approach was Rs. 1,500 (US\$44) per slum family for the on-site provisions and Rs. 1,000 (US\$30) for the off-site collection and treatment. This total cost of Rs. 2,500 (US\$74) per household was the same as that of a shared twin pit latrine (developed by UNDP) but the advantages are considerably greater. With the SNP's integrated holistic view, all families have individual facilities and a much cleaner living environment.

Source: Jacobsen, Michael; Webster, Michael (2015) ; Diacon (1997).

4.2. Better Management of Flooding and Water Scarcity

Rationale: The majority of regional capitals face both growing flooding impacts and severe water scarcity. With climate change, the frequency and intensity of flooding and water scarcity will increase if actions are not taken. The current piecemeal approach relying on structural measures (primarily retention walls or drainage channels) and/or relocating at-risk populations does not provide effective and long-term flood mitigation solutions.

Actions and Investments

3. *Plan and implement integrated flood risk management in all regional capitals:*
 - a. *Undertake and mainstream integrated flood risk management planning:*
This includes (i) improving drainage systems based on watershed-level planning for future populations and hazard exposure, dynamic flood risk modeling (including mapping for flood plains and dry river beds), and incorporating the work into land-use planning and zoning and infrastructure and building development; (ii) improved liquid and solid waste management, including addressing water pollution; (iii) encouraging urban watershed management, including upstream runoff; and (iv) improving green and recreational areas that can enhance water absorption, recharge groundwater aquifers, and serve as buffer zones to prevent encroachment on flood-prone areas.
 - b. *Establish flood warning and preparedness:* To better prepare for flooding, the cities need to establish or build on existing flood warning systems, linking them with the National Meteorological Agency, the National DRM Commission, and Regional Bureaus. Flood preparedness plans need to be developed as a part of city-level contingency plans and linked with community preparedness activities (especially for those communities at high risk).
 - c. *Invest in implementing and monitoring integrated flood risk management plans:* National and local governments should prioritize investing in implementing and monitoring integrated flood risk management plans.
4. *Resolve water scarcity and address the challenges of climate variability through improved monitoring and recharge of aquifers.* To meet the fast-growing demand for water resources, it is important to take actions that focus on increasing efficiency in service provision and groundwater recharge while identifying alternative sources. It is recommended to establish a national taskforce to address this challenge and which can commission and supervise needed studies to identify improved policy and practice, with detailed actions required at national, regional and local levels.

BOX 4.3.**Integrated Urban Water Management in Teresina, Brazil**

Integrated urban water management (IUWM) is a holistic approach to managing water usage at the level of the watershed, recognizing the needs of the city as well as upstream and downstream users. IUWM integrates land use, water supply and sanitation, management of storm water and solid waste, and engages stakeholder participation to clarify the diversity of water needs and ensure that water quality is matched to its intended use.

IUWM has been applied in many cities across the world. In Brazil, the city of Teresina was frequently flooded. It lacked green spaces and suffered from high social vulnerability, poor infrastructure, solid waste pollution in its lakes, and informal settlements near flood-prone areas. A concentrated program of IUWM included drainage and flood control, waste water collection and treatment, improved sanitary facilities in low-income households, and reduction of lake pollution, in concert with urban infrastructure projects such as roadways, leisure spaces and schools. Residents were engaged throughout the IUWM process.

Through the IUWM process, the City of Teresina made significant strides towards community resilience. More than 26,000 people were protected from floods (50-year return period); 25,000 people gained access to sanitation; urban roads were rehabilitated; a newly constructed park provided drainage and leisure space, and became a source of local pride; 500 families resettled away from areas at risk; and 168 very poor families benefitted from household improvements.

BEFORE **AFTER** **BEFORE** **AFTER**

4.3. Improve Disaster Preparedness Including Fire Safety and Response

Rationale: The regional capitals do not have a dedicated budget or staff to plan, mainstream, and implement disaster and climate risk management actions. The cities do not provide flood warnings or earthquake, landslide, or volcano alerts, and currently no disaster contingency plans are in place to prepare communities for disasters. The cities have very limited human resources and no financial contingency to deal with disasters. Cities also lack adequate equipment and resources to respond to fire or take fire safety measures, especially in tall buildings and informal markets. With growth in cities' populations, higher fire-related mortality is expected, which is already high in Ethiopia.⁴³ These resources and infrastructure are needed to improve overall safety and to enhance each city's competitiveness and its potential to attract and retain new investments.

Actions and Investments

5. *Establish a Disaster Risk Management Institutional Framework in cities:* Following the new national DRM policy, extend the existing national and regional DRM structure to the cities with dedicated staff and budget within city administrations. The urban DRM unit will be in charge of developing a DRM strategy, including: (i) securing early warning on flooding, drought, and high winds, and alerts for earthquakes and landslides; (ii) ensuring community disaster preparedness; (iii) developing contingency planning and budgeting; and (iv) exploring risk financing and insurance options. City-based DRM units can build on the structure and systems of the existing National DRM Commission, such as the National Incident

Management Systems to ensure timely warning and response.

6. *Improve disaster data collection, risk assessment, and information sharing:* There is an urgent and ongoing need to understand what and where are the risks, in order to rationally allocate resources. This can build on the Woreda Risk Profile system and includes the following:
 - a. *Generation and Analysis of Hazard and Risk Information:* More information on local geotechnical and hazard risks (e.g., earthquake, flooding) is required for DRM and planning. Risk analysis tools should be developed and implemented to generate hazard and risk maps to inform decision-making.

Activity: The specific nature of these tools would be based on a user needs assessment as an essential first step. The tools could be web-based or stand-alone and are intended for use at local, regional and national—including ministerial—levels of government. Such work will ensure access to the up-to-date data and enable enhanced risk communication. Concurrent with development of risk analysis tools would be detailed mapping of high flood and seismic hazard areas, providing land use planners and design professionals with reliable data.
 - b. *Seismic and flood hazard monitoring instruments and stations:* Current earthquake and flood instrumentation is inadequate and needs improvement. Such instruments are critical for gathering hazard information needed to inform risk modelling as well as to ensure building codes and land

⁴³ Ethiopia is effectively spending roughly 1.5 percent less on fire protection features in buildings than middle and high-income countries (as a fraction of total building cost) and suffering close to 20 times the mortality, which currently totals close to 12,000 deaths per year.

use plans are risk-informed. Such instruments are also critical in developing early warning systems for impending floods and earthquakes.

Activity: A systematic diagnostic could be carried out to identify gaps in earthquake and flood monitoring capacity (e.g., seismometers, flood gauges) to generate a prioritized action plan for developing a network of seismic and flood hazard monitoring stations. This activity would involve procuring required monitoring equipment, developing network connectivity between stations as well as implementing state-of-the-art information management technology. Such investments will require corresponding technical assistance, including (a) evaluation of institutional business model and service delivery capacity;⁴⁴ (b) assessments of the roles,

responsibilities, and coordination mechanism of hazard monitoring, disaster risk management and building safety authorities in order to strengthen them; and (c) establish nationwide standardized criteria on data gathering and analysis (i.e., forecasting methodologies) as well as Standard Operating Procedure (SOP) for early warning systems (i.e., an up-to-date training on current data, tools, and products for early warning systems and exchange activities between national meteorological and hydrological services, DRM agencies, and other stakeholders).

A joint task force between the Ministry of Urban Development and Housing and the National DRM Commission can identify next steps to improve risk information collection and sharing, and coordination on DRM actions.

Figure 4.1. Benefits and Results of a DRM Oversight Unit and a Comprehensive DRM strategy

⁴⁴ Such an evaluation would include (but not be limited to) three aspects: (1) institutional assessment, with special attention paid to budgeting, financing and cost-recovery when considering the sustainability of seismic and climate information services; (2) situation and gap analysis of observation networks and forecasting systems; and (3) assessment of the use and integration of seismic, meteorological and hydrological monitoring services within an overall disaster risk management framework.

7. *Improve fire and rescue response capacity by providing financial and technical support to fire services:* A needs assessment of the fire support services will identify the specific training and equipment needed to improve response capacity for densely populated buildings and neighborhoods. An investment program will assist in providing mobile firefighting units and search and rescue

equipment appropriate for city responses to fire incidents. Special attention will be paid to ensuring that equipment is tailored for use in areas that experience chronic water shortages. Finally, fire services will be enabled to take a more proactive role in assisting city officials in identifying building code violations that could have fire safety implications.

BOX 4.4.

Improving Emergency Preparedness in the Regional Capitals

Short-term priority investments (two- to three-year horizon)

- Training and resources for key city officials responsible for DRM to enable them to implement national DRM policy
- Technical support for a comprehensive all-hazards risk vulnerability assessment for each city
- Technical support to develop city-level early warning strategies
- An equipped Emergency Operation Center in each city to improve the capacity of first responders (fire, police, and emergency medical services) to provide fast and reliable emergency response. It may also include structural retrofits
- Safety training and personal protective equipment (PPE) for fire response units

Medium-term priority investments (five-year horizon)

- Training for city officials and emergency responders in the implementation of National Incidence Management System (NIMS)
- A public emergency preparedness program
- Technical support for the development of a hazard mitigation plan for each city
- City emergency operations plans, including development and testing
- Technical support for a skill and salary review for fire responders at the city level per city
- PPE and critical disaster response equipment for first responders
- Technical support for the development of emergency response plans for industrial parks

Long-term priority investments (ten-year horizon)

- Support to implement strategic elements of city hazard mitigation plans
- Training equipment for the National Fire Training Academy

Box 4.5 provides an example of how emergency management is structured in cities in other countries.

BOX 4.5.

An Example of City-level Emergency Management Structure

York Region, Ontario, Canada

The York Region (population 1,175,690) consists of nine local municipalities in the province of Ontario: Vaughan, King, East Gwillimbury, Newmarket, Georgina, Markham, Aurora, Richmond Hill, and Whitchurch-Stouffville. As part of their legislative compliance, each municipality in Canada must appoint an Emergency Management Program Committee, consisting of at least two municipal employees with the authority and ability to provide strategic direction and make decisions about emergency management programming. Each municipality is also responsible for assigning a Community Emergency Management Coordinator, whose role is to implement and maintain a Municipal Emergency Management Program, as required by the Canadian Emergency Management and Civil Protection Act. In many municipalities, this individual is the Fire Chief, Police Chief, or Emergency Management Program Coordinator. This individual must complete a standardized training and earn a certification in emergency management at the municipal level

Figure B4.5.1. York Region Emergency Management Structure (Ontario, Canada)

Best practice is to have a dedicated person assigned as the community emergency management coordinator. For larger cities or cities that experience frequent disasters, however, it is not ideal for the fire or police chief to have the additional responsibilities of a community emergency management coordinator.

4.4. Improve Building Regulatory Frameworks to Mitigate Seismic Risk and Enhance Overall Safety of the Built Environment

Rationale: The regional capitals are witnessing rapid growth in new construction but have limited capacity to ensure that the new and existing structures are built to safely withstand earthquake, flooding, fire, spontaneous collapse, and other harmful conditions. Regulatory implementation and monitoring can have significant impact on the long-term safety, productivity, and resilience of the urban built environment. Without improvements in planning, building inspection and regulatory departments, a significant proportion of the regional capitals will be at risk from unsafe buildings susceptible to the above mentioned risks as well as many others.

Actions and Investments

8. *Reduce risk in the existing built environment:* The proposed activities address the urgent need to reduce high risk situations that currently exist in the built environment. They would serve as the bulk of a recommended investment program as they involve civil works and structural upgrading of public buildings.
 - a. *Funding Rapid Visual Screening (RVS):* There has been no recent comprehensive survey of prevailing risks in the built environment with regard to vulnerability to seismic, flood and fire risks. Public schools and hospitals should receive the initial attention of a nationwide screening effort that would inform and help prioritize future retrofitting efforts to be undertaken as part of a larger integrated investment on building safety. This activity would fund a survey of public buildings to identify

those requiring structural upgrade and retrofit.

Activity: Conduct Rapid Visual Screening of schools, hospitals and critical public structures in Addis Ababa and 10-15 other cities of Ethiopia. The RVS surveys will be based on three parameters: exposure, vulnerability and occupancy. The outcome of this activity will be an inventory of public buildings vulnerable to seismic and fire risks. For structures identified as vulnerable to floods, other measures will be suggested which may not be directly related to structural upgrade and retrofit but may involve interventions such as relocation or community-wide flood protection. The rapid review will provide the basis for conducting a more comprehensive structural analysis to define priority structures to be retrofitted (with associated cost).

- b. *Funding facility for building retrofits:* The Government of Ethiopia has a significant public contingent liability to chronic risk and disaster—particularly in its built structures (i.e. schools, hospitals, government facilities). To reduce future potential risks of disasters, the Government can invest in building retrofits and structural upgrades to ensure public buildings (and the people they serve) are resilient to chronic risk and disaster.

Activity: Based upon initial findings from the RVS, a more in-depth comprehensive structural assessment will be carried out. The outcome of this activity will be a prioritized investment plan for structural retrofits—to be financed with either government, development partner and/or multilateral development finance.

9. *Establish quality enhancement review and regulatory processes at national and local levels:* This includes the development of a multitude of capacities—for building and planning departments, design professionals, and construction workers—to build safe buildings. These activities are largely technical assistance in nature and will address the urgent need to ensure quality of construction. This will entail quality requirements and code compliance for buildings and will require well-trained staff able to implement regulatory processes and enhancement reviews.

Activities under this action address the need to avoid building future structures that are unable to withstand shocks, through the enhancement of existing quality assurance mechanisms, as Ethiopia engages in a massive urban development boom over the next several decades. Without improvements in its planning and building inspection and regulation departments, a significant proportion of Ethiopian cities will be at risk from unsafe buildings susceptible to structural collapse, fire, earthquake and other risks. Ensuring the construction quality of new buildings requires code compliance, which can only be accomplished by appropriately staffing building and planning departments with well-trained staff as well as implementing programs which raise the capacity for safety among design professionals, builders and construction workers.

- a. *Information and communications technology (ICT) platforms for building and inspection departments:* Building departments and building inspectorates are generally ill-equipped with information technology (IT) hardware and software, making it difficult to conduct sufficient plan review and inspection. The absence

of IT infrastructure also undermines efforts to provide adequate levels of information and transparency to builders and owners. Improvements in administrative efficiency consistently improve regulatory effectiveness.

Activity: Conduct a preliminary detailed process-mapping and re-engineering of administrative procedures to determine appropriate technology and scope of modernization. This could be carried out in building departments in Addis Ababa and 10-15 other Ethiopian cities in the initial phase. An investment would likely support new functions, including: updating and digitizing a database with spatial data; digitizing archives of permits and other decisions; establishing a workflow management tool (including document management and archiving); creating online submission of building plans and issuance of permits; training municipal building officials on new processes; supporting field inspections using mobile devices; and supporting management reporting and oversight.

- b. *Training of building inspectors and building code officials:* At the city level, there is an insufficient number of qualified and specialized staff, which is a significant operational challenge. Currently, there is a shortage of specialized engineers in building departments, especially in electrical and sanitary engineering. Building officials must demonstrate technical competency in areas of review and inspection for which they have responsibility. The absence of consistent qualifications and specialized skills undermines the capacity of building departments and building inspectorates to carry out

robust controls—both at the design and construction stages.

Activity: Carry out a training needs assessment at the national level, and train building inspectors and building code officials in Addis Ababa and 10-15 other Ethiopian cities with a focus on teaching and familiarizing technical and engineering municipal staff with the new building code requirements.

- c. *Training of private engineers and tradesmen:* There is no qualitative assessment of professional capacity for building practitioners, including engineers and architects. Professionals are only evaluated based on their years of experience and the number of projects they have worked on, irrespective of the degree of complexity. A widespread concern in Ethiopia is the limited capacity and workmanship of lower level contractors, vocational workers and tradesmen. These issues lead to insufficient and inconsistent levels of qualifications of building practitioners.

Activity: Conduct a comprehensive capacity needs assessment, in partnership with the Ministry of Construction, building professional associations and academia. This activity will support the Construction Management Institute and other relevant partners in designing, setting up and delivering needed training programs for engineers, architects, tradesmen and vocational workers on topics ranging from risk-informed design to good construction practice and occupational health and safety.

- d. *Enhanced Permitting and Inspection Procedures:* Currently, a procedure is in place for plan review and inspection.

However, the current procedure provides little guidance for reviewers and inspectors to conduct a more qualitative review that includes code compliance from planning through construction.

Activity: To enhance current permitting and inspection procedures, current Standard Operating Procedures will be updated to include a how-to guide for building code officials, plan reviewers and inspectors to conduct a more performance-based review and inspection of plans and structures. Such procedures can include improved checklists involving more complex inspections on potential building performance as well as identifying focal points in the federal ministry and academia to advise on more complex issues. Standard coordination procedures should also be laid out in this regard. The SOP will also include a standardized report-back mechanism documenting outcomes of the review and inspection to enhance transparency and improve communication between building officials and building professionals.

- e. *Enhance soils and construction materials testing facilities:* Regional testing facilities often lack the needed financial and technical resources as well as equipment to conduct appropriate testing of soils and construction materials—especially for high-rise construction.

Activity: Conduct a comprehensive needs assessment of facilities and equipment to test soils and construction materials—with particular attention to identifying equipment required to test building materials used in high-rise

construction (e.g., tensile testing for rebar, compressive strength testing for concrete). Based upon this assessment, produce a detailed procurement plan for critical missing testing equipment for soils and building materials. This activity will also include corresponding training in equipment operation and use.

4.5. Support the Key Sectoral Priorities

Rationale: Sectoral assessment carried out during this TA found that a number of steps are needed to ensure robust functioning of the key city sectors to improve resilience. Specifically, SWM affects functioning of drainage systems in the cities, increases flooding risk, and also affects disease outbreaks. Water supply and sanitation remains critical because water scarcity can jeopardize cities' functioning and health and safety. Better transport and roads are needed to ensure timely response to emergencies in at-risk areas of the cities (such as informal markets and settlements). Rehabilitation of energy networks is needed to avoid fire incidents caused by faulty wiring, as well as to ensure a 24-hour network for efficient functioning of hospitals, schools, businesses, and offices. Equally essential, improvements in urban finance are needed not only to ensure financial resources for infrastructure and services but also for contingency funds during emergency.

10. *Support key sectoral priorities:* To improve inter-sectoral and coordination, data collection and management, and technical and financial capacity, an inter-sectoral committee can review current coordination mechanisms and suggest improvements, especially with regard to developing integrated and resilient urban development and capital improvement plans. A national think tank can potentially support regional capitals and secondary cities to improve overall technical capacity.

As a part of the integrated and resilient urban development plan, investments in the following key sectoral priorities is proposed for all cities:

(i) *Solid waste management (SWM):* Improve SWM collection services primarily for communities exposed to flooding; ensure appropriate disposal of solid waste by developing appropriate disposal sites; and develop integrated SWM plans for each city, taking into consideration future needs;

(ii) *Water supply and sanitation:* To improve water security, improve the quality of services and capacity of water utilities, making the sector more inclusive, reliable, and robust. Special attention should be given to conserving water sources, avoiding overexploitation, and monitoring and recharging the aquifers;

(iii) *Transportation:* Improve accessibility to at-risk areas of the cities (such as informal markets), schools (often used as shelters) and hospitals; improve public transportation services, reduce congestion, and increase safety measures; and foster the development of integrated land use, transportation, and drainage plans;

(iv) *Energy:* Rehabilitate and expand distribution networks to reduce fire incidents and increase access; improve the use of renewable energy sources while increasing robustness, redundancy, and reliability; and

(v) *Urban finance:* Improve policies for collection and use of municipal revenues, develop a contingency plan and dedicate funds to improve access to finance during emergencies.

Table 4.1 summarizes the priority interventions identified during the CityStrength Diagnostic exercise, and includes proposed implementing agencies.

Table 4.1 Priority Interventions, and Implementation Responsibility		
Timeline	Actions and Investments	Implementation Responsibility
I. Effectively manage rapid urban growth in a risk-sensitive manner, focusing on the most vulnerable		
Short term	1. Develop integrated, coordinated, and risk-sensitive urban master planning, implementation, and monitoring processes	CA, ULGs, MoUDH,
Short to medium term	2. Resolve housing crisis and support the most vulnerable	CA, ULGs, MoUDH, relevant line ministries
II. Better management of flooding and water scarcity		
Short term	3. Plan and implement integrated flood risk management in all regional capitals	CA, ULGs, MoUDH, MoWIE, NDRMC
Short to medium term	4. Resolve water scarcity	CA, ULGs, MoUDH, MoWIE, NDRMC
III. Improve disaster preparedness including fire safety and response		
Short term	5. Establish Disaster Risk Management institutional framework	CA, ULGs, MoUDH, NDRMC
Short to medium term	6. Improve disaster data collection, risk assessment, and information sharing	ULGs, MoUDH, NDRMC, CA
Short to medium term	7. Improve fire and rescue response capacity by providing financial and technical support to fire services	ULGs, MoUDH, NDRMC, CA
IV. Improve building regulatory framework to mitigate seismic risk and enhance overall safety		
Short term	8. Reduce risk in existing environment by assessing key infrastructure to be retrofitted and developing an investment plan	MoC, MoUDH, RB, CA, ULGs
Short to medium term	9. Establish Quality Enhancement Review and regulatory process at national and local levels	MoC, MoUDH, RB, CA, ULGs
IV. Support key sector priorities		
Medium term	10. Support key sectoral priorities as a part of integrated and resilient urban development	CA, ULGs, MoUDH, relevant line ministries

Note on abbreviations: CA: City Administration; MoC: Ministry of Construction; MoUDH: Ministry of Urban Development and Housing; MoWIE: Ministry of Water, Irrigation and Electricity; NDRMC: National Disaster Risk Management Commission; RB: Regional Bureaus; ULGs: Urban Local Governments.

Moving forward with the resilience agenda will require mainstreaming the above-mentioned priorities in relevant government and donor programs, such as the Urban Local Government Development Project, Urban Safety Net Project, as well as sectoral priorities and programs. At the same time, a dedicated investment program will be needed to support core resilience priorities (see Box 4.6 below).

BOX 4.6.

A Safe and Resilient Cities Program in Ethiopia

Proposed Objective: The overall objective of the proposed intervention is to strengthen preparedness and response to disaster and climate risks in Addis Ababa, Dire Dawa, and the regional capitals, focusing on reducing vulnerability of the current and future built environment.

Expected Results: The proposed intervention will enhance the capacity of targeted city administrations to effectively prepare for, respond to, and recover from disasters and other emergency events. It will improve flood, fire and earthquake preparedness and response, strengthen risk sensitive and integrated land use planning and implementation, and the quality of new building construction, with the following anticipated results:

1. Build effective local capacity for incorporating disaster and climate risk in integrated land use plans;
2. Establish effective emergency preparedness and response to all emergencies, particularly flooding, fire, and earthquake;
3. Provide a safer built environment, via:
4. Improved built environment including capacity to enforce the quality of new building construction and development of a program to reduce existing physical vulnerability;
5. Effective and well-functioning urban drainage network; and
6. Improved urban watershed management, with effective preparedness for flooding and water scarcity.

Proposed Interventions: Three main components include:

1. Improving climate and disaster risk management will require:
 - Establishing a climate and DRM unit with a dedicated staff and budget within the city administrations or Urban Local Governments, and developing national and regional capacity to improve coordination during emergencies;
 - Improving disaster data collection, risk assessment, and information sharing, and linking it with risk-sensitive and integrated development; and
 - Special attention is required to improve flood warning, earthquake alert, fire and rescue response capacity by providing financial and technical support to local emergency operation centers or fire departments, and improving coordination and connectivity from national and regional levels to cities.
2. Safer built environment: The following priority reforms are proposed to ensure effective regulatory processes and a culture of compliance:
 - Avoid the creation of new risks by enhancing existing quality assurance mechanisms, including the development of capacity for building and planning departments, design professionals and construction workers;
 - Reduce risk in the existing built environment by prioritizing retrofit programs, initially targeting public buildings, schools and hospitals.
3. Risk mitigation investments: Resilient development during rapid and unprecedented urban growth requires integrated, coordinated, and risk-sensitive urban planning, followed by adequate implementation and monitoring processes. Two key risk mitigation options are proposed:
 - Planning and implementing integrated urban water and flood risk management, including drainage network solutions; and
 - Implement integrated and risk-sensitive development in selected high-risk areas, including building retrofitting within cities, prioritizing the most vulnerable population.

Making the Case for Resilience

Investment in improving resilience—better hazard considerations in land use, building regulations and sectoral planning, as well as improved emergency preparedness in Ethiopian regional capitals would provide many benefits. The most obvious benefit is the lives and property saved in disaster or emergency situations. A dramatic reduction in fatalities and serious injuries and less diversion of city resources to disaster response and recovery can strengthen trust in and legitimacy of government structures and authority, opportunities for optimization of resources, and conformity to international standards and practices.

Benefits of improving building regulations

Just by improving the provision and enforcement of building regulations, potential losses from fire, earthquake and flooding can be reduced considerably. An assessment carried out for this study found the following benefits (See Annex 3 for details):

- **Improved compliance with fire safety measures could save 160,000 lives by 2050:** The estimated number of lives saved is based on data-driven estimates of the benefits of improved fire protection that would result from compliance with the fire code, improved construction and egress, installation of sprinklers and the assurance of fire-resistance materials.
- **Compliance with building seismic provisions would reduce Average Annual Losses by 30 percent by 2050, from US\$128 million to US\$90 million:** Under current building regulation practices, particularly in urban areas, estimated AAL would increase to US\$128 million by

2050. If building regulation practices are improved and if it were possible to ensure compliance with seismic design codes, estimated AAL would be cut by about 30 percent, to US\$90 million, a net annual reduction of about US\$38 million. Thus, for example, an investment of US\$10 million in improving building regulation would be expected to result in savings of about US\$600 million from earthquake losses alone, or very approximately a benefit-cost ratio of 60.

While Ethiopian cities are not exposed to severe earthquakes, even moderate events can cause huge human and economic losses. Such events are not to be dismissed; in 1906, a magnitude 6.8 earthquake occurred within tens of kilometers of Addis Ababa. For comparison, in 1960, a magnitude 5.7 earthquake in Agadir (Morocco)—a city which had construction very similar to that in Ethiopia—caused significant damages and nearly 12,000 deaths.

- **If flood management practices were improved, it is estimated that the AAL would be reduced to about US\$93 million, a net annual reduction of about US\$230 million each year:** If flood management practices were improved,⁴⁵ estimated AAL would be reduced to about US\$93 million, a net annual reduction of about US\$230 million each year. For the purpose of this estimate, the term “improved practices” refers to compliance with appropriate design and land use requirements and better facilities for structural flood control.⁴⁶

⁴⁵ Improvement in flood management practices were quantified based on the assumption that urban areas would receive flood protection measures equivalent to a 100-year flood, and other areas equivalent to a 50 year flood.

⁴⁶ Such facilities would typically involve levees, flood walls, dams and bypass structures. The investment required to achieve the assumed level of flood improvement is currently not quantified.

Achievement of local goals, economic growth, and job creation

All the regional capitals want to attract investment and become cities with a vibrant local economy and better quality of life. Achieving these goals will require investing in improving resilience. Resilience investment has considerable benefits for cities, measured not only in terms of lives saved and damages averted, but also in terms of economic growth from infrastructure built or enhanced, services delivered, or increased supply of developable land (i.e., land not contaminated or located in areas at high-risk for natural disaster). Economic growth also stems from increased land values following on investment in environmental remediation or infrastructure investments protecting land from natural disasters. All these measures improve the competitiveness of cities and make them more appealing for investors.

More assurance for investors who can anticipate fewer disaster losses, leading to increased private investment in homes, buildings, and other properties that comply with safety standards, increased capital investment in infrastructure, including retrofitting, renovation, and renewal, and increased tax base, business opportunities, economic growth, and employment as safer and better-governed cities attract more investment. Many cities, such as Hawassa, are attracting investments through industrial parks. Yet even a single seismic or disaster event can affect a city's competitiveness in attracting and retaining private investments.

Looking Forward: Investment in Resilience for Thriving Cities

Ethiopia is well-positioned to enhance resilience in its capital and secondary cities. These urban centers are the engines of economic growth, with potential to further improve overall prosperity and reduce poverty. With strong commitment from leading ministries to address the shocks and stresses that threaten to set back

development gains, rapid economic growth and urbanization present an opportunity to improve cities' resilience and economic competitiveness. The findings and recommendations of this report aim to help Ethiopia address urban challenges, highlighting the need for long-term investment in strengthening resilience.

Bringing transformative change to Ethiopia's regional capitals will require sustained leadership and changes in behavior at all levels, along with access to finance, enhanced incentives for local leaders, and improving advocacy and awareness through media. Capacity building at all levels will be essential. Development of a national think tank can improve overall technical capacity in the regional capitals and secondary cities. To keep up the momentum, enthusiasm and incentives—for government staff, local leaders, NGOs/CSOs, and local universities—will have to be explored. This will require a review of current awards and salary, and recommendations for other ways of supporting momentum, such as through study visits. National, regional and local advocacy on preparedness for shocks and stresses will require incorporating resilience-based lessons in school curricula, incorporating drills in schools and raising citizen awareness through media and other sources. Finally, and most importantly, it will be critical to access finance for investing in urban resilience. Potential approaches include international and national climate and DRM funds, innovative financing by establishing a local fund, and exploring ways of involving the private sector.

Ethiopia is at a crossroads. Urban development with a business-as-usual approach will lead to higher impacts from future disasters and climate change, threatening viability of urban centers and development gains to date. In contrast, forward-looking investment in resilience—in infrastructure, institutions, and awareness—will lead to thriving, competitive and inclusive urbanization.

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V. ANNEXES

Annex 1: List of Key Stakeholders from City Administrations

Adama: Ato Aman Hussien (City Manager, Adama City Administration); Ato Abera Sori (Head of Urban Development, Adama City Administration); Ato Ahmed Bekeli (Head of Housing Office, Adama City Administration); Ato Lema Asfaw (Head, Environmental Protection Office, Adama City Administration); Ato Fekadu Dubisa (Building Chief, Adama City Administration); Ato Rashid Kedir (City Profile Head, Adama City Administration); Ato Negassa Lemi (Head, Water Supply and Sanitation, Adama City Administration); Ato Muluneh Dhabesa (Head, Urban Beautification and Greenery, Adama City Administration); Ato Aman Kedir (Head of Transport Office, Adama City Administration); W/ro Tigist Girma (Head of Land Administration, Adama City Administration); Ato Yoannes Garedew (Head of Finance Office, Adama City Administration); and Ato Dawit Abera (Head of Labour & Social Affairs, Adama City Administration).

Addis Ababa: Ato Walelign Desalegn (Director, Rivers, River Sides Development and Climate Change Adaptation Project Office, Addis Ababa City Administration); Ato Moges Agonafir (Expert, Road Maintenance Department, Addis Ababa City Administration); Ms. Fikrete Mamo (Road Management Officer, Addis Ababa Roads Authority, Addis Ababa City Administration), Ato Efreem Bekele (Team Leader, Addis Ababa and Surrounding Oromiya Integrated Master Plan Project Office, Addis Ababa City Administration).

Assosa: Ato Tewfik Abdulkayoum (Mayor, Assosa City Administration); Ato Temesgen Disassa (Head, Bureau of Urban Development and Housing, Beneshangul Gumz Region); Ato Asadiq Abas (City Manager, Assosa City Administration); Ato Bderdin Ahmed (Transport Head, Assosa City Administration); Ato Misganaw Tesfa (Expert, Urban Greenery and Solid Waste office, Assosa City Administration); Ato Abdulaziz (Head, Water Supply and Sanitation Office, Assosa City Administration); W/ro Sinknesh Haile (Head, Finance Office, Assosa City Administration); Ato Ahmed Yahy (Expert, Construction Management, Assosa City Administration); Ato Fida Workineh (Expert, Disaster Risk Management Office, Assosa City Administration); and Ato Senai Lema (Head, Urban Development and Housing Office, Assosa City Administration).

Bahir Dar: Ato Kidane Miskr (City Manager, Bahir Dar City Administration); Ato Asnake Yirgu (Department Head, Bureau of Urban Development & Construction, Amhara Region); Ato Yibeltal Yeshaneh (Housing Office Head, Bahir Dar City Administration); Ato Animaw Mekonnen (Land Administration Head, Bahir Dar City Administration); Kibret Achamyeh (Building Permit Chief, Bahir Dar City Administration); Ato Abiy Sisay (Deputy Head, Water Supply and Sanitation, Bahir Dar City Administration); Ato Fisseha Tezzara (Head, Fire Protection, Bahir Dar City Administration); Ato Habtamu Wubalem (Head, Labour and Social Affairs Office, Bahir Dar City Administration); Dr. Dereje Tsegaye (Lecturer, Bahir Dar University, DRM Department); Ato Abyot Aizoh (Construction Ato Shewaferaw Mergia Engineer, Bahir Dar City Administration); Dr. Amlaku Asres (Head, Organization for Rehabilitation and Development in Amhara); (Expert, Construction Management Office, Bahir Dar City Administration); and Ato Zelalem Getahun (Head, Beautification and Greenery office, Bahir Dar City Administration).

Dire Dawa: Ato Adem Farah (Head of Bureau of Urban Development and Housing and Deputy Mayor of Dire Dawa City Administration); Ms. Saadia Ahmed (Head, DRMC Office, Dire Dawa City Administration); Ato Faisel Abdulahi (Department Head, Disaster Protection and Food Security Office, Dire Dawa City Administration).

Administration Ato Binyam); Ato Mesfin Yimer (Expert, Disaster Protection and Food Security Office, Dire Dawa City Administration); Ato Wondimagegn Beri (DRM Specialist, Disaster Protection and Food Security Office, Dire Dawa City Administration); Ato Gebeyehu Tilahun (Chief of Mayor's Office, Dire Dawa City Administration); Gebretensai (Construction Permit Head, Dire Dawa City Administration); Inspector Abraham G/Egziabhier (Fire Protection Coordinator, Dire Dawa Police, Dire Dawa City Administration); Ato Bekele Desalegn (Expert, Urban Development and Construction, Dire Dawa City Administration); Ato Biruk Bekele (Head, Water Supply and Sanitation, Dire Dawa City Administration); Ato Yalew Assefa (Head, Sanitation and Beatification, Dire Dawa City Administration); Rahel Demeke, (Expert, Labour and Social Affairs Office, Dire Dawa City Administration); and the entire Dire Dawa Red Cross Society Staff for their collaboration.

Gambella: Ato Akane Opada (Mayor, Gambella City Administration); Ato Obom Ojullu (Former Mayor, Gambella City Administration); Ato Thokhat Bichok Door (Project Engineer, Infrastructure Office, Gambella City Administration); Ato Simon Tiach (City Manager, Gambella City Administration); Ato Tut Ganwan (Finance Head, Gambella City Administration); Ato Oman Nyigow (Head of Revenue Office, Gambella City Administration); and W/ro Aromochan Ojulu (Head, Women and Children Affairs, Gambella city Administration).

Harar: W/ro Shukria Ahmed (City Manager, Harar Municipality), Ato Mohamed Nuredin, (Deputy Head, Bureau of Urban Development and Construction, Harari Regional State); Ato Mariwan Adem (Planning Department Head, Harar Municipality); Ato Atham Mohammed (Deputy Head, Finance and Economic Development Bureau, Harari Regional State); Abdulhakim Abibeker (Water Supply Head, Harar Municipality), Ato Abdulhafiz Abdulwasi (Head, Urban Planning Department, Harar Municipality); Abdukur Abdurahman (Chief Inspector and Coordinator, Fire Protection, Police Commission, Harari Regional Government); Ato Sultan Haji Temam, (Head, Environmental Protection Authority, Harari Regional Government); and Ato Endale Mengesha, Social Protection Process Head, Labor and Social Affairs Bureau, Harari Regional Government).

Hawassa: Ato Tewodros Gebiba (Mayor, Hawassa City Administration); Ato Mebrate Melese, (Advisor to the Mayor, Hawassa City Administration); Ato Yilma Suntuz (V/Head of Industry & Urban Development, Bureau of Urban Development and Housing, SNNPR); Ato Damte Data (Project Coordinator, Bureau of Urban Development and Housing, SNNPR); Ato Worku Thomas (Expert, Hawassa City Administration); Ato Teshale Wante (Expert, Hawassa City Administration); Commander Derese Busaro (Chief, Fire Protection, Hawassa City Administration); D/Sergant Tadesse Hamito (Head of Traffic, Hawassa City Administration); Iyasu Nejo (Head, DRM office, Hawassa City Administration); Ato Dembeshu Neare (Acting Vice President, Hawassa University); Ato Belachew Yaekob (Lecturer, Hawassa University); and from the Sidama Zone Red Cross, Ato Dawit Baekele, Sister Hana Mamo and Ato Ababe Wana.

Jigjiga: Ato Ahmed Mohamoud (Mayor, Jigjiga City Administration); Ato Fraham Mohamed (City Manager, Jigjiga City Administration); Ato Nieman Umar, (Infrastructure Process Head, Jigjiga City Administration); Ato Beshir Mohammed (Bureau Head, Urban Development and Housing, Somali Regional State); Ato Mohammed Ahmed (Environment Specialist, Jigjiga City Administration); Ato Anas Sherf (Building Permit Head, Jigjiga City Administration), Ato Gosaye Fiseha (Engineer, Urban Local Government Development Program, Jigjiga City Administration); and Ato Mohamed Abdurahman (Finance Expert, Jigjiga City Administration).

Mekelle: Ato Tesfalem Hadush (Mayor's Representative, Mekelle City Administration), Ato Goitom G/Meskel (Program Coordinator, Tigray Region Bureau of Urban Development, Industry and Trade); Ato Senay Ebisa (Head, Urban Development, Mekelle City Administration); Ato Gebremichael Hayelom (Acting Head, Construction and Transport Office, Mekelle City Administration); Ato Kahsay Hailu (Building Chief, Mekelle City Administration); and Girmay Berehe, (Finance Head, Mekelle City Administration)

Semera-Logia: Ato Yasin Mohamed Umer (Mayor, Semera-Logia City Administration); Ato Abdulkadir Mohammed (Head, Bureau of Urban Development and Housing, Afar Region); Ato Anuar Ahmed (Head, construction Management Office, Semera-Logia City Administration); Ato Abdela Abdu (Head, Water Supply and Sanitation, Semera-Logia City Administration); Ato Anuar Mohamed (Head, Environment Protection Office, Semera-Logia City Administration); Ms. Fatuma Abdu (Head, Urban Greenery & Solid Waste Management, Semera-Logia City Administration); Ato Raja Yimer (Finance Head, Semera-Logia City Administration); Ato Mesube Idris (Head, Labour and Social Affairs Office, Semera-Logia City Administration).

Annex 2: Population Projection for Regional Capitals

The Central Statistical Agency (CSA) of Ethiopia conducts a population census every 10 years. Three censuses have been conducted, in 1984, 1994, and 2007. On the basis of the census results, the CSA projects the population of the country at national, regional, woreda, and city levels. The CSA also conducted an inter-censal population survey (ICPS) in 2012 to measure changes since 2007 (CSA, 2013a). In 2014, the CSA projected the 2014-2017 population using the component method on the basis of 2007 Census results, various Demographic and Health Study (DHS) reports (2000, 2005, 2011), and International Center for Prison Studies (ICPS) (2012) (CSA, 2013c). The projection was made for regions, zones, and woredas. Towns with woreda status are also included in the projection. Most regional capitals have either woreda or zonal status and thus have population projections for 2014, 2015, 2016, and 2017.

The CSA has not yet made a projection of city population beyond 2017. In this study, a projection for 2017-2037 is filled by using the 2017 CSA projection as the base year and then applying the country-level estimate made by the World Bank for different years (see Table A1.1).

Table A1.1 National Urbanization Projected Growth Rate

Year	Growth Rate (%)
2007-2012	5.6
2012-2017	5.6
2017-2022	5.4
2022-2027	5.3
2027-2032	5.2
2032-2037	5.0

Source: World Bank, 2015. Ethiopian Urbanization Review

Table A1.2 provides the population projection for different cities on the basis of the CSA projection and Table A1.1.

Table A1.2. Population Projection of Regional Capitals								
Regional Capitals	1994 Census	2007 Census	2014 CSA	2017 CSA	2022	2027	2032	2037
Addis Ababa	2,084,588	2,738,248	3,195,000	3,433,999	4,466,869	5,782,892	7,451,158	9,509,776
Adama	127,842	220,212	308,526	355,475	462,394	598,624	771,317	984,417
Assosa	11,749	24,214	43,203	52,575	68,388	88,537	114,078	145,596
Bahir Dar	96,140	155,428	266,667	362,297	471,268	610,112	786,119	1,003,309
Dire Dawa	173,188	232,854	268,000	293,000	381,128	493,415	635,757	811,405
Gambella	18,263	39,022	62,093	74,102	96,390	124,789	160,788	205,211
Harar	76,378	99,368	125,000	137,000	178,207	230,710	297,265	379,394
Hawassa	69,169	157,139	285,785	335,508	436,421	564,999	727,992	929,123
Jigjiga	56,821	125,876	154,183	169,390	220,339	285,255	367,546	469,092
Mekelle	96,938	215,914	307,304	358,529	466,367	603,767	777,943	992,875
Semera-Logia	3,775	16,663		19,749	25,689	33,258	42,852	54,691

Annex 3. City Profiles: Shocks and Stresses in Regional Capitals and Dire Dawa City Administration

This Annex presents profiles for each of the nine regional capitals and Dire Dawa City Administration. The profiles include geographic and demographic information, and then elaborate on shocks, stresses and priorities identified during the CityStrength Diagnostic workshops. The shocks and stresses have been color-coded based on their recurrence and level of impact on city, starting with red for the most severe, followed by orange and yellow. This Annex presents city profiles in the following order:

- 1. Adama**
- 2. Assosa**
- 3. Bahir Dar**
- 4. Dire Dawa**
- 5. Gambella**
- 6. Harar**
- 7. Hawassa**
- 8. Jigjiga**
- 9. Mekelle**
- 10. Semera Logia**

1. ADAMA

- I. Overview:** Adama is the capital of the eastern Shewa zone and the Adama district of the Oromiya Region with 14 urban and 4 rural 'kebele' administrations. It is located 100 km south east of Addis Ababa in the Ethiopia rift valley area. Locational opportunities such as proximity to Addis Ababa, railway to Djibouti, and the highway to Harar are major contributing factors for its growth. The city is projected to reach close to 1 million residents by 2037 (CSA, WB). The city's location in the Ethiopia rift valley, a seismic active area, makes it prone to earthquakes. With an average altitude of 1620 miles above sea level, the city has relatively a flat topography and it lies in a sub humid tropical zone with an average annual temperature of 21°C.
- II. Demographic Trends and Physical Growth:** Applying the national urban growth rate estimated by the World Bank, the population of Adama is projected to reach close to a million people by 2037 (Figure 1). One of the reasons for the fast population growth is migration. The 1994 and 2007 censuses revealed that the proportions of migrants in the city were 53.2% and 59.2 % respectively. Furthermore, the satellite image of the city shows that the city has grown from 2.7 sq km in 1973 to nearly 42 sq km in 2016 (figure 2). In general, the city expansion appears to be in a concentric form from the center outward. The city sprawled beyond its physical boundary delineated by CSA after 2000.

Figure 1
Population Growth in Adama

Source: CSA various publication and own computation on the basis of WB estimate

Figure 2
Physical growth of Adama city

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of Shocks and Stresses

Major shocks	
Shocks	Remark
Flooding	Flooding is a significant natural hazard in Adama city attributed to its location within the flat lying rift. The main causes of flooding are heavy rain, high water table, and culvert damage or blockage (Getahun, 1987). Even if there is no historical recorded on the number of human life casualties, flooding in Adama city has been posing severe challenges to city dwellers due to the lack of an appropriate sewerage system both in terms of quality and capacity.
Fire	Fires are attributed to unsafe cooking practices and poor electrical wiring. The city doesn't have adequate fire-fighting preparedness. For example, firefighters cannot reach fires that break out in high rise buildings, and there is an insufficient number of fire hydrants and sprinkler systems. Similarly, the fire brigade lacks a sufficient number of fire trucks. Fires especially affect informal markets, which directly affect the livelihoods of residents. Informal settlements are highly vulnerable to fire since the construction materials are often easily flammable and fire spreads easily due to high density areas.
Earthquakes	The city is located with the East-Africa Rift Valley, a seismically sensitive area of the country. However, the city is not prepared for earthquakes. Overall, there is a lack of enforcement and supervision of the implementation of building codes. Therefore, as the city continues to grow, the built environment remains vulnerable to seismic shocks.
Landslide and Volcano	Rockslides are common features observed around the city, especially along the ridges exploited by quarrying. Hazard assessment found Adama at risk of volcanic flow.

Major stresses	
Stresses*	Remark
Water shortage	Adama uses water from the Awash River and groundwater. The rapidly increasing population and huge investments in socioeconomic and industrial establishments make the supply of additional water indispensable. For example, the industrial park that is planned for the city will attract tens of thousands of people to the city. At present, the city's residents already face severe shortages of water. Supply has been completely stopped in the northern parts of the city for more than a year. In other areas of the city, it is being distributed on a rationed basis every three or four days.
Shortage of housing and illegal settlements	Housing shortage is a major challenge. As of 2015, the ratio of people needing access to housing per 1,000 people in Adama was 104.7 (SECR, 2015). The city also contains a huge number of informal housing that is becoming a challenge for the city. Adama has also been experiencing the highest level of informal expansion reported as 1,138.34 ha in 2012 (SECR, 2015). The industrial park that Adama will host will attract people to the city and will thus exacerbate the housing challenge.

Drainage	The city has poor drainage capacity which exacerbates the flooding problem. During the city consultations, the city mentioned that flooding in the middle of the city is caused by inadequate drainage which leads to run off. The studies on the drainage system need to be updated with latest information.
Solid waste collection and disposal	Different aspects of SWM, such as land fill and public awareness initiatives, are yet to be implemented in the city. In 2007, the city was able to collect 35% of the waste generated (Dereje, 2001). The remaining waste is usually indiscriminately disposed of in drainage lines, open spaces, street sides and/or is informally burned. Currently, the city does not have a sanitary landfill and it lacks an adequate number of staff and equipment (SECR, 2015). Insufficient finance is a major obstacle to improve the quality and expand the coverage of SWM services. In addition to waste from individuals, as the city continues to grow and establish itself as a manufacturing center, industrial waste will also increase (SECR, 2015).
Traffic accident	Due to its strategic location along the railway line and at the junction of major routes to Addis Ababa and Harar, Adama has become a city with high frequency and severity of traffic accidents. For example, the data available at the city's transport authority office revealed that during a ten-year period (2004/05-2014-15), there were 264 deaths, 283 serious injuries, 359 minor injuries and 1,043 property damages. Some of the contributing factors for the traffic accidents include the city form which concentrates goods and services in the central part which leads to congestion, a lack of appropriate taxi stations, a shortage of appropriate sidewalks for pedestrians, and a large number of three wheelers which dominate the transport system although they don't represent a safe mode of transportation.

*Other stresses listed by the city include energy shortages and inadequate sanitation

IV. Priority Actions identified during CityStrength consultations with city stakeholders:

- **Long term land use/drainage master plan:** The city needs to develop a long term land use/drainage master plan with a long term vision that accommodates the increasing population due to rapid industrialization of the city. It is also important to prepare a complementary implementation plan.
- **Integrated urban water management:** Flooding and water scarcity are two major issues in the city. There is therefore a need to implement an integrated urban water management approach to deal with the issues. The approach should also take solid waste, informal settlements and environmental issues into account.
- **Housing Development:** Universal access to safe housing with basic services is the basic necessity for city dwellers. The provision of safe housing should prioritize those in the high-risk areas.
- **Improving the reliability of electricity provision:** Electric outage and interruptions are common problems of electricity supply affecting both households and businesses. Electric provision should be improved by adding a new substation and upgrading the existing one.
- **Traffic management:** Traffic congestion and traffic accidents are very severe in the city. There is a need to develop a traffic management plan and enhance implementation capacity.
- **Creation of jobs and employment:** The level of unemployment rate in the city is one of the highest in the country. As the city continues to attract migrants from the surrounding areas, the problem of unemployment will become more severe. Employment opportunities need to be provided for the growing population.

2. ASSOSA

- I. Overview:** Assosa, one of the border cities of Ethiopia, is the regional capital of Benishangul-Gumuz Regional Stat. Assosa city is located at a distance of 687 km from Addis Ababa. The city has economic linkages with the surrounding cities such as Gimbe, Nekemte and Nejo. The growth rate registered by the city during the inter-censal period is the highest next to Gambella City. The western and north-western parts of the region have low-lying areas or lowlands (under 1,500m) while the northern part has highlands (2,500m). The major river basins in the region are Abay, Beles, Dedessa, Dura, and Dabus.
- II. Demographic Trends and Physical Growth:** The CSA (2013) projection estimated the population of the city to be over 50,000 by 2017. Applying the national urban growth rate estimated by the World Bank based on CSA data, the population is projected to reach over 100,000 by 2032 and close to 150,000 by 2037 (Figure 1). The city has the highest proportion of migrants (68.14%) in comparison to other cities of emerging regions. The satellite imagery for the city shows that the city has grown from an area of 0.2 sq km in 1973 to 10.7 sq km in 2016 (Figure 2). This is nearly a 20-fold increase in areal size. The city has grown in a concentric manner and has stayed mostly within the administrative boundary.

Figure 1
Population Growth in Assosa

Source: CSA various publication and author's own computation on the basis of WB estimate

Figure 2
Physical growth of Assosa

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of Shocks and Stresses

Major shocks	
Shocks	Remark
Landslide	Landslides occur due to physical and morphological factors, mostly during rainy season. Landslides cut roads off and affect neighborhoods.
Flood	Flooding in the city is extensive and affects significant portions of the city. For instance, in 2016, flooding affected three kebeles and the market place. Similar to other cities, inadequate drainage system and solid waste management system contributes to flooding events. The city does not have a land use plan that takes into account locations that are vulnerable to flooding.
Fire	Fire occurs in the city and is exacerbated by a limited fire control systems and preparedness. The government is prioritizing creating awareness of harmful traditional practices, such as grass burning, and strengthening fire control mechanisms.

Major Stresses	
Stresses	Remark
Lack of adequate infrastructure	Poor infrastructural development is one of the critical obstacles to ensuring the smooth functioning of the city. Concerning access to piped sewerage, the city does not have a modern liquid waste sewerage network system. In 2007, the municipality was capable of collecting only 12.3% of the solid waste generated (CSA, 2007). In 2014, the city had a total length of 67.2 km of road, with paved road representing 27.9 km or 41.5%. This proportion is the highest compared with the average of the cities of the emerging regions, but lower than the average of the other 27 major urban centers in the country (46.9%). The city also faces a weak integrated water and solid waste management system, and poor energy and water supply infrastructure.
Housing shortage and informal settlements	The state of Ethiopian cities study revealed that as of 2015, the ratio of people needing access to housing per 1,000 was 65.7 and the total housing demand between 2000-2006 was 1,889 (SECR, 2015). Informal settlements are occupying a significant part of the city. During city consultations, the city representatives listed as one of the priorities development of an effective housing program including public houses, rentals, cooperatives and private housing.
Poverty and unemployment	Based on the CSA (2014) unemployment survey, the total unemployment rate of the city was 15.9%. This level of unemployment is slightly lower than the national urban unemployment rate, which was 17.4% in 2014; however, unemployment still represents a significant challenge for the city. The poverty headcount for Assosa city for 2010/11 was 34.8% and is thus much higher than the national level of poverty.
Lack of implementation capacity	The city in particular and the region in general need improvements in institutions, human resources and systems. Implementation capacity is affected by lack of budget and resources.

Note: The city also listed storms as a shock and water scarcity, increasing temperatures, and traffic accidents as stresses.

IV. Priority Actions identified during CityStrength consultations with city stakeholders:

- **Improve flood risk management:** In Assosa, flooding is caused by inadequate drainage system and a poor solid waste management system. If the city can install a proper drainage and SWM system, this will help in reducing the waste and also reducing the problem of flooding. Risk informed land use system is needed to reduce flooding. This will require identifying flood-prone areas and flood plains, and put in place zoning and other protective measures such as plantations, gabions etc.
- **Strengthen fire control mechanisms:** Grass burning is mostly undertaken by farmers with the assumption that it improves soil fertility. In the process, fire can damage property and even lead to loss of human life. The city thus needs to develop specific capabilities that can mitigate the effects of fire and fire related disasters. This involved improving emergency response capacity.
- **Integrated planning and financing of infrastructure:** One of the major stresses the city is currently facing is poor infrastructure and services needed for the smooth functioning of the city. The infrastructure and services in poor condition include water supply, drainage systems, roads, electricity, landfill, and the waste management system. The city needs to invest in these critical areas in a manner that will improve the service delivery function of the city.
- **Ensure skills development and job creation:** Poverty and unemployment are critical problems the city faces. The fact that poverty is much higher than the national average signals its urgency. One of the ways to reduce poverty is to develop the skills of the labor force, create jobs and use necessary inputs such as credit facilities.
- **Develop an effective housing program:** The city has a high demand for housing. It is important to strengthen the housing stock and quality to address the increasing demand. The city government can provide a mix of housing options including public housing, rentals, cooperatives and private housing. It should also involve finding appropriate way of managing informal settlements.

3. BAHIR DAR

- I. Overview:** Bahir Dar is the capital city of the Amhara region and attained metropolitan status in 2011 with the satellite towns of Meshenti, Tis Aba and Zige. There are 18 kebeles; nine of them are found in Bahir Dar city and the rest are in rural areas. The city of Bahir Dar is one of the fastest growing and the third largest city in the country. It's also a growing tourist destination because of Lake Tana, Tis Esat fall, and many monasteries. Bahir Dar receives an average annual rainfall of 1437 mm with a monthly mean maximum and minimum temperature of 29.70 C and 23.30C respectively.
- II. Demographic Trends and Physical Growth:** Applying the national urban growth rate estimated by the World Bank, the population of Bahir Dar is projected to reach over a million people by 2037 (Figure 1). Bahir Dar had a total area of 53.5 sq km in 2016. The city's administrative boundary is about 213.4 sq km which implies that the city has a large expanse of land for expansion.

Figure 1
Population Growth in BAHIR DAR

Source: CSA various publication and own computation on the basis of WB estimate

Figure 2
Physical growth of BAHIR DAR

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of Shocks and Stresses

Major shocks	
Shocks	Remark
Flood	Nearly 80% of Bahir Dar is prone to flooding, particularly its western part. The reasons include intensive rainfall, limited storm water drainage lines, inappropriate disposal of liquid and solid waste in waterways, deforestation of the upper catchment of Gudo Bahir, soil erosion, and a shallow ground water table in and around the city (NUPI, 2006). As a result, flooding occurs in the city every rainy season though the intensity seems to be higher every 5-10 years. The western part of the city, which is the main part of Bahir Dar, has a flat topography and is blocked to the north by Lake Tana. This area suffers from floods that develop from the inner part of the city and upper side of Gudo Bahir (NUPI, 2006).
Fire	Fire occurs in the city and damages property. The city doesn't have an adequate fire-fighting response capacity as a result of insufficient technical and financial support. For example, the fire brigade doesn't have appropriate equipment to respond to fires. The city also has room for improvement in making roads adequate and accessible by emergency responders.

Major Stresses	
Stresses	Remark
Lake Water Pollution	The Lake ecosystem is deteriorating as a result of ill treatment and pollution by different economic activities. Major institutions in the city discharge waste water into Lake Tana and the Abay (Blue Nile) River through pipes and open ditches.
Water scarcity	Bahir Dar city receives its water supply mainly from two sources: springs and ground water. Spring water is by far the dominant source (79.3%) while ground water covered only 20.7% in 2009. About 50% of the spring water capacity is currently pumped to the city water supply network. Water distribution and the quality of water are key challenges.
Unemployment	Though the level of unemployment in Bahir Dar in 2014 (14.3%) was lower than the national average (17.4%), it still is a major problem in the city. According to the MSE agency, there were 21,706 registered job seekers in the city in 2014/15. Most of the unemployed in the city are among the youth population. The level of poverty in the city has declined from nearly 30% in 2004/05 to 14.5% in 2010/11.
Housing shortage	The housing challenge in the city includes shortages, and informal housing. In terms of shortage, there is a 27,000 housing backlog and there were 15,000 applicants for plots. It is also believed that the number of informal houses amount to about 5,000 or around 12% of the total houses. Slums are particularly found in the kebele rental houses across different kebeles. One of the responses to housing shortage in Bahir Dar city was the integrated housing development program (IHDP) which is a national program aimed at building low-cost housing for low-income people.
Traffic accident	Bahir Dar City has a total road length of 836.9 km. Of this, 141.08 km or 16.9% are paved road. This proportion of paved road is much lower than the proportion of paved roads in other major cities (46.9%). The bulk of the roads are gravel and earth roads. These may not be all-weather roads and hence limit mobility within the city. Three-wheeled vehicles, taxis, buses, bicycles, horse-drawn carts and private automobiles are used for intra-city mobility. There are two city buses in the city running along two routes. The city also uses water transport in and around Lake Tana. The level of traffic congestion and poor roads exacerbates traffic accidents.

Note: The city also listed energy shortages as an additional stress.

IV. Priority Actions identified during CityStrength consultations with city stakeholders:

- **Drainage master plan:** One of the top priority issues in the city is to develop a new drainage master plan including identification and prioritization of investments. This should include the establishment of a technical team that will work with a drainage consultant and follow up on the implementation. The drainage master plan will help overcome the frequent flooding in the city.
- **Environmental compliance:** Environmental compliance is a key issue in the city in order to reduce the problem of lake pollution. As many institutions continue their discharge to the lake with little or no regard to environmental regulation, it is important to ensure environmental compliance of these institutions. The bureau of health, the bureau of environmental protection and land administration and the city administration should work together on the required regulations and enforcing the same. In addition, the Regional Environment Authority and the City Beautification and greenery office need to be strengthened to conduct audits of environmental and social safeguards and enforce compliance.
- **Address urban stresses:** Sectoral challenges such as housing shortage, traffic accidents, and water scarcity require urgent solutions. Policies and strategies along these lines should thus be developed.

4. DIRE DAWA

- I. Overview:** Dire Dawa, established in 1902, owes its emergence to the AA-Djibouti line. The City has a state status and is accountable to the Federal Government and the Ministry of Federal Affairs. Dire Dawa has a two tier systems: the city and kebele administration. There are nine urban kebeles in the city of Dire Dawa. Dire Dawa city, since its establishment, is an important commercial and transport corridor linking the Ethiopian hinterland with the coast. The city is the second largest after Addis Ababa, though other regional capitals are expected to surpass Dire Dawa's population. Dire Dawa is located in the semi-arid regions of Ethiopia which deal with drought. In past decades, the cities in the semi-arid region saw a decline in the annual rainfall and a rise in rainfall variability.
- II. Demographic Trends and Physical Growth:** Applying the national urban growth rate estimates, the population of Dire Dawa projected to reach over 800,000 by 2037. The city will thus be heading to million population shortly after 2037. Satellite image for different years shows that the city had a built-up area of 6.2 sq km in 1973. By the year 2016, the city grew to 29.3 sq km representing a near five-fold increase in size, expanding beyond the administrative boundary delineated by the CSA in 2007.

Figure 1
Population Growth in Dire Dawa

Source: CSA various publication and own computation on the basis of WB estimate

Figure 2
Physical growth of Dire Dawa

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of Shocks and Stresses

Major shocks	
Shocks	Remark
Flood	Located in the foothills of the Harerege highland, Dire Dawa suffers from severe flooding caused by heavy rains in upstream areas, which is aggravated by clogged or no drains, soil erosion and deforestation. The highest loss of people's lives occurred during August 2006 when over 200 people were killed, 244 people were unaccounted for, 10,000 people became homeless and 1,827 households in 17 rural kebeles. Two types of flood events affect Dire Dawa: (1) mountain runoff during torrential rains in upper catchments of Kersa and Haromaya; and (2) flash flooding that occurs due to localized heavy rainfall. Areas vulnerable to flooding include all places where the river crosses and peripheral areas of the city or the rural kebeles around the city. Informal settlements affected by the flooding are particularly vulnerable. The city's Disaster Emergency Unit issues traditional methods such as sandbags and sand-bund to protect riverside dwellers from flood damage.
Fire	The city is vulnerable to fire incidents, particularly informal markets, industrial areas, and poor quality housing. The city has a fire brigade under the police department, but it has low capacity to respond to the incidents, due in part to insufficient equipment and supplies.
Earthquake	The city is at risk of earthquakes but is not prepared for a seismic event. This was assessed by the Innovation Lab team of GFDRR by looking at available global data. The impact of a seismic event would be exacerbated by current challenges in the construction sector as reported by the participants of the CityStrength consultations. Challenges include a lack of testing capacity for building materials at the regional and local level, and a lack of sufficient qualified construction workers.

Major Stresses	
Stresses	Remark
Water scarcity	Dire Dawa suffers from an inadequate provision of safe and clean water for both drinking and sanitation services. The water supply system can satisfy only 65-70% of the demand (Dire Dawa Water Supply and Sewerage Authority, 2014). Frequent interruptions in water supply are due to overall limited water supply, infrastructure break down and electric power outages. In response to the problem, the Dire Dawa administration is implementing an urban water supply and sanitation project involving the construction of 15 wells to tap water from two prospective well fields. Bilateral partners are also assisting the Government in increasing water supply.
Housing shortage	Poor quality housing, over crowdedness and informal settlements are challenges that the city faces. Dire Dawa attracts many immigrants due to its location along the Addis Ababa-Djibouti transport corridor. According to data featured in the SECR, Dire Dawa has the largest coverage of informal settlements (1,770.7ha) with the vast majority of them (80%) located in hillsides and some of them in wetlands. ¹ These informal houses do not have access to basic services such as water, power, roads etc.
Unemployment	According to CSA in 2014, the level of unemployment in the city was 22.8% which is higher than the unemployment rates of major towns in the country (20.7%) for the same period. The city is characterized by a large number of informal jobs with the level of informality being 25% in 2014. This is nearly twice the level of informality among major towns in the country (13%). Women have high levels of informality with 35% of them being engaged in informal job. Dire Dawa has a comparatively high poverty rate. The levels of unemployment and poverty may be associated with disruptions of the railway transport service connecting Addis Ababa with Djibouti, the privatization of the Dire Dawa Textile Industry, and a reduction in contraband trade that also contributed to the local economic base of the city.

Traffic accident	Traffic accidents were identified as a major stress in the city. Motorized transportation within the city includes a combination of public buses, privately owned mini-buses and Bajaj. The availability of these options does not meet the demand and they are unaffordable to many. The main mode of transportation in the city is walking, although the city is not pedestrian-friendly.
Energy shortage	Electricity outages are reported as a common phenomenon. The majority of residents (96%) use electricity for lighting. The majority of the people that commonly experience electric outages (52%) reported facing interruptions three or more than three times a week.
Drought and locust	Drought and locusts affect the rural areas of the city. Drought occurs every 6-8 years due to the El Niño-Southern Oscillation along with sea surface warming, leading to temperature anomalies in the Southern Atlantic and Indian Oceans, (DDAEP, 2011). Drought contributes to food insecurity and crop loss.

Note: The city also listed excessive transport congestion as a stress.

IV. Priority Actions identified during CityStrength consultations with city stakeholders:

- **Establish and strengthen early warning and emergency response systems for urban settlements:** Early warning systems are needed to provide flood warning, earthquake, landslide, or volcano alerts. Currently, there are no disaster contingency plans or financing in place to prepare communities for disasters. It is recommended that to establish a Disaster Risk Management structure in Dire Dawa. The DRM unit in the city will be in charge of developing a DRM strategy, ensuring early warning on flooding, drought, and high winds, and alerts for earthquakes and landslides are provided; ensuring community preparedness to disasters; developing contingency planning and budgeting; and exploring risk financing and insurance options.
- **Strengthen watershed management:** Dire Dawa is one of the cities heavily affected by flooding. The piecemeal approach relying on structural measures (primarily retention walls or drainage channels) and/or relocating at-risk populations does not provide effective and long-term flood mitigation solutions. It is recommended to urban watershed management including upstream runoff; and improving green and recreational areas that can enhance water absorption and recharge groundwater aquifers. Ensure the development and implementation of a technically-sound drainage master plan.
- **Ensure water security:** Conduct a water resources study and develop a water security plan. This is urgently needed in order to satisfy the growing water demand from households and industry.
- **Regularization of informal settlement:** Informal settlements have a low quality of life and introduce urban sprawl. It is therefore important to regularize these settlements and ensure a safe and improved quality of life.
- **Improve traffic management:** Review and upgrade the road network and undertake traffic management functions.
- **Use alternative renewable energy:** Explore and develop alternative renewable energy sources.

5. GAMBELLA

- I. Overview:** Gambella city is the regional capital of the Gambella region. It has economic links with the surrounding areas of Metu, Jimma and South Sudan, which makes it a trading center. Gambella city is located 776 kilometers from Addis Ababa (Gambella Regional State, 2015), and it's one of the fastest growing emerging cities in the country. The region is known for its dense and abundant forest.

II. Demographic Trends and Physical Growth:

According to projections made by the CSA (2013), the population of the city in 2017 is projected to be close to 75,000. On the basis of the growth rate estimated by the World Bank based on CSA data, the population of the city will be over 200,000 by 2037. Gambella city has expanded physically from an area of 0.9 sq km in 1973 to 12.8 sq km in 2016. This shows that the city has expanded nearly 13-fold over a period of four decades. The city has sprawled in the eastern and northern direction out of the administrative boundary.

Figure 1
Population Growth in Gambella

Source: CSA various publication and own computation on the basis of WB estimate

Figure 2
Physical growth of Gambella

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of Shocks and Stresses

Major shocks	
Shocks	Remark
Flood	Flooding occurs in the summer due to the overflow of the Baro river, compounded by an inadequate drainage system, affecting people and livestock and livelihoods. Poor disaster risk management, climate change and the city's location in the Baro-Akobo plain also make Gambella prone to annual flooding. Gambella has no early warning system or risk maps showing areas at risk of different natural hazards and climate change. The city also lacks a contingency plan for natural hazards.
Fire	Fire incidents in the city can be significant because most houses are mud-walled with thatched roof hats, and, as in most regional capitals, the firefighting capacity is inadequate.
Drought	Studies indicate that climate change in Gambella city results in a changing rainfall pattern (unreliable and erratic), higher risk of floods and drought, natural forest and range land degradation and malarial disease outbreak.
Malaria and other disease outbreak;	Gambella is located in a malarial prone area. Additionally, a study carried out by the Ministry of Health and EHNRI for certain urban sites in 2011 indicated that in 2009, Gambella was among the cities with high incidence of HIV/Aids.
Conflict	Gambella is one the most conflict-ridden regions in Ethiopia (Medhane, 2010; Mossa, 2014). Strengthen good governance and rule of law as a priority of the city.

Major stresses	
Stresses	Remark
Water scarcity	The sources of water for Gambella city are surface and groundwater, yet, the water supply system of the city appears inadequate and unreliable (Dulla, 2007; Fethanegest, 2007). The Baro River serves as a source for the city and has a catchment area of 23,461 km ² . According to CSA (2007), about 62.7% of the housing units obtain potable water outside their compound whereas 12.4% of the housing units obtain water from a river/lake/pond. There is a frequent water supply interruption as well as significant water quality challenges.
Housing Shortage, Informal settlement and migration	According to the 2007 population census, migrants represent 59% of the city's population. Between 1994 and 2007, Gambella also had the highest population growth (4.1%) out of all the regional capitals. The number of migrants is higher compared to other major cities, with migrants representing 49% of the population. Major issues concerning urban development and accommodating migrants include: land affordability, supply of new housing, and availability of housing finance. The ratio of people needing access to housing is estimated to be 65.9 per 1,000 (SECR, 2015). The problem of land supply and housing has led to the mushrooming of informal settlements in the city.
Unemployment	According to the CSA (2014) unemployment survey, the total unemployment rate of Gambella city was 7.7%. This level of unemployment is lower than the national urban level of unemployment of 17.4% in 2014. However, the rate of youth unemployment in Gambella is above the average when compared to other urban areas.

Sanitation challenges	Access to sanitation in urban areas is inadequate. The main sanitation facilities of the city include traditional pit latrines and flush toilets. According to CSA (2007), about 46.5% of the housing units do not have toilet facilities.
Capacity and financial constraints	The city has limited technical capacity to prepare detailed plans and put in place participatory planning processes. Financial capacity is also weak.

Note: The city also listed waterborne diseases and malaria prevalence, hot weather, traffic congestion, HIV/AIDS and pollution as stresses.

IV. Priority Actions identified during CityStrength consultations with city stakeholders:

- **Building the capacity of the city administration:** It is important to put in place a capacity building program to ensure the smooth functioning of the city, including human resources, by training and creating awareness on improving the working culture.
- **Develop a modern city master plan including a contingency plan:** Master plans are critical for orderly and rational growth of cities. The city needs to have a modern master plan that also includes contingency plans to respond to disasters.
- **Expand and manage the city level road network and drainage system which considers the water volume of the city:** The road system has to be equipped with a proper drainage system to prevent floods.
- **Coordinate with regional government to plan and implement an upper catchment treatment activity:** One of the reasons for the occurrence of floods in the city is poor upper catchment treatment. It is essential to rehabilitate the upper catchment area to reduce runoff emanating from the highlands.
- **Develop a robust early warning system for potential disasters:** The city does not have any preparedness for disasters including fire, floods, and droughts. The creation of an early warning system thus becomes one of the priority actions needed in the city. In this regard, it is essential to strengthen the fire brigade and fire hydrant system and the DRM structure at the city level.
- **Facilitate the development of agro-industries to create employment opportunities:** As the region is endowed with large-scale agricultural investment, it is appropriate to establish agro industries that can forge linkages with the commercial agriculture in the region.
- **Mobilize the community to promote sanitation activities in the city:** Community mobilization could be an effective way of overcome this problem.
- **Strengthen good governance and the rule of law to reduce conflict:** Conflict has remained one of the barriers for development in the region in general and in the city in particular. The root causes of the conflict seem to be lack of good governance and lack of rule of law. These need to be given adequate attention in order to reduce conflict and promote peace.

6. HARAR

- I. Overview:** Harar is the capital of Harari People National Regional State. The city is 525 km away from Addis Ababa. Harar City, designated as “UNESCO World Heritage Site and a Living Museum”, is a historic city (World Bank, 2015). Harar is the only major urban center of the Harari region. Harari is divided into 17 rural kebeles and two town woredas, namely Harar and Hamaresa, which houses 62% of the regional population. Temperature variability and uneven frequency of rainfall affect agricultural production and productivity.
- II. Demographic Trends and Physical Growth:** The CSA (2013) projected the population of the city to be 137,000 in 2017. Applying the national urban growth rate estimated by the World Bank based on CSA data, the population of Harar is projected to reach close to 400,000 by 2037 (Figure 1). Traditionally, the city has witnessed a large number of immigrants, making up more than half of the population (MUDHCO AND ESCU, 2015). According to satellite imagery, the city has grown in an elongated manner from 3.3 sq. km in 1973 to 15.4 sq. km in 2016, which is nearly a five-fold increase (Figure 2).

Figure 1
Population Growth in Harar

Source: CSA various publication and own computation on the basis of WB estimate

Figure 2
Physical growth of Harar

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of shocks and stresses

Major shocks	
Shocks	Remark
Water scarcity and drought	The sustainability of the town's water supply has been a problem for decades and was aggravated with the drying up of Lake Alemaya. The Harar Water Supply and Sanitation Project, designed to provide a long-term solution to the crisis, draws water from an artesian well near Dire Dawa more than 75 km away. This requires reliable energy which is a challenge across Ethiopia. The project provided water to Harar and four additional nearby towns. As a result of this initiative, access to safe water in the city has increased from 73% (2011) to 89% (2016). The frequent drought that has been affecting the area every three years affects 27% of the regional population (including people from Harar city) through chronic and acute food shortages.
Fire	The city has experienced multiple fires, primarily in market areas, affecting livelihoods of people and animals and causing significant monetary losses. The biggest market has been burned at least twice. Fire is aggravated by a lack of adequate fire exits or access roads in informal markets. The market is currently being rebuilt taking into consideration an appropriate fire-resistant structure and design. Fires are primarily due to unsafe electrical wiring. Harar, similar to other regional capital, has a firefighting brigade under their police department but it has inadequate capacity and equipment.
Flooding	The old town of Harar (Jegol) was prone to severe flooding due to its sloped terrain and narrow internal streets that impeded surface drainage. Flooding in 2015 affected 10-25% of the total area of the city.
Earthquake	Harar is at a risk of earthquake. The city considers it a priority to develop seismic risk maps, incorporate seismic risk in building regulations and construction practices, and assess seismic vulnerability of existing structures in the historic city center.

Major stresses	
Stresses	Remark
Lack of sewerage and proper SWM system	The existing manpower and resources in the city are not adequate to handle/manage the generated solid and liquid wastes in the city. With regard to sanitation, the 2011 welfare monitoring survey of Ethiopia shows that 1.29% of households use flush toilets, 87.04% use pit latrine, 10.79% use forest/field and the remaining use other toilet facilities. It has been estimated that about 57% of the daily generated solid waste is collected and dumped. The remaining significant amount of solid waste is disposed of along roads, riversides, and near residential areas. Harar has recently secured funding to construct sanitary landfills. The lack of proper solid and liquid waste management in the city seriously pollutes the available small intermittent rivers such as Bishan Buna, Segcha, Amumer, and Deje.
Housing shortage and informal settlements	According to MUDHCO AND ESCU (2015), the housing demand for the years 2000-2006 was about 2,250 houses. The ratio of people needing access to housing per 1,000 people in the city was about 23.3 in 2014 (MUDHCO AND ESCU 2015), which is low compared to cities such as Addis Ababa (361), Dire Dawa (176.6), and Harar (104.7). The city also struggles with poor quality of housing.

Unemployment and street children	According to 2014 data, the overall unemployment rate for Harar city was 12.2%. Poverty and unemployment rates in Harar are less than the national average and the city usually performs well in poverty reduction compared to other cities. Nonetheless, the city still places unemployment and poverty among their key priorities. MSEs are a source of employment for many across all cities, however, in Harar, the number of operators per 1,000 people is on the lower end when compared to other cities. The informal sector accounted for 34.3% and 33.1% of the employment in 2010 and 2014 respectively, signifying that the informal sector is a major contributor of livelihood in the city (CSA, 2010, 2014).
Traffic accidents	Overall, there is weak traffic management and traffic safety. Road accidents resulted in the deaths of 24 people and 99 injuries in 2014/15. Though walking is a major mode of transport used by city dwellers, the majority of roads are not pedestrian-friendly. Public transport service provision is inadequate.

*The city also listed price inflation as a stress.

IV. Priority Actions identified during CityStrength consultations with city stakeholders:

- **Identify alternative sources of water supply:** Water scarcity is a major problem for the city. It is important to identify alternatives to water supply sources and develop a water scarcity management plan.
- **Integrated flood risk management:** The city needs to prepare a more robust citywide drainage system, including a flood warning system. In addition, the city needs to establish buffer zones to prevent people from settling in at-risk areas and increase ground flood water absorption in green spaces. Improvements in solid waste collection and disposal systems are needed, as well as on raising awareness on appropriate practices to prevent clogging of the drainage system.
- **Improve fire response system:** Fire occurrences in the city need to be properly addressed and their causes determined. It is also necessary to invest in improving the fire emergency response system, ensuring access of responders to at-risk areas, developing and implementing a new fire code (especially adequate electrical wiring) and instituting an emergency system. Moreover, awareness raising is necessary on safe cooking since unsafe cooking practices could be one of the reasons for the fires.
- **Develop seismic capability to reduce the risk of earthquakes:** This will involve preparing seismic risk maps, incorporating seismic risk in building regulations and construction practices, and assessing seismic vulnerability of existing structures in the historic city center.
- **Focus on Local economic development:** Problems of unemployment and street children, which have been identified as one of the major stresses of the city, can be addressed by promoting local economic development.
- **Improve traffic management and safety:** Traffic accidents can be reduced by improving traffic management, traffic safety and strategic siting of public transport terminals.

7. HAWASSA

- I. Overview:** Hawassa, which has been administratively given a zonal status, is the leading urban administration in the Southern, Nations, Nationalities and People's Region (SNNPR) and serves as the regional and zonal capital. The city has 8 sub-cities with one of them — Tula sub-city – being a rural sub-city. The sub-cities are divided into 21 urban and 11 rural kebeles. The city is located at the shore of Lake Hawassa which plays a significant environmental, social, and cultural role in the lives of the people residing in the city. The city has a warm climate and it receives rainfall twice a year during the main rainy season and the Belg rainy season.
- II. Demographic Trends and Physical Growth:** Hawassa is one of the fastest growing cities in the country. The population of the city has more than tripled during the last two decades. In 2007, the proportion of migrants in the city was 60%. Applying the national urban growth rate estimated by the World Bank based on CSA data, the population of Hawassa is projected to reach over 900,000 by 2037, thus housing nearly a million people. The city has also experienced rapid physical growth. The satellite images for different years shows that the city has expanded more than four-fold between 1973 and 2016. It has grown from 9.6 km² in 1973 to 37.4 km² in 2016 (Figure 2). The city also surpassed the physical boundary delineated by the CSA in 2007 (23.2 km²).

Figure 1
Population Growth in Hawassa

Source: CSA various publication and author's own computation on the basis of WB estimate

Figure 2
Physical growth of Hawassa

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of shocks and stresses

Major shocks	
Shocks	Remark
Floods	Hawassa's vulnerability to floods is a result of its location in a low-lying area with inadequate drainage system that is further affected by poor waste management practices that clog up the drains and increase run off. There is also inadequate monitoring of the watershed in the surrounding areas which is also one of the causes of flooding. In addition, flood management is challenged by lack of technical and financial resources to implement the necessary investments.
Earthquakes	The city is located in Ethiopian Rift Valley and is exposed to earthquakes. A recent earthquake (3.7) in January 2015 caused panic in residents. According to the SECR, the city reported to follow all seven steps required to enforce building codes. Nonetheless, the city still expressed the need to strengthen the building codes implementation, and assessing current buildings for seismic safety.
Fire	The fire incidents have affected commercial and informal market areas, similar to other regional capitals. The city has inadequate firefighting capacity and a shortage of the necessary supplies and equipment (SECR, 2015).
Major stresses	
Stresses	Remark
Lake pollution	The city's existence depends significantly on the nearby Lake Hawassa which is facing many challenges: chemical pollution; degradation of natural resources induced by the land use/land cover changes; loss of wetlands; organic growth in the lake; overfishing; inefficient irrigation water management; discharge of waste into the lake; and climate change induced. Both individuals and industries contribute to the pollution of the lake. The discharge from the industries is transported to the lake through surface runoff/stream flows which also contaminates storm water and groundwater.
Water scarcity/ Drought	Hawassa city sources its water supply mainly from ground water (55%) and surface water (45%). In general, water supply in the city does not meet the high demand. There are also places in the city where water disruption is high or water access is a problem. Additionally, studies revealed that the Hawassa watershed will experience rising temperature and precipitation (Jihur 2015). Further, it was noted that, due to an increase in evaporation, drought conditions will prevail in the watershed (Juhur, 2015). It is thus important to put in place mechanisms that will mitigate the effects of drought in the future, which is projected to become increasingly frequent beginning in 2020.
Housing shortage	The city is experiencing rapid development and is expected to attract more development activities. Rapid population growth, difficulty to access land in the city and insufficiency of housing stock have resulted in the proliferation of informal settlements. There is a plan to regularize informal settlements in the expansion areas and this will have huge cost implications. In the inner city, the administration focuses on renewal and redevelopment of housing in order to make them livable and conducive for investment. Though the city provides land through bidding and also allocates land to housing cooperatives, the housing supply is still significantly lower than demand. The ongoing construction of the industrial park is expected to exacerbate the demand for housing as it will be another pull factor for migrants.

Unemployment	Currently, there are over 22,000 employment seekers and the majority of them have some level of education. According to the CSA (2014) unemployment survey, the total unemployment rate of Hawassa city was 13.7%. This level of unemployment is relatively lower than the national unemployment rate which was 17.4% in 2014. The bulk of employment in the city is in the formal sector. The proportion of informal jobs in the city stood at 14.5% in 2014. Construction and services are by far the two most important MSE sectors. However, the lake can be better leveraged for job creation. The industrial zone is also expected to generate a large number of jobs.
Traffic accidents	The numerous three wheeler taxis are major contributors to traffic congestion and they cause direct accidents to vehicles, motor cycles and pedestrians. The city faces challenges during peak hours as the transport options do not meet the demand. The majority of modes of transport operate on paved road while neglecting people who live in unpaved areas such as informal settlements. In 2014, Hawassa had a total of 703 km of road with paved roads representing 156 km (22.2%). This proportion is lower than the average for major 27 cities in the country (46.9%). A low proportion of paved road decreases mobility. There is also lack of coordination between the transport sector and other related sectors.

*The city also listed urban growth from migration and street children as stresses.

IV. Priority Actions identified during CityStrength consultations with city stakeholders:

- **Plan and implement an integrated flood management system:** A combination of improper drainage system, increased run off and a poor waste management system cause flooding in Hawassa city. It is therefore important to undertake and mainstream integrated flood risk management planning. In this regard, there is a need to improve the drainage and liquid and solid waste management systems so that wastes do not clog drainage lines and streets. Improving the watershed in the surrounding areas will also help reduce runoff into the city which is also one of the causes of flooding. The current initiatives to reduce flooding and pollution – digging ditches, terracing, developing wetlands - should also be continued. Since flood management requires investment, there is a need to identify resources (technical and financial) to implement integrated flood management initiatives.
- **Protect buildings from seismic hazards:** Hawassa is found in the Rift Valley zone – one of the seismic areas in the country. The recent tremors that took place in the city are an indication that earthquake is an important shock to consider. Buildings therefore need to be protected to minimize the effect of the shock. This includes reviewing existing buildings to determine capacity to withstand hazards and strengthening the capacity of the building agency to inspect buildings against hazards, issue regulations and enforce them.
- **Address current SWM capacity:** Though Hawassa has a better SWM performance than other cities, it still relies on a dump site for wastes which is surrounded by residential areas and has a significant negative effect on nearby residents. A new landfill is urgently needed. It is therefore important to conduct a technical study to build a new sanitary landfill.

8. JIGJIGA

I. Background: The city is situated about 630km east from Addis Ababa City and 60 km away from the border of Somaliland. The city has two layers of administration: the Jigjiga City Administration and 11 kebeles of the city. The city is found in a sub-tropical agro-ecological zone with a temperature ranging between 12.27°C and 27°C and rainfall ranging between 400mm and 800mm with an annual mean rainfall of 712mm (Yohanis and Genemo, 2015).

II. Demography and Demographic trends: The city experienced a high population growth rate of 6.1% between 1994 and 2007. However, the proportion of migrants in the city in 2007 (25.5%) was less than the average for major towns (48.7%). CSA estimates the population of the city to be close to 170,000 in 2017 (CSA 2013). On the basis of World Bank estimates of urban growth (per CSA data), the population of Jigjiga will reach over 365,000 in 2032 and over 465,000 in 2037 (Figure 1). Jigjiga city has experienced a rapid increase in its physical size. The satellite imagery (Figure 2) shows that the city's area of 1.7 m2 in 1986 expanded to 28 sq m2 in 2016, a nearly 17-fold increase the three decades since 1986. In fact, the city has sprawled beyond its administrative boundary in the northwestern, northern and eastern directions.

Figure 1
Population Growth in Jigjiga

Source: CSA various publication and author's own computation on the basis of Govt. and WB estimates

Figure 2
Physical growth of Jigjiga

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of shocks and stresses

Major shocks	
Shocks	Remark
Floods	Jigjiga city has experienced serious floods in different years. A recent flood that occurred in the city at the end of March 2016 resulted in the deaths of 23 people and injury of 84 people when a river that crosses the city burst its banks. As a result of climate change, the rainfall pattern is changing and the temperature is generally rising. This is increasing the city's exposure to flooding hazards.
Fire	Fire was mentioned as one of the top three shocks faced by the city, though the city is unable to respond to fire outbreaks due to inadequate firefighting capacity and equipment.
Landslide	Heavy rainfall causes landslides in the city. The city stakeholders listed landslides as one of the top three shocks in the city and its vulnerability is likely to increase as a result of climate change, which will bring changes in rainfall patterns.

Major stresses	
Stresses	Remark
Water scarcity	Jigjiga city has a critical water-supply problem. At the same tie, the rainfall pattern is changing from time to time and temperature is generally increasing as a result of climate change. Such variability in the climate can further increase water scarcity.
Housing shortage	Jigjiga, among other regional capitals, experienced relatively higher growth rates of more than 5% between 1994 and 2007. There is an imbalance between demand and supply of housing with a backlog reaching 18,000 and causing a serious concern over informal settlements. About 301.8 ha of land or 14.4% of the total area was occupied by informal settlers, a high figure compared to other emerging cities where the proportion remains below 3% (SECR, 2015).
Poor solid and liquid waste management	Access to sanitation facilities in the city is a challenge in Jigjiga city. According to CSA (2007), out of 23,262 housing units 5,493 (23.6%) do not have access to a toilet and 8,788 (37%) of housing units use shared pit latrines. Another challenge is the absence of a modern and functioning sewerage system in the city. Solid waste management in the city is also inadequate. In 2007, the municipality and the private sector collected 57.6% of the solid waste generated (CSA, 2007). The remaining waste was indiscriminately disposed of in drainage lines, rivers, open spaces behind housing units, road side and/or is informally burned, causing environmental and public health concerns.
Unemployment	The level of unemployment in 2012 was 18.8%, which was higher than the national urban unemployment rate of 17.3%. However, this is an improvement from a level of 39.4% in 2010 (CSA, 2012). The share of informal employment in the city is very high and has ranged between 29% and 43% (2009-2014).
Lack of capacity to implement and monitor plans	The city has a structure plan but it hasn't been properly implemented and the activities haven't been properly monitored. Future plans need to identify risk areas in the city and areas for safe expansion. This is a large undertaking which is restrained by the weak capacity in the city to implement and monitor plans.

*The city also listed drainage infrastructure, informal settlements in risk areas, energy shortage, migration, and transport accidents as stresses.

IV. Priority Actions identified during the CityStrength consultations with city stakeholders:

- **Improved and integrated urban planning and development:** Land use planning is a key instrument to overcome numerous challenges in the city. It is important to undertake the following actions through land use planning:
 - Identify risk areas in the city (all water courses). This involves identifying the settlements that are exposed to flooding.
 - Identify a buffer zone around the water courses and other risk areas, and monitor and control any future legal or illegal settlements in that area. This includes reforestation and establishing parks and other recreation areas to prevent encroachment and to increase absorption capacity.
 - Identify areas for safe expansion where provision of basic infrastructure and services can be safely provided.
 - Update the existing plans based on current realities in the city, focusing on the mitigation of risks.
- **Address flooding:** It is important to widen the riverbanks and clean the canals before proceeding with the building of a retaining wall similar to the one in Dire Dawa. It is also critical to develop integrated urban watershed management measures to improving flood management including upstream soil and water conservation, floodplain management, flood water and response system.
- **Address water scarcity:** The problem of water scarcity can be addressed through:
 - Monitoring, protecting, and recharging the aquifer.
 - Prioritize groundwater for consumption, and invest in dams to protect the bore holes for recharging the acquirer.
- **Address liquid and solid waste management:** It is imperative to build a new sanitary landfill to replace the current open dump site.

9. MEKELLE

- I. Overview:** Mekelle city is the capital of the Tigray regional state and serves as the primary economic hub in the region. It has a city administration, a municipality, seven sub-cities, 33 kebeles and 105 Ketenas with decentralized service delivery functions. Mekelle is a fast-growing urban center and a major strategic investment area of the region. The city is found at a distance of 784 km north of Addis Ababa. The city has a mild temperate agro-climatic zone, which is characterized by a summer rain season with erratic rainfall distribution, temperature fluctuations and a dry season with high winds.
- II. Demographic Trends and Physical Growth:** The city experienced a very high population growth rate of 6.2% from 1994 and 2007. In 2007, more than half the city's population were migrants. Applying the national urban growth rate estimated by the World Bank based on CSA data, the population of Mekelle is projected to reach nearly a million people by 2037 (Figure 1). Regarding the physical size, the city had a total land area of 2.5 km² in 1973. This grew to 21.4 km² in the year 2000 (Figure 2). By 2016, the built-up area of the city was 46.4 km². Though some parts of the city have sprawled outside of the administrative boundaries, most of the built-up area remains within its administrative boundaries.

Figure 1
Population Growth in Mekelle

Source: CSA various publication and author's own computation on the basis of WB estimate

Figure 2
Physical growth of Mekelle

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of shocks and stresses

Major shocks	
Shocks	Remark
Floods	Mekelle is located in part of the Tekeze river basin. Ellala and Aynalem streams flow from East to West aligning the Tekeze watershed. Flooding occurs most often during the rainy season. There is a lack of a well-planned drainage system and as a result, there is storm water runoff. The structural plans of the city have not taken into account past flooding events and therefore, the city continues to be exposed to flooding. In addition, participants of the city consultation noted that solid waste blocks drainage channels causing flooding. Uncontrolled open dumping in storm drains, ditches, rivers, open fields, and agricultural farms, create environmental and health hazards, and exacerbate flooding.
Earthquake	The city is located on a seismic belt. Seismic considerations are not considered building or other infrastructure design.
Fire	Fire is another risk the city faces but the level of preparedness of Mekelle city for fire and other types of man-made and natural disasters is generally limited with inadequate equipment and supplies. For instance, Mekelle city does not have a specialized agency for disaster preparedness.

Major stresses	
Stresses	Remark
Water scarcity	Water supply in the city has not been proportionally developed to support the ever-increasing demand which will continue to grow with the industrial park that is being built. The main source of Mekelle city's water supply is ground water. Wells service the city, but are very expensive to drill as the water table is approximately 350m below the surface. The distribution system depends primarily on gravity but the network also relies on pumps. Frequent shortages occur as water is distributed on a scheduled basis to ensure a more equitable supply. Many households, schools and health institutions often lack water and basic sanitation facilities, which had drastic implications for the public health (Castro, Maoulidi& MCI, 2009). There is a need to regulate the kind industries that can be allowed in the city. Soft drinks industries, for example, can drain already constrained water supply in the city.
Housing shortage	As of 2015, the ratio of people requiring access to housing was 98.1 per 1,000 people. About 734.42 ha of land or 3.5% of the total area is occupied by informal settlements. New settlements have emerged over the plots allocated for housing by the city administration. The housing development, however, has not been accompanied by the necessary provision of infrastructure services.

Environmental pollution (water, noise, and air)	The city does not have a liquid waste sewerage network system, and sanitation facilities in Mekelle consist mainly of pit latrines and pour-flush latrines with septic tanks. There is one dry bed constructed which is recently functioning. Due to the lack of a treatment plant or liquid waste disposal site in the city, liquid and semi-solid wastes are disposed of in uncontrolled open dumping areas such as rivers, open fields and agricultural farms, creating environmental and health hazards. There is a need to enforce environmental regulations on factories that utilize natural resources.
Traffic accidents/congestion	The city has a total road length of 384.50 km with 167.5 km or 43.6% being paved road. Mekelle does not have well established public transport systems. Private car, taxis and mini buses are the most used motorized modes of transportation. Walking and cycling are also city transportation alternatives in the city. There is poor management of traffic in the city mainly due to a lack and shortage of manpower, signs and signals. This leads to traffic congestion and makes the city vulnerable to traffic accidents.

IV. Priority Actions identified during CityStrength consultations with city stakeholders:

- **Follow an integrated urban water management approach** to deal with current flooding and water scarcity issues, and prioritize the protection of current sources by taking into account environmental issues and waste management.
- **Revise the master plan** for the city with a long-term vision, taking into account the increased population and clearly identify expansion areas where basic services can be provided. Furthermore, develop a comprehensive drainage plan to alleviate runoff flooding.
- **Housing and Construction:** Provide universal and safe housing for all, and ensure that infrastructure being built is earthquake-resistant. Moreover, retrofit key infrastructure to withstand shocks, especially the water system.
- **Strengthen Disaster Risk Management:** Establish a DRM unit under the City Administration, and strengthen the capacity to respond to fire incidents.
- **Pollution:** Manage water, noise and air pollution.
- **Develop a traffic management plan** and enhance implementation capacity to alleviate the traffic congestion in the city.

10. SEMERA LOGIA

I. Background: Semera city is a newly established city (2011) to serve as the capital of the Afar National Regional State. It also serves as the main transit artery of Ethiopia for import and export through the Djibouti port. Semera is one of the smallest cities in terms of population size. Migration to the city is one of the highest compared to cities of the emerging regions.

II. Demographic Trends and Physical Growth:

According to projections made by the CSA (2013), the population of Semera-Logia is expected to be close to 20,000 in 2017. According to the estimates by the World Bank based on CSA data, the population of the city is expected to reach over 40,000 by 2032 and close to 55,000 by 2037 (Figure 1). A census in 2007 revealed that 71.6% of the residents were migrants (CSA, 2008) coming from neighboring regional states. Semera-Logia grew from 2.5 sq. km in 2000 to 11.1 sq. km in 2016 which is a nearly five-fold increase in size (Figure 2). Logia has a much larger areal coverage than Semera at present. The administrative boundary delineated by CSA, which is 92.3 sq. km, is much larger than the present size, therefore, Semera-Logia has a large space to accommodate its physical expansion.

Figure 1
Population Growth in Semera/Logia

Source: CSA various publication and author's own computation on the basis of Govt. and WB estimates

Figure 2
Physical growth of Semera/Logia

Source: CSA, 2007, GLCF, www.landcover.org/data

III. Summary of Shocks and Stresses

Major shocks	
Shocks	Remark
Floods	In addition to the natural exposure to river flooding, urban flooding is caused by an inadequate drainage system.
Fire	Fire was reported by city stakeholders as a significant shock in Semera/Logia. However, the city doesn't have the appropriate resources to respond to fire outbreaks. For example, the city only has one fire truck and a poor road network which limits the accessibility of emergency responders.
High winds and rains, land slides	Landslide together with high winds and rains, is a significant shock that affects the lives of residents. Response to landslides will have to include terracing.
Water scarcity	Semera/Logia is characterized by a hot arid climatic situation. Over the past few decades, there has been a significant change to the landscape of Afar as a result of recurrent drought and other anthropogenic factors. Climate change impacts are further going to worsen droughts and water scarcity.
Earth quake	The city lies in one of the most seismically sensitive areas of the country. Yet, the city is not prepared for a seismic shock.

Major stresses	
Stresses	Remark
Inadequate water supply and sanitation	The source of water for Semera-Logia city is ground water. In 2007, 97.4% of the population was reported to have access to safe water supply (CSA, 2007). Yet, the water supply system is also reported as fairly inadequate and unreliable due to: poor infrastructure, lack of adequate human resources, and insufficient operational funds. In terms of sanitation, a significant proportion of households live with no toilet facilities and sewerage systems. The main sanitation facilities of the city include: traditional pit latrine and pit flush toilets. According to CSA (2007), about 56.7% of the housing units do not have toilet facilities and 35.5% of the housing units have pit flush latrines. Similar to water supply, the key problems and challenges of sanitation in the city is the lack of modern infrastructure.
Transport Accident	The city houses import and export routes and the presence of many heavy trucks. Congestion and accidents are a common phenomenon. Many long vehicles and euro trackers that deal with import and export activities usually park on the two sides of the main road (especially in Logia) causing traffic accidents. Traffic accident in the city is estimated to be 114 per 10,000 vehicles annually.
Inadequate solid waste management	Coverage and efficiency of solid waste management appears to be low and the proportion of uncollected waste is greater than the waste that gets collected. There is only one landfill in the city which is not operational. According to CSA (2007), about 80.4% of the housing units dispose their wastes in an open space/behind the housing unit whereas 19.6% of households burn or bury their waste.
Shortage of energy	The city struggles with power shortages. There is no alternative source of energy in case the electric grid is down. People in the informal settlements are not connected to the electric grid. The major problem of electricity supply in Semera-Logia city is power interruption.

The city also listed the following stresses: Poor road infrastructure, pollution from charcoal production around the city, no recreational facilities, no drains, lack of institutional capacity due to the recent establishment of the regional capital (2011), rapid population increase – a large number of incoming migrants, poor coordination among different institutions, high illiteracy, truck drivers staying in Logia can cause social issues, housing shortages, increased temperature, informal settlements and slums.

IV. Priority Actions identified during the CityStrength consultations with city stakeholders:

- **Improve integrated flood risk and water scarcity management:** An integrated approach is needed to manage floods and water scarcity. This includes improved water supply network by managing ground water through aquifer recharge. Improved drainage and flood plain management is needed along with the development of a citywide solid waste collection and disposal plan and create awareness for sorting waste.
- **Strengthen fire services:** As fire continues to be one of the major shocks, there is a need for more fire trucks and an improved road network.
- **Prevention of landslides caused by high wind and rain:** Implement afforestation and terracing programs to prevent landslides. Improve the building codes that include wind resilience and implement them.
- **Improved seismic resilience:** Seismic-resilient codes and their implementation are needed. Awareness raising on earthquakes and associated preparation and response is needed among citizens.
- **A DRM strategy:** It is important to have a DRM unit in the city government and DRM strategy for the city based on detailed risk profile and including dedicated budget, early warning, and disaster preparedness.
- **Improved transport management:** There is a need to develop internal roads in new/expanding city areas and plan and implement alternative roads to bypass highway traffic, which will alleviate traffic congestion. Social support should also be provided to cope with challenges of long distance truck route in the city. Furthermore, it will be important to have improved drainage systems to reduce run-off that causes flooding.

Annex 4: Quantifying Benefits from Investment in Urban Resilience

In an effort to quantify some of the benefits derived from investment in urban resilience, this study assessed the reduced potential human and economic losses from fire, flood and earthquake associated with improved building regulations. The estimates are based solely on projected growth in population and building stock accounting for increasing urbanization. All estimates are in current dollars, are based on constant GDP per capita and do not discount future values or account for inflation or changing exchange rates. The assessment found that:

1. Improved compliance with fire could save 160,000 lives by 2050: Ethiopia's current death rate due to fire is 12.11 persons per 100,000 people, which ranks it 20th in the world. By comparison, this rate is 11 in Kenya, 9.83 in Madagascar, 3 in Indonesia and 1.81 in Peru.⁴⁷ The majority of fire-related injuries occur in the home and workplace. While a significant proportion of these losses are in rural areas and will likely decrease due to an “urban benefit” derived from better access to fire protection and medical care, as Ethiopia urbanizes, low-rise building density will nevertheless increase significantly and many more mid- and high-rise buildings will be built. Both of these types of urban settings (dense low-rise and mid- to high-rise buildings) will pose very significant challenges for fire departments, and the hazard risk can be best dealt with through modern building codes and regulation. Achieving effective building compliance with codes is not easy, but can pay many dividends. If improved fire protection⁴⁸ at an incremental cost of 1 percent of building cost is achieved in newly constructed urban areas alone, then by 2050 urban fire mortality would instead be about 600 deaths per year (while rural deaths would remain about 16,400)—resulting in nearly 2,900 lives saved per year. Considering the 34 years between 2016 and 2050, the net reduction in lives lost as a result of improved fire protection sums to 164,000 people, with 75,000 urban lives saved and 89,000 rural lives saved. The estimated number of urban lives saved is based on data-driven estimates of the benefits of improved fire protection that would result from compliance with the fire code, improved construction and egress, installation of sprinklers and the assurance of fire-resistance materials. The estimated reduction in rural fire-related mortalities is based on assumed benefits due to education on better building practices.

2. Compliance with building seismic provisions would reduce Average Annual Losses by 30 percent by 2050, from US\$128 million to US\$90 million: To quantify potential benefits from improvements in seismic construction, data on (a) seismic hazard, (b) building stock at risk, and (c) vulnerability of this stock were combined and used to estimate “average annual loss” (AAL)⁴⁹ for the building stock. The AAL for the current Ethiopian building stock valued at US\$311 billion is estimated to be about US\$50 million. While seemingly insignificant, a “100-year earthquake” could result in direct building losses equivalent to 1.6 percent of the national building stock; business interruption and other impacts would further exacerbate these losses. Such events are not to be dismissed; in 1906, a magnitude 6.8 earthquake occurred within tens of kilometers of Addis Ababa.⁵⁰ For comparison, in 1960, a magnitude 5.7

⁴⁷ Source: World Life Expectancy (2016) and World Health Organization (2014)

⁴⁸ Improved fire protection entails compliance with fire protection provisions of the building code and an appropriate investment in passive and active fire protection measures that typically include sprinklers, fire alarms, and appropriate insulation for stairwell and vertical openings.

⁴⁹ AAL is a standard term used in the finance and insurance industries, and may be thought of as the long-term average loss per year due to a hazard such as earthquake—a damaging event might not occur for a hundred years, but at that time the commensurate loss might be on the order of one hundred times the AAL.

⁵⁰ Sources are vague as to its precise location, indicative of work that needs to be done to improve the understanding of seismicity in Ethiopia.

earthquake in Agadir (Morocco)—a city which had construction very similar to that in Ethiopia—caused significant damages and nearly 12,000 deaths.

While Ethiopia's current AAL is estimated to be US\$50 million, projecting urban growth to 2050, the estimated value of the national building stock would increase to nearly US\$920 billion. Under current building regulation practices, particularly in urban areas, estimated AAL would increase to US\$128 million. If building regulation practices improved and if it were possible to ensure compliance with seismic design codes, estimated AAL would be cut by about 30 percent, to US\$90 million, a net annual reduction of about US\$38 million.⁵¹ Thus, for example, an investment of \$US10 million in improving building regulation would be expected to result in savings of about US\$600 million⁵² from earthquake losses alone, or very approximately a benefit-cost ratio of 60.⁵³ For the purpose of the current estimation, the term “improved building regulation” is defined by the assumption of regulatory compliance with the seismic provisions of the building code.

3. If flood management practices were improved, it is estimated that the AAL would be reduced to about US\$93 million, a net annual reduction of about US\$230 million each year: This calculation involves a combination of land use and structural flood protection measures. To quantify potential benefits from improvements in flood management, data on (a) riverine flood hazard, (b) building stock at risk, and (c) vulnerability of this stock were combined and used to estimate AAL for the building stock. The AAL due to riverine flooding for the current Ethiopian building stock valued at US\$311 billion is estimated to be about US\$123 million (or 0.04 percent of the building stock at risk). If current conditions continue, particularly in urban areas, it is estimated that the AAL would increase to US\$323 million. If flood management practices were improved,⁵⁴ estimated AAL would be reduced to about US\$93 million, a net annual reduction of about US\$230 million each year. For the purpose of this estimate, the term “improved practices” refers to compliance with appropriate design and land use requirements and better facilities for structural flood control.⁵⁵

⁵¹ Note: this reduction would almost be equivalent to the current AAL.

⁵² Savings of US\$38 million would be achieved in 2050—that is, the 34th year from now—next year, proportionately less savings would be achieved, ramping up to the full US\$38 million in 2050. The US\$600 million accounts for this ramping up of savings.

⁵³ This assumes the US\$10 million investment would achieve its result. If a US\$20 million investment is required, then the benefit cost ratio is 30. This also doesn't include any added cost of construction due to improved building regulation—however, building regulation typically doesn't add much to construction costs and, in fact, typically results in overall savings.

⁵⁴ Improvement in flood management practices were quantified based on the assumption that urban areas would receive flood protection measures equivalent to a 100 year flood, and other areas equivalent to a 50 year flood.

⁵⁵ Such facilities would typically involve levees, flood walls, dams and bypass structures. The investment required to achieve the assumed level of flood improvement is currently not quantified.

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