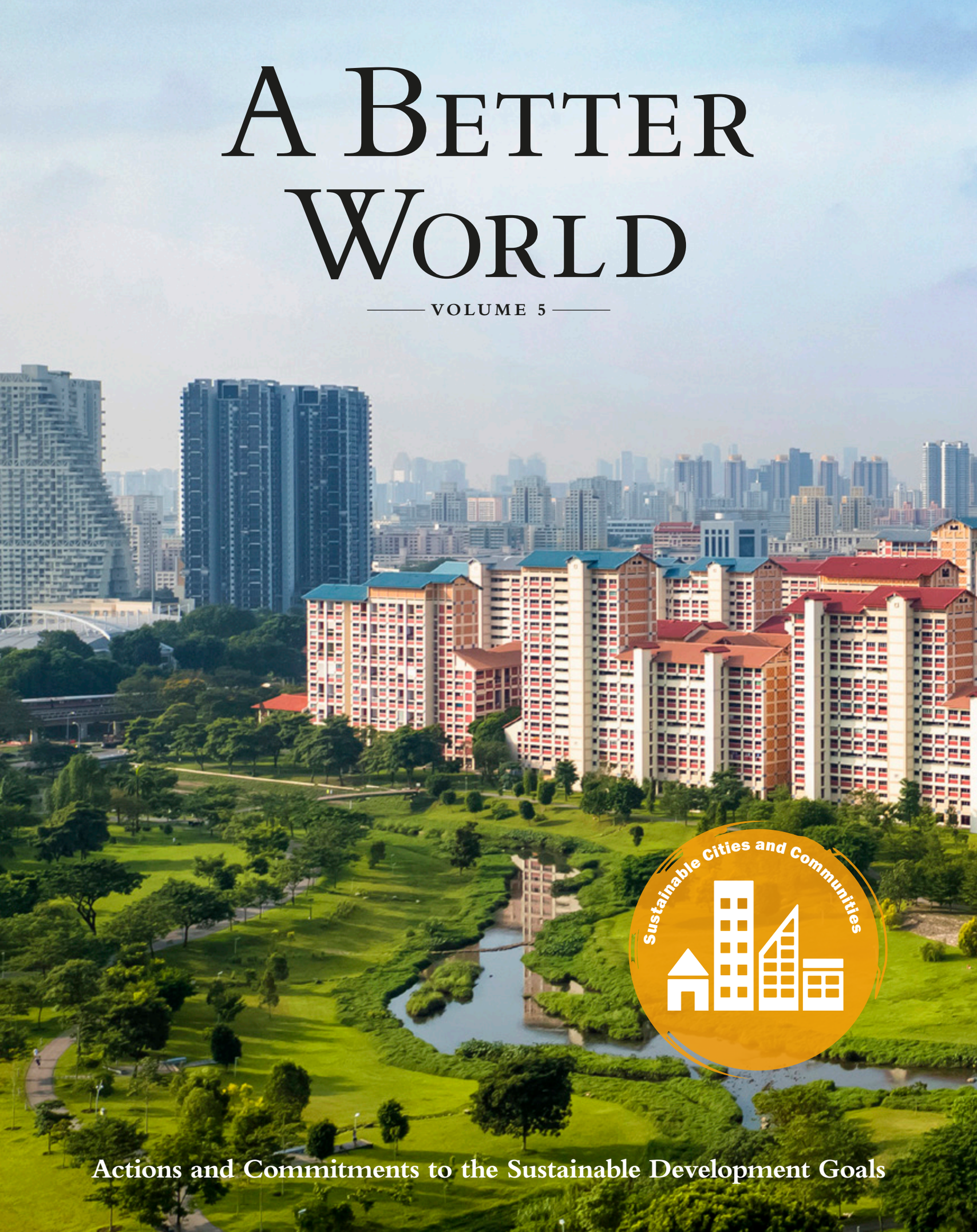
A Better World

VOLUME 5



Actions and Commitments to the Sustainable Development Goals

A Better World

VOLUME 5

Actions and commitments to the Sustainable Development Goals

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Cover photo: The green network of parks interwoven throughout public housing estates has contributed to a high quality of life for many Singaporeans. Image courtesy of Singapore Tourism Board.

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Foreword

SEAN NICKLIN, GENERAL COORDINATOR OF THE HUMAN DEVELOPMENT FORUM AT TUDOR ROSE

With the establishment of the United Nations Sustainable Development Goals (SDGs) in 2015, the Human Development Forum at Tudor Rose has expanded its publishing operation with the creation of a series of volumes entitled *A Better World*, each dedicated to one or more of the 17 SDGs. This volume, published in May 2019, covers Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable.

The target of Goal 11 for 2030 is to ensure access to safe and affordable housing. The indicator named to measure progress toward this target is the proportion of urban population living in slums or informal settlements. Between 2000 and 2014, the proportion fell from 39 per cent to 30 per cent. However, the absolute number of people living in slums went from 792 million in 2000 to an estimated 880 million in 2014. Movement from rural to urban areas has accelerated as the population has grown and better housing alternatives are available.

A Better World: Volume 5 outlines the concept, the main elements and the current international framework for assessing the progress towards SDG 11. It proposes a stepwise approach to further tailor national requirements with the overall goal of making cities and human settlements inclusive, safe, resilient and sustainable. The following articles discuss the progress and challenges in this essential topic, highlighting good practices in a wide variety of societies and disciplines.

By focusing on the experiences and livelihoods of people, especially those in vulnerable human habitats, the book shows the benefits of best policy and practices, and how these may develop further as we come to terms with a changing and more turbulent world. This innovative endeavour is a striking example of sharing respective resources to engage the many official governmental, international organizations, institutional and professional interests in displaying the extent and variety of their efforts to make the world a better place.

Since 1999 Tudor Rose has published 29 books in partnership with the United Nations and its agencies, covering a diverse range of subjects from disaster reduction, water management and climate science to intercultural dialogue and humanitarian assistance. The books are read extensively by the human development sector and especially by community leaders in vulnerable regions around the globe. The books are close collaborations between individual United Nations agencies, United Nations Member States and civil sector organizations, committed to a better future for the world. They have widened the knowledge of people in vulnerable communities and given them inspiration and knowledge to better their lives in a sustainable way.

Towards inclusive, safe, resilient and sustainable cities

Robert Ndugwa, Dennis Mwaniki and Donatien Beguy, Global Urban Observatory Unit, UN-Habitat

Urban areas have never been more significant in providing housing and livelihoods to growing populations. Clearly, sustainable development will not be achieved without addressing the basic human rights of the millions of urban dwellers who live in poverty, lack access to basic services and infrastructure, and experience extreme marginalization and insecure living environments. According to the World Bank, 3 billion more people will need housing by 2030[1] and many will be in urban areas.

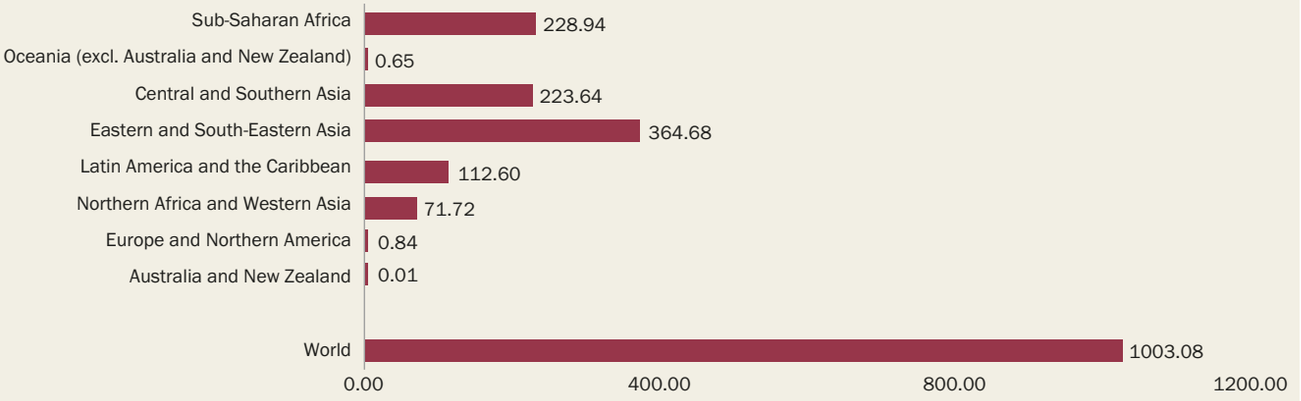
As a basic human right, the delivery of adequate housing can enhance economic and social well-being for individuals and communities. However, where decent urban housing is unavailable, this can lead to a range of negative impacts, including inequality, barriers to inclusion, and poor health. In developing countries, most of the urban expansions that have occurred in the last four decades have been characterized by informality resulting from varied reasons including, but not limited to, poor urban planning, lack of enforcement of legal instruments, and unaffordability.

Globally, the crisis of unaffordable housing is attributed to speculative behaviours that finance urban expansions beleaguered by poor basic urban services provision, including high rates of provision of mobility and sustainable means of urban development. Regrettably, neither the public nor the private sector have been able to deliver affordable housing for the poor at the scale that the prevailing housing predicament requires.

Developing countries also face severe challenges around sustainability and quality of life, with 97 per cent of cities in these countries failing to meet air quality standards, compared to 49 per cent in developed countries, and air pollution causing around 3.4 million deaths annually. While urban areas and cities in general have seen positive changes in recent years in terms of those living in poor conditions, a great deal more still needs to be done. We have witnessed extensions of approaches to housing, and urban policies going beyond merely addressing affordability to cover among others, security of tenure, accessibility, habitability, cultural adequacy, equity, and food security. Indeed, sustainable urbanization is well-thought-out as being key to addressing some of the fundamental risks to natural and man-made hazards and some of the root causes of instability and conflict such as social and spatial inequalities, unequal access to land, lack of basic services and pressures on natural resources.

We have also witnessed the proportion of the global urban population living in slums dropping by 20 per cent between 2000 and 2016, although the absolute numbers of those experiencing slum-like conditions increased to more than a billion, meaning that the pressure on cities due to rising demand for services and migration from rural areas shows no signs of abating.

Urban population living in slums or informal settlements



source: UN-Habitat, 2019

The role of the SDGs in urban areas

The 2030 Agenda for Sustainable Development is the result of agreement by Member States on 17 Sustainable Development Goals (SDGs), encompassing 169 global targets and more than 230 indicators. Progress on these commitments will be monitored up to 2030, and Member State governments have the primary responsibility to follow up and review progress made in implementing the goals and targets.

Urban areas have a critical role to play in the achievement of the goals that are enshrined in the 2030 Agenda. SDG 11 (Sustainable Cities and Communities) was formulated to track progress in cities and human settlements across 10 targets and 15 indicators, and this is in addition to many other complementary city and urban level targets/indicators that are being monitored throughout the other 16 SDGs. A UN-Habitat analysis of such urban-related targets shows that at least 60 per cent of the SDG targets can and should be monitored and reported at the city, urban or local level in cities, with progress and results reported at the national level.

With the overall aim of making cities and human settlement inclusive, safe, resilient and sustainable, SDG 11 advocates various interventions, including eliminating slum-like conditions, providing accessible and affordable transport systems, reducing urban sprawl, and increasing participation in urban governance. It also has a focus on enhancing cultural and heritage preservation, addressing urban resilience and climate change challenges, encouraging better management of urban environments (pollution and waste management), providing access to safe and secure public spaces for all, and improving urban management through better urban policies and regulations.

United Nations Member States clearly face a range of tough challenges to achieve sustainability in cities and urban areas, as outlined in SDG 11 and its associated targets and indicators. However, they can draw upon a wide range of resources and good practices or proven experiences that have been amassed in recent years. The monitoring of various aspects of life in cities has been high on the development agenda since 2015, particularly in the context of the SDGs and also the New Urban Agenda (NUA).

Image: UN-Habitat, 2019

One of many regional and global workshops conducted by UN-Habitat's Global Urban Observatory Unit

In July 2018, Goal 11 was reviewed for the first time as part of the United Nations High-level Political Forum on Sustainable Development, the global platform tasked with follow-up and review of the 2030 Agenda for Sustainable Development and the SDGs. Local monitoring and reporting at country level has proved to be of particular importance in this global process and will continue to be central to the ongoing tasks of monitoring and feedback. In particular, the availability of metadata from the many custodian agencies and other guides for SDG 11 is crucial to enabling understanding and monitoring progress of the social indicators that need to be taken into account. This in turn improves the ability of Member States to report on the frequently complex situations encountered on the ground.

Why sustainable cities matter

More than half of all people have called cities or urban areas home since 2007, and it is predicted that by 2030, cities will be home to 60 per cent of the global population, increasing to 68.4 per cent by 2050.[2] The pressures placed on cities by population growth should not be underestimated. Most of the growth in urban populations in the coming three decades is set to take place in less developed regions, including East and South Asia and sub-Saharan Africa.[3] Urban energy consumption in these regions is about 70 per cent of the global total and carbon emissions are at a similar level.[4]

The size of the world's major cities has been steadily rising in recent years and the trend is set to continue. In fact, statistics from UN-Habitat based on global monitoring of urban expansions (SDG 11.3.1) shows that urban areas are currently growing at a faster rate than their populations, with a concomitant reduction in density of housing and related implications for efficiency of land and sustainable resource use. Rapid urbanization in developing nations is frequently marked by a lack of adequate planning, with impacts ranging from extreme poverty and social inclusion to high unemployment. Almost one third of cities are not planned, with 30 per cent of urban environments not subject to any formal layout process. This has consequences at all levels of urban life, including in the most basic aspects such as waste management, leading to poor public health and degraded facilities. Properly managed and planned public space can ameliorate these problems by enhancing safety and social cohesion.

Support for urbanization

The monitoring work that needs to be undertaken to achieve the SDGs builds to some extent on systems that were set up previously for the Millennium Development Goals that preceded them. The quest for resilient, sustainable cities that lies at the heart of SDG 11 is also supported by existing initiatives, such as the Sendai Framework and the NUA, adopted in Quito in 2016. The 2018 Kuala Lumpur Declaration on Cities 2030, which was adopted at the 9th Session of the World Urban Forum, is feeding into conversations regarding the role of urbanization in a sustainable future.

The United Nations Educational, Scientific and Cultural Organization's (UNESCO's) Creative Cities Network is working towards the implementation of the 2030 Agenda, with 180 cities in 72 countries. Together, these initiatives

Global baseline status of SDG 11 targets and indicators

Targets	Current inidcators
Target 11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.	**Indicator 11.1.1** Proportion of urban population living in slums, informal settlements or inadequate housing.
Target 11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.	**Indicator 11.2.1** Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities.
Target 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.	**Indicator 11.3.1** Ratio of land consumption rate to population growth rate. **Indicator 11.3.2** Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically.
Target 11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage.	**Indicator 11.4.1** Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed, World Heritage Centre designation), level of government (national, regional, and local/municipal), type of expenditure (operating expenditure/investment) and type of private funding (donations in kind, private non-profit sector, sponsorship).
Target 11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	**Indicator 11.5.1** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population. **Indicator 11.5.2** Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters.
Target 11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels	**Indicator 11.b.1** Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030. **Indicator 11.b.2** Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies.
Target 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.	**Indicator 11.6.1** Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated by cities. **Indicator 11.6.2** Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted).
Target 11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities.	**Indicator 11.7.1** Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities. **Indicator 11.7.2** Proportion of victims of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months.
Target 11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.	**Indicator 11.a.1** Proportion of population living in cities that implement urban and regional development plans integrating population projections and resource needs, by size of city.
Target 11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.	**Indicator 11c.1** Proportion of financial support to the least developed countries that is allocated to the construction and retrofitting of sustainable, resilient and resource-efficient buildings utilizing local materials.

source: UN-Habitat, 2018

underscore the need for urbanization to be taken seriously as a key aspect of global policymaking.

The exponential growth in big data is dramatically expanding both the types of information that can be captured in cities and the possibilities for gathering and processing such information. However, for many Member States, existing methods of data gathering are not sufficient and new reporting systems need to be put in place.

Both qualitative and quantitative data collection systems tailored for SDG 11 have been developed by various United Nations agencies, including UN-Habitat, United Nations Office for Disaster Risk Reduction, UNESCO, World Health Organization and the United Nations Office on Drugs and Crime. These agencies, along with the Regional Commissions, United Nations Population Fund and the United Nations Statistical Division, also provide technical and methodological support to Member States, along with monitoring and reporting for SDG 11 at the global level.

Data challenges

There is huge variation among Member States in the quality and availability of data on SDG 11's 10 targets and 15 associated indicators. Unsurprisingly, as they are data rich, large cities are better placed than smaller urban environments to upgrade systems that collect, and make sense of data on the full range of targets and indicators. In addition, for many countries, the work of integrating SDG indicators in national monitoring systems is still in the early stages. With less than a third of countries reporting on at least one target and just 3 per cent delivering data on more than five indicators, there is much work still to be done.[5] Cities and urban areas stand to benefit particularly from the constantly expanding possibilities of data collection and processing, not just for SDG 11. According to UN-Habitat's analysis of all SDGs indicators, more than half of the SDG targets have an urban component. Also, most of the 244 SDG indicators have some connection to urban policies.

Cross-referencing with other SDGs can yield vital support to countries working towards SDG 11. There are clear links with the other goals, for example SDG 1 on poverty or access to basic services, SDG 3 on health, SDG 4 on education, SDG 5 on gender equality, SDG 9 on building resilient infrastructure and promoting sustainable industrialization, SDG 12 on ensuring sustainable consumption and production patterns, SDG 16 on good governance, and SDG 17 on partnerships and means of implementation.[6]

Interlinkages between SDG 11 and other SDGs

source: UN-Habitat, 2018

Urbanization is an unstoppable phenomenon

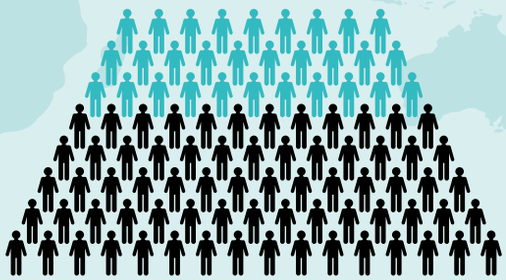
▶ *The world is rapidly urbanising*

The world's population living in cities or urban centres has risen steadily over the years

Since 2007
over
50%

By 2030
about
60%

By 2050
approximately
66%



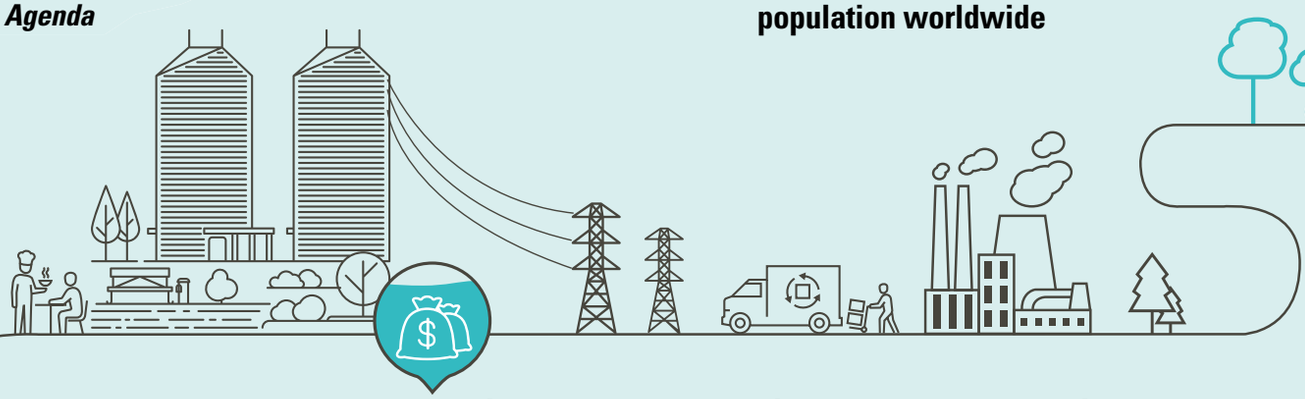
From 2010 to 2050

2.5 to 3 billion people

will be added to the urban population worldwide

SUSTAINABLE DEVELOPMENT GOALS

Urban areas will be increasingly critical for achieving all SDGs and integrating the social, economic and environmental goals set forth in the 2030 Agenda



Cities contribute to ▶

80%
of global GDP

70%
of global energy consumption

70%
percent of global carbon emissions

Image reproduced from SDG 11 Synthesis Report, High Level Political Forum 2018, pp 6–7

Image: UN-Habitat, 2019

UN-Habitat workshops bring stakeholders together for improved development cooperation

Capacity-building

To ensure the success of the work countries need to do on SDG 11, there is a need to guarantee adequate resources and funding, along with capacity-building initiatives within individual countries and work to coordinate activities both within and across goals. The groundwork for the collaborative efforts needed has been laid by the 2030 Agenda for Sustainable Development and the NUA, both of which advocate an integrated approach to urban development. However, a global assessment by UN-Habitat to determine how well prepared countries were to monitor and report on urban-related SDG targets found that most countries do not have the capacity and the systems to undertake this work accurately, reliably and in a timely manner for evidence-based policymaking. There is an increasing need for support as countries seek to adopt new methodologies for data collection, such as GIS-based systems, with investments in satellite and earth observations technologies — but for many countries, the needs are more basic, as they struggle to develop the necessary monitoring and reporting mechanisms. This work needs to be supported through partnership with government ministries and departments, local authorities, private sector organizations, academia and civil society groups. An aspect of data gathering that requires particular support in leaving no one behind is the requirement within the SDG framework for all aspects of age, gender and disability to be incorporated when countries undertake measurement of indicators. Sustainable development depends upon establishing conditions for all to participate meaningfully in society, and a significant part of this is the design of integrated spatial and urban planning and management. For the monitoring work required by SDG 11, some indicators (such as those related to gender and disability) need to be disaggregated based on agreed parameters, while others (such as those related to culture) do not need to be disaggregated, leading to potential confusion. UNESCO is providing support in this regard, having worked with various organizations to develop a framework and suite of thematic indicators for culture in the SDGs across a number of goals and targets, with particular focus on SDG 11.

The importance of monitoring and reporting

Many countries have already begun the process of improving their understanding of the requirements of SDG 11, having requested technical support from UN-Habitat and other custodian agencies. Much of the need relates to capacity-building for collection and analysis of urban data and the formulation of policies arising from this process. Setting up appropriate monitoring systems is the first step towards achieving these aims, and the custodian agencies are assisting countries in this task. While many large cities, particularly in developed countries, have access to sophisticated statistical resources and technologies to assist in monitoring and reporting for SDG 11, they still face challenges in applying unified definitions and standards to their urban data. Harmonization of methods and concepts and consistent approaches to measurement over time will be crucial to success in this regard. Willingness to share information and continuously gauge progress at global, national and local levels will be key to cities' ability to delivering on their SDG 11 commitments. Monitoring and reporting at the local level on some of the core, fundamental drivers of change for sustainable urban development — such as the extent to which governments are developing and implementing urban policies, level of efforts made for strengthening urban governance, and financing — need to occur in parallel to ensure that the cycle of evidence generated informs subsequent policymaking processes.

At the global level, many partners agree that harnessing the transformative force of sustainable urbanization to achieve the SDGs requires their localization alongside consolidation of all efforts from governments, private sector, citizens, civil society, and academia. There is a clear need to enhance coherence and coordination across all global and local partners even among the United Nations System in its efforts to assist Member States to achieve the urban targets set out for Agenda 2030, NUA and other global related agreements such as the Global Compact for Refugees and Migrants, and the Paris Agreement on Climate Change.

On the technology angle, advances in earth observations, remote sensing and geospatial information technologies over the last decade have created major opportunities for urban monitoring. To leverage on the emerging opportunities, UN-Habitat and many other agencies are integrating these technologies into SDG methodologies and technical guidelines for data production, analysis and dissemination, which are now being used by cities and countries for urban monitoring in line with the SDGs and NUA. Up to 2030, remote sensing and geospatial information techniques will be used to produce data for at least four SDG 11 indicators — 11.3.1, 11.2.1, 11.7.1, 11.1.1 — as well as to support broad urban monitoring and data-based decision-making processes.

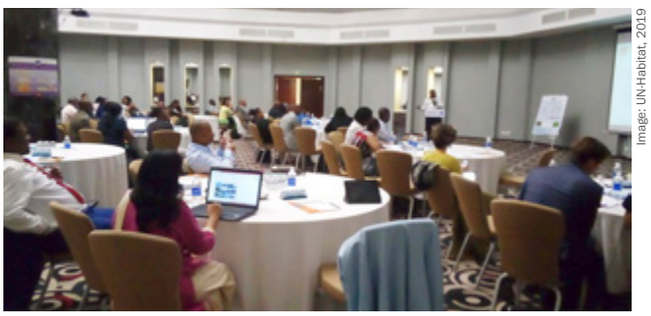


Image: UN-Habitat, 2019

One of many regional and global workshops conducted by UN-Habitat's Global Urban Observatory Unit

Urban October — a call to enact effective policies and sustainable solutions for a better and inclusive future for cities

Dr. Aida Karazhanova and Kantinant Silabhusith[1]

Urban environments create many issues of concern. Addressing one issue at a time is insufficient unless its solution has a positive impact on multiple issues. How should cities employ a holistic approach, with measures required to be taken on so many different levels simultaneously?

Cities and human settlements have an essential role to play across all of the goals of the 2030 Agenda for Sustainable Development. The New Urban Agenda has mapped out the direction and development goals for cities over the coming decades, with the common understanding that the process of urbanization must shift from sprawling and quantity-led development to an innovative, inclusive, cost- and time-efficient, quality-oriented approach.

In order to address urban issues, the United Nations has designated the first Monday of October every year as World Habitat Day, and the last day of October as World Cities Day. The month of October is therefore gathering momentum for raising awareness, reflecting on the state of towns and cities, and acting as a constant reminder of collective responsibility for the future of human habitats and in promoting sustainable urban developments. Every year, governments endeavour to convene regional partners as well as experts across various urban sectors, the private sector and academia to discuss and address the pressing issues and highlight activities and events around specific themes.

Image: ESCAP (2018)

A new canal housing project has been launched that aims to upgrade the settlements and the drainage network along the canals as well as improving the environment and infrastructure

What have we learned from Urban October 2018 on the themes of municipal solid waste management and building sustainable and resilient cities? What policies should be implemented to address the issues in an effective and timely manner? What values could be crystallized by the events of 2018 and the upcoming 2019 Urban October, and what actions taken to accelerate the collective achievement of SDG 11, making cities inclusive, safe, resilient and sustainable? This article aims to share the authors' observations on policy messages that were covered during three important events at the United Nations Conference Centre in Bangkok, Thailand and in the materials and press-releases of UN-Habitat, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the Government of Thailand.

Bridging gaps, adapting to change and overcoming cultural barriers

One of the issues faced by municipal governors in South and South-East Asia is the annual backlash and series of petitions from marginalized and disadvantaged communities that are affected by rapid economic development patterns.

The start of Urban October

The Four Region Slum Network marked World Habitat Day on 2 October, 2018 with a march of mobilized slum communities in front of the United Nations building in Thailand. Varind Damrongphan, President of the Four Region Slums Network, raised a petition to the United Nations, highlighting the need to address various issues on access to housing in the slum communities. The communities voiced their concerns about existing policies, and advocated new policies to specifically target the communities' needs. The communities want to be heard and consulted and have suggested to decision makers that new policies can be developed through engaging in dialogue with the local communities. Policies should enable solutions and ensure living spaces for sustainable communities. As a response, policymakers and social media made many efforts to close the communication and knowledge gaps between governments and communities on the uneven distribution of benefits and social responsibilities.

Image: ESCAP (2018)

Demonstrators from the Four Region Slum Network, 2 October 2018

The official inauguration of World Habitat and World Cities Day 2018

ESCAP, UN-Habitat, the Royal Thai Government and the Asian Coalition for Housing Rights organized a commemorative event welcoming over 800 participants on 10 October 2018.[2] Panel discussions held at the United Nations with community leaders from 10 countries revealed that those local communities not being consulted on upcoming development changes feel excluded and marginalized and that any advantage inherent in development is being enjoyed only by the private sector.

During these official events at the United Nations Conference Centre, the leaders of international communities also assembled to speak up and to protect their fundamental human rights for equality, dignity, access to housing and freedom. Representatives of these communities shared their experiences of overcoming economic development challenges and discussed the policies and norms that they implemented to find solutions. The urban poor representatives were united in their efforts to bridge cultural differences and experiences through life stories and sharing lessons learned. The solutions discussed included the importance of information gathering, mapping and profiling of local slums to assess community needs, measures undertaken by slums to protect against unwanted development, raising community funds to buy land and housing, and assisting in disaster relief and prevention.

The Government of Thailand, as host country of the Urban October events at UNCC Bangkok, announced a pledge to ensure housing for all by 2030. Also, the new Canal Housing Project was launched[3] which aims to upgrade settlements and the drainage network along the canals as well as improving the environment and infrastructure.[4]

Ideas were shared at the event on the nature of approaches with which to address tensions that hinder progress, thereby overcoming cultural barriers and exploitation in the inclusive city. The event's opening remarks were made by His Excellency Minister of Social Development and Human Security, General Anantaporn Kanjanarat, who announced that: "Through the 20-Year National Housing Development Master Plan, the National and Provincial Committee on Housing Development is moving towards the achievement of SDG 11 and the implementation of the New Urban Agenda in cooperation with communities and stakeholders. Thailand stands ready to cooperate and share experiences and best practices with other countries to fulfil our common effort to achieve the SDGs."

The concluding event

The Global Forum on Human Settlements (GFHS) 2018[5] concluded the Urban October events, calling for advancing urban innovation to achieve SDG 11 and the New Urban Agenda, making cities inclusive, safe, resilient and sustainable.

One of the emerging areas of policy concern highlighted by GFHS among others, was the efficiency of urban water management in a rapidly urbanizing Asia-Pacific. Expanding economies and the negative impact of climate change in the region together create a growing demand for freshwater resources, as well as for water services for food (through agriculture) and energy (through industry). The current urban infrastructure is insufficient to cope with the growing needs for wastewater treatment systems, basic water supply and severe pollution. With this new pressure of unequal demand and distribution of water supply, an urban-rural divide has been created and needs to be addressed. The poor quality of urban water and its insufficient quantity create fundamental problems for surface water management, impacting economic and social development in the region.

Urban water issues, exacerbated by water scarcity or water excess, are not aligned with the trends of population growth. The region's municipal decision makers must create a multisectoral, inclusive and comprehensive local strategy and take an integrated approach to policy development. This is vital to ensure that the necessary infrastructure and services are in place to provide access to water and sanitation, and enable management of rainwater, wastewater, stormwater drainage, and run-off pollution; control of waterborne diseases and epidemics; and reduction in the risk of water-related hazards, such as floods and droughts. Overall, the region needs improved urban water management practices that can prevent water resource degradation, ensure access to safe supply, and improve resilience to climate change.

Highlights and policy needs

Solid waste management

The accumulation of solid waste is a global issue and is a major problem in the Asia-Pacific region. With poorly-planned development, the composition of wastes and their management is becoming more complex and giving rise to more non-biodegradable and toxic wastes. No other region of the world faces as great a need as that of breaking the link between prosperity and its associated consumption and waste generation rates. A publication by ESCAP reports that cities in South Asia spend between US$ 10 and US$ 30 to collect, transport, and dump each tonne of waste, accounting for 20 to 50 per cent of municipal expenditure.[6]

Costs of inaction or unsound waste management can be high. It is estimated that the cost of managing solid waste may range between 10 and 35 per cent of the expenses incurred for its remediation. The responsibility to act resonates with a large cross-section of society, especially young Thai citizens, who will otherwise inherit the burden of the waste produced today.

In developing countries, over 90 per cent of solid wastes are disposed into unregulated dumping sites and are openly burned. The environmental impact of this form of disposal highly affects the urban poor. Also a career in waste disposal is often viewed with disdain, despite it being fundamental to waste management in cities. Urban October 2018 made a point of celebrating the efforts of cities in ensuring cleanliness and waste management. Since 2009, the Waste Concern organization and its partners, supported by the ESCAP Secretariat, has shared its achievements in promoting a waste-to-resources approach across the region, making it publicly available at the knowledge corner of the waste-to-resources section of the ESCAP website.[7]

ESCAP's seminar on municipal solid waste management, including plastics, concluded that a shift is required in mindsets and consumption patterns, from the current linear model of take–use–dispose of, to a more sustainable and circular economy concept. This shift is gaining momentum.

Inclusive cities and empowered urban communities

The urban poor of the region are facing difficulties in finding sustainable housing options, which is illustrated in various United Nations and national reports. Urban areas are growing at an unprecedented rate, with expectations that up to 70 per cent of the worlds' population will be living in cities by 2050. The current global estimate is that cities house 60 per cent of their citizens in slums[8] with no access to the basic infrastructure that others take for granted, such as water, electricity, employment and education. In total, around 1 billion people live in slum conditions today[9] and "the slum challenge remains a critical factor for the persistence of poverty in the world, excluding fellow humans and citizens from the benefits of urbanization and from fair and equal opportunities to attain individual and collective progress and prosperity."[10]

With 80 per cent of a country's economy being sustained by cities, it is important that this issue is addressed to ensure continued urban growth. Policies, such as providing subsidies for maintaining infrastructure, loans and grants for new housing, have now been enacted and funds established to help cities become more inclusive for those who struggle financially in finding alternatives to improve their quality of life.

In the effort to encourage organizations to move towards sustainable business practices, the Government of Thailand has presented awards to individuals and organizations in recognition of their dedicated work in ensuring social benefits for their communities. To help create solutions, Urban October has convened a panel discussion on the topic of Building Sustainable and Resilient Cities, represented by grassroots and community leaders from over 10 countries in the Asia-Pacific region, affiliated with the Slum/Shack Dwellers International regional alliance.

The example of the Baan Mankong collective housing programme, supported by the Community Organization Development Institute (CODI) in Thailand, was highlighted during Urban October 2018. The project has been underway since 2003 and, as of February 2019, some members of the community have begun to move into their new homes. The programme has already been implemented in 388 cities, benefiting over 108,000 families. The programme organizers hope that this first move into the new houses will create the impetus that other members of the community need in order to begin the transition to more stable, sustainable and secure housing.

CODI helps communities to build houses for the poor with low-interest loan schemes. By solving housing issues in those areas, communities improve their own lives. In a safe and stable environment, community members can focus

Image: ESCAP (2018)

World Habitat Day and World Cities Day 2018, Bangkok, 10 October 2018. In attendance were community representatives from Bangladesh, Cambodia, India, Indonesia, Myanmar, Pakistan, Philippines, Sri Lanka and Thailand, all focused on the key messages required to map the way forward for urban environments

on education and employment, increase contributions to the local economy, and reduce the number of substance abuse cases that are still prevalent in lower income areas.

How to finance urban infrastructure

With identified technical solutions, communities feel the need to ensure a feasible continuous financing system. Funding schemes are enacted by both the private and public sectors. In this regard, Urban October 2018 has highlighted the need to foster partnerships as a key instrument for achieving SDG 11 — Make cities inclusive, safe, resilient and sustainable — through the implementation of other goals such as SDG 17 — Revitalize the global partnership for sustainable development. Financing architecture at local level, aligned with national levels at specific key intervention points will have the most effect on overall urban development, and will maximize the impact from enacted policies. Urban October has highlighted the fact that banks and financial institutions can and should provide green bonds, consider environmental impacts and explore blockchain technologies to monitor transactions and decentralize financial opportunities for a wider audience. Financial subsidy schemes should also support the private sector's efforts and align the goals and values of different institutions through enabling policy convergences. Economic stimulus plans must also consider the growing population in urban areas and create the living space for people that are moving in.

What could help those left behind in future cities?

Sustainable infrastructure and liveable cities are the result of effective policy implementation, resulting from fruitful collaboration between the government and local communities in following a clear, strategic vision. Local communities are heavily burdened, and complain when the government and large organizations undertake improvements to infrastructure without consultation with those communities. Therefore, policies and norm setting are followed and effectively implemented only in cases where participatory planning is ensured and government efforts are aligned with the needs of communities.

Given the lessons learned, governments need to continue providing the outlets for communities to voice their concerns to enable gradual improvements. Governments can and must collect information through surveys, biometric data and interviews, and consider the views of communities as a key factor before implementation. Local communities need to strengthen their skills to be outspoken and improve messaging and communication with the respective government representatives and decision makers at all levels, and they need to attain new skills to undertake the new jobs as they arise.

Current decisions can be understood in the context that preceded the respective government policies. Policies and organizations aid communication between local communities and the government by giving communities a channel to reach out to public sectors. If these means are followed, then the voices and concerns of the poor communities are heard, and no one will be left behind.

The annual delivery of the Urban October events brings value to the public and highlights the importance of participatory processes, as it explores the full spectrum of issues, policy options, solutions and opportunities for communities and governments to communicate and collaborate. The most effective way of bringing awareness, and of elucidating and enacting the policy cycle, is to analyse its components and the processes behind them, and understand the interrelationship in real time between the problems and the policy narrative components. It is important to communicate and exchange ideas clearly and vividly with the local communities.

The future of Asian cities is now driven with the aspirational vision of governments to achieve the Sustainable Development Goals through setting new norms and enabling new policies and new institutional linkages between the various constituencies. With the right incentives, the private sector will become interested in investment, and communities will be able to steer policies and take ownership of them in order to ensure sustainable livelihoods.

The SDG 11 Global Council

Dr. Aisha Bint Butti Bin Bishr, SDG 11 Global Council Chairperson; Dr. Okan Geray, SDG 11 Global Council Member; Meera Al Shaikh, SDG 11 Global Council Secretariat, UAE

The establishment of Global Councils on SDGs is a testimony to the strategic role played by the United Arab Emirates (UAE) as part of global efforts to achieve the SDGs. Her Excellency Reem Al Hashimy, UAE Minister of State for International Cooperation, and chairperson of the National Committee on Sustainable Development Goals, launched the Global Councils on SDGs in 2018 during the World Government Summit in Dubai.

Global Councils on SDGs are established for two years and constitute an innovative global platform that is conducive to the exchange of views and experiences, and identifying best practices that can be translated into practical applications to accelerate the implementation of SDGs globally. In this context, Her Excellency Dr. Aisha Bint Butti Bin Bishr, director general, Smart Dubai, was appointed chairperson of the SDG 11 Global Council (SDG 11-GC). She aimed at establishing a globally representative and inclusive body by ensuring that council members represent a broad range of geographies and stakeholder types. Members were therefore selected, in 2018, from the Americas, Europe, Africa and Asia-Pacific, representing multi-stakeholder types from worldwide experts in academia, non-governmental organizations (NGOs), and the private and public sectors.

SDG 11-GC's vision is to catalyse and accelerate the achievement of SDG 11 by 2030. The mission is to formulate a pragmatic, multi-stakeholder, widely-applicable SDG 11 framework for cities; and to implement selective pilot initiatives by utilizing the formulated framework.

During its course of work, SDG 11-GC capitalizes on science, technology and innovation and leverages emerging technologies such as artificial intelligence, data, blockchain and Internet of Things, if and where applicable.

SDG 11-GC abides by the following principles:

- Utilizing a pragmatic approach
- Applying wide stakeholder engagement
- Leveraging existing initiatives
- Forming strong partnerships
- Recognizing differences
- Leaving no one behind.

As it commenced its work, SDG 11-GC was aware of the following challenges:

- Cities are at various levels of development with different performance characteristics with respect to SDG 11
- There are existing global initiatives at global, regional, national and local levels
- Cities might not be well informed as to how to enhance their performance with respect to SDG 11
- Public financing might be limited for cities
- The particular context with respect to institutions, administration and governance differs among cities.

SDG 11 Global Council scope of work

SDG 11-GC will conduct its work in two phases. The first entailed formulating a pragmatic, high-level implementation framework for cities to utilize in implementing SDG 11, with the framework having been agreed by all Council members in February 2019. The framework assists cities to:

- Assess their current position with respect to SDG 11 targets
- Understand gaps using a data-driven evidence-based scheme such as targets and key performance indicators (KPIs)
- Formulate a high-level pragmatic and actionable approach for closing identified gaps through targeted action items
- Exchange knowledge and practices among themselves.

The framework also highlights various enablers for successful implementation of SDG 11, and prescribes a high-level approach for implementing initiatives by relying strongly on robust partnerships — capitalizing on SDG 17 — from various constituents including financing organizations and public and private sector organizations, among others.

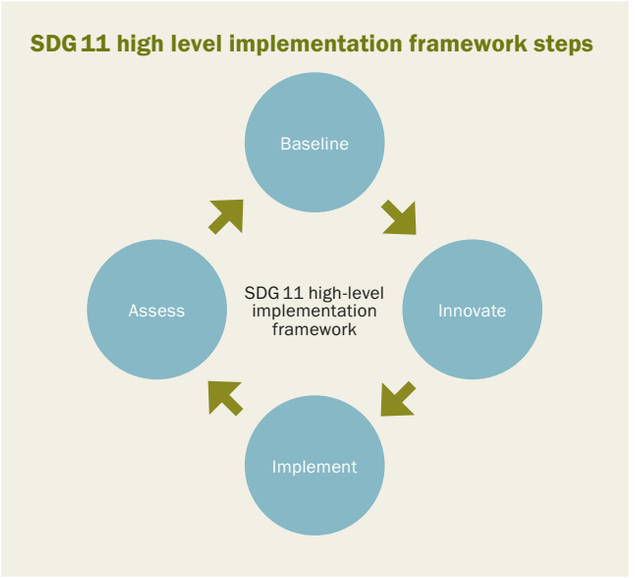
The second phase is targeted for completion by February 2020 and entails actioning the formulated framework by:

- Applying it to selected SDG 11 pilot projects globally — the actual number of implementation projects will vary based on resource availability and council consensus
- Establishing partnerships, for example between multilateral organizations, financing organizations and the private sector
- Overseeing pilot projects
- Refining and revising the formulated framework through lessons learned.

The framework will ensure a systematic approach in the implementation of SDG 11. It will also enable transparency and impartiality for the council to select pilot projects in the second phase.

SDG 11-GC will explore and assess both horizontal and specific city/issue pilot implementation projects. Horizontal projects are applicable to more than one city addressing a general concern among cities, whereas a specific city/issue might focus on a particular issue pertinent to a single city.

Note that criteria such as well-defined scope of implementation projects, availability of financing, readiness and commitment of cities may play a key role for the selection of pilot projects.



First phase preliminary findings of SDG 11-GC — high-level implementation framework

As SDG 11-GC nears the completion of its first phase of work, it has formulated its draft high-level implementation framework consisting of the following steps:

Step 1 — Baseline

This entails conducting a rapid current state review and audit that determines the baseline for a city with respect to SDG 11. More specifically, it appraises a city's current status with respect to the following three components:

- SDG 11 city targets and KPIs,
- Ongoing city-level SDG 11 initiatives and action items
- Various enablers to aid in SDG 11 implementation.

Step 1a — SDG 11 city-level targets and KPIs

SDG 11 targets are formulated at national level. The framework proposes cities to cascade down their national targets to city (local) level ones, allowing formulation of city level dashboards and comparison of performances at city-level.

The framework also incorporates translating SDG 11 targets into KPIs to measure progress towards intended results as well as providing an overview of existing relevant SDG 11 KPIs formulated by credible international organizations such as UN-Habitat, ISO, U4SSC. This also gives cities the flexibility to incorporate their own specific KPIs.

Step 1b — Ongoing city-level repository of initiatives/action items

This component includes actual initiatives/action items formulated and being implemented by a city towards achieving SDG 11 targets. In some cases, they may be national-level initiatives being implemented at city or local level. The role of urban observatories, if available, is briefly discussed.

A simple tool is included for a city to use to collate its list of initiatives/action items related to SDG 11 implementation.

Step 1c — Enablers

This component refers to enablers that help in implementing SDG 11. The presence of these enablers will potentially increase the likelihood of success for a city in implementing SDG 11. The following enablers are included and briefly explained in the framework:

- Leadership and governance
- Strategy and policy
- Ecosystems and engagement
- Utilization of science, technology and innovation
- Data
- Financing
- Regulations
- Skills and knowledge.

A simple checklist in the form of a table is included which can be used by a city to assess its current status, or baseline, with respect to SDG 11 enablers.

Step 2 — Innovate

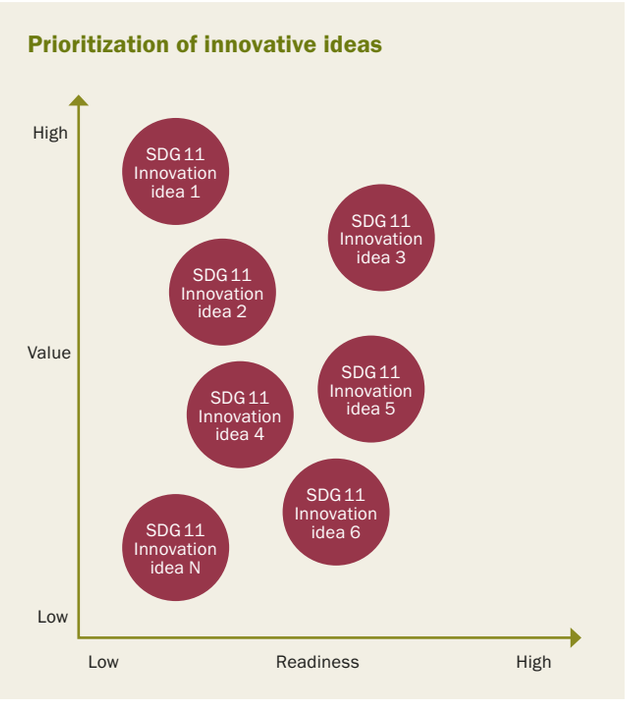
Having assessed its current status in Step 1, the city can innovate to create initiatives and action items to close its gaps with respect to SDG 11 targets. Some of the above discussed enablers can be utilized during this stage to potentially enhance the innovation effectiveness.

In this step, the city is recommended to engage stakeholders to address its urban challenges related to SDG 11. Financing alternatives can be taken into account for otherwise unfeasible innovation ideas.

Benchmarking, the inclusion of best practices, experimentation and internal innovation can all be used by cities to determine their own long list of innovation ideas.

Innovation prioritization approach

A thorough and impartial prioritization method will be useful to determine the shortlisted innovation ideas for SDG 11 implementation. Hence, the framework includes a simple innovation prioritization approach with two main criteria.



The first criterion is the value that identifies the projected (ex-ante) impact of the innovation idea. The second criterion identifies the readiness of the city, or the ease of implementation of the idea by the city. Each criterion comprises several attributes that are briefly explained in the framework.

The city can then use a simple scoring system for the criteria and their attributes. The scores can be identified either qualitatively or quantitatively based on available data and conducted analyses. Having well-defined criteria and attributes also helps in more accurate relative scoring among the innovation ideas.

This prioritization approach allows cities to assess all formulated ideas with respect to well-defined criteria. Hence, at the end of Step 2, a city will have a concrete list of initiatives and action items for SDG 11 implementation. The city can then formulate an implementation plan by deciding which initiatives and action items to begin, and at what point. Certain restrictions such as human and financial resources constraints may determine actual implementation timing. The initiatives and action items can be phased out depending on restrictions and their mitigation timeframes. In some cases, cities may opt to diminish implementation risks prior to commencing the implementation of initiatives and action items.

Step 3 — Implement

This step entails the city's actual implementation of SDG 11 initiatives and action items in line with the plan created in the previous step, with cities assembling the resources required. High calibre programme and project management skills would be of benefit during implementation.

It is important to note that enablers introduced in Step 1 can be utilized during Step 3 to catalyse implementation. Some examples are given below to illustrate the approach:

- KPIs might help in overseeing and monitoring progress
- Political leadership and appropriate governance would help in timely and robust execution
- Policies might be used as a tool to induce certain behaviour and outcomes
- Extensive stakeholder engagement would ensure early buy-in and increase the chances of success through consensus. Innovation ecosystems consisting of public and private sectors as well as civil society (NGOs) would be beneficial for successful implementation
- Skill and knowledge gaps can be identified early in the process, and targeted training and research and development programmes can be launched to mitigate them
- Financing gaps can be closed by alternative financing mechanisms through appropriate planning.

Step 4 — Assess

This step involves the post-implementation assessment of the results for SDG 11 initiatives and action items. Cities are encouraged to assess the actual outcomes with respect to those intended. This step will allow the city to evaluate whether or not it has reached its intended city (local) level SDG 11 targets. If the city had formulated KPIs with target values and timeframes for achievement, it would be important to assess whether the targets have been met and the actual role the initiatives and action items have played in achieving them.

Image: Getty Images

SDG 11-GC will finalize and publish its SDG 11 high-level implementation framework by the second quarter of 2019 for cities to utilize as an input to their SDG 11 implementations

Similarly, various enablers can be assessed for their effectiveness. Lessons learned can be identified to determine favourable and adverse consequences of the initiatives and strategic action items. Positive aspects of successful initiatives may potentially be cross-utilized; for example, a successful policy in one initiative may trigger the use of a similar policy approach in another. Such examples can be extended to other enablers, while identification of ineffective enablers would result in their potential relinquishment.

It is important to note that subsequent to the assessment conducted in Step 4, cities are expected to revert to Step 1 and re-initiate the high-level implementation framework cycle by defining their new baselines or current status. This is important since SDG 11 is valid until 2030, and recurring application of the SDG 11 high-level implementation framework will be essential.

SDG 11 Global Council upcoming work

SDG 11-GC will finalize and publish its SDG 11 high-level implementation framework by the second quarter of 2019 for cities to utilize as an input to their SDG 11 implementations. Subsequently, pilot implementation projects will be determined by council members and will be undertaken during 2019 which mostly forms the second phase of the council work.

SDG 11-GC anticipates that both the high-level implementation framework and the conducted pilot projects will assist all aspiring cities to provide guidance and, to a certain extent, support in implementing their own SDG 11 initiatives to achieve the 2030 targets. SDG 11-GC aims to contribute substantially to making cities and human settlements inclusive, safe, resilient and sustainable.

The Urban SDG Knowledge Platform

Youngmin Chang, Director of Programmes; Seunghyeon Han, Programme Officer, CityNet Secretariat

With the 2030 Agenda for Sustainable Development, the world has acknowledged the importance of urban planning and management practices. Recently, the role of local authorities was highlighted by United Nationis members, as cities are the hub of new opportunities.[1] Rapid urban growth has proceeded throughout the world, causing various problems due to the lack of social, economic and environmental infrastructure such as housing, sanitation, transportation, energy, education, and many other facilities along with physical assets. With urban growth, each city has its own local perspective determined by its urban spaces and development rate. The actions taken by local government and urban stakeholders can overcome the challenges faced by the population and develop local solutions to improve living conditions.

In 1987, in order to assist local governments in their development process, CityNet was founded to provide support through city-to-city cooperation, capacity-building workshops, technical assistance, and global partnerships. Since then, CityNet has aimed to address the needs and challenges of its members. Subsequently, the Urban SDG Knowledge Platform has been developed to assist in the sharing of local urban policies and practices, and support the achievement of the Sustainable Development Goals (SDGs).

With the Urban SDG Knowledge Platform, CityNet aims to solve urban challenges with local solutions where changing one city provides the potential to help others.

Introduction to the platform

The Urban SDG Knowledge Platform was established in collaboration with the United Nations Economic and Social Commission for Asia and the Pacific, the Seoul Metropolitan Government (SMG), and CityNet to promote and support knowledge sharing and city-to-city cooperation for sustainable urban development. It includes uptake and replication of successful initiatives and best practice by: providing a repository of policies at city level conducted by municipal governments and other stakeholders; facilitating north-south, south-south, and triangular cooperation by linking cities that have developed specific policies, initiatives and best practice; and managing regional follow-up and reviews of the implementation of the 2030 Agenda by providing an online platform for local governments to share progress and lessons learned from their policies.

Image: RECIPRO:CITY: Issue No. 02

Old Seoul station overpass

Seoul Metropolitan Government efforts to achieve the SDGs[2]

Since the United Nations Conference on Environment and Development, Rio Summit, held in 1992 in Rio de Janeiro, Brazil, SMG undertook various initiatives to implement sustainability into the city's development plan. In 2013, SMG launched the Sustainable Development Commission to check sustainable implementation in local policies. Since then, the commission has been working towards putting Seoul's Masterplan for Sustainable Development into action.

In 2016, the commission representative members along with several stakeholders and citizens, gathered to plan the Seoul Sustainable Development Goals (Seoul SDGs) and actively incorporate the United Nations SDGs based on local circumstances. Under the Seoul SDGs, there are 17 major goals and 96 detailed targets that are guiding the city's direction for development as a sustainable city. Based on those goals and targets, by 2030, SMG aims to reflect the principles of the 2030 Agenda, and establish a social security system suited for the city to satisfy the basic needs of vulnerable social groups. Therefore, the Seoul SDGs act as a compass for several local policies for the city's economy, society and environment.[3] These efforts also have important implications for sustainable development throughout Korea.

Seoul Metropolitan Government's sustainable development project case[4]

Seoullo 7017: pedestrian-friendly development rejuvenating an old overpass into a green pedestrian walkway in the centre of the city

The vision of SMG to become a pedestrian-friendly city was created at the start of 2013, with plans to ensure the comfort and safety of pedestrians by developing more car-free zones and pedestrian paths. Since then, the SMG has executed diverse new projects, including the development of pedestrian-friendly environments, car-free street projects, new strategies to support transportation routes, child-safe streets and others. Seoullo 7017 is a regeneration project

Image: Archdaily Portal, https://www.archdaily.com

The pedestrian-friendly development of Seoullo 7017, rejuvenating an old overpass into a green pedestrian walkway in the centre of Seoul

considered as one of the strategies under this policy, as it has transformed an old overpass structure into an innovative pedestrian path open to citizens.[5] The Seoul station overpass was built in 1970 to accommodate the growing population and traffic congestion from the city's central area, and was originally designed to link the east and west areas of the station. From that time, it served as a main passage and traffic distribution channel to Namdaemun Market, a large and one of the oldest traditional markets in Seoul, that has supported local economic growth since 1414.[6]

The overpass not only served as a main link within the city, but also as a symbolic part of Seoul station since it was the most memorable structure encountered on arrival. Hence, its significance for Seoul's residents who have lived in its presence for nearly 50 years. However, since the late 1990s, the structural safety of the ageing overpass became a serious issue since it was becoming damaged. To monitor its safety, SMG performed inspections and carried out necessary maintenance work on a regular basis. At the end of 2006, a precision safety test diagnosed the overpass structure with grade D, indicating that the bridge was unsafe for use, based on the Korean Safety Assessment Standard.

Eight years passed without a local government decision as to whether to demolish or redevelop the overpass. A decision was almost made to demolish it but, with the boom of regeneration development and the vision of making Seoul into a pedestrian friendly city, the local government decided to revitalize the entire area as well as prioritizing pedestrian access. The old structure was therefore turned into a pedestrian walkway — Seoullo 7017 — and opened to the public.

The project began in March 2014, when the SMG reviewed the structural safety condition of the overpass to assess the possibility of redeveloping and reusing it. Since then, meetings with design and structural experts were conducted along with discussion sessions, on-site visits, and public debates to create a mutual cooperation strategy for its development. Demolition of the overpass baseplates began in December 2015 and, from March 2016, the repair and landscape refinements were carried out. Finally, the construction of Seoullo 7017 started in June 2016, ending in April 2017, when the new project was opened to the public.

Seoullo 7017 was developed to promote the regeneration of the Seoul Station area while preserving the old structure. The main objective was to create people-oriented pedestrian paths with green and cultural spaces to connect neighbouring areas and bring positive impacts to the community.

The design for Seoullo 7017 was selected through an open international architecture competition, won by Winy Mass from Dutch architect, MVRDV. Located in the heart of Seoul, the reborn overpass is currently known as the Skygarden, an 983 m elevated walkway with more than 24,000 plants of diverse species, suitable for different climates, and attracting the public during all the seasons of the year. During the design process, the architect suggested shaping the overpass with

greenery and connecting it with the neighbourhood surroundings. As a result, in addition to the green space itself, Seoullo 7017 offers connections to nearby retail malls, museums, coffee shops, foot spas, performance stages, restaurants, and other buildings. This was done by connecting multiple ramps, stairs, and elevators to its structure, thus simultaneously improving the pedestrians' experience and creating a public attraction.[7]

Policy implementation and replicability

Urban regeneration projects are an approach to reviving areas in decline while maintaining the existing infrastructure. These projects encourage cultural and tourism development, but more importantly, they increase the convenience for residents to promote sustainable development in the city. Seoullo 7017, as an example of urban regeneration development, was inspired by the New York City High Line Park, formerly a 2.33 km abandoned highway, and rebuilt with flowers and trees to attract tourists and residents. The Seoullo 7017 itself also offers inspiration for other cities and can be replicated and adapted to local conditions.

Image: Archdaily Portal, www.archdaily.com

Integration of Skygarden Seoullo with the transportation system

Image: Archdaily Portal, https://www.archdaily.com

Integrated spaces designed around Seoullo 7017

Image: Archdaily Portal, https://www.archdaily.com

Overview of Seoullo 7017, showing the extent of redeveloped area around the overpass

Getting land rights on the map — a stable foundation for sustainable communities

Amy Coughenour Betancourt, Chief Executive Officer; Madaleine Weber, Communications Director; Frank Pichel, Chief Programs Officer, Cadasta Foundation

Land and property rights are not usually listed among the top priorities for human rights or development goals — but they should be. Having a secure place to call home, without fear of expulsion, is a basic human right. Secure land tenure is foundational to sustainable development and unlocks a host of development gains across the 17 Sustainable Development Goals (SDGs).

Land tenure is linked to the alleviation of poverty and food insecurity and to the increased economic empowerment of women. Without clear and secure property rights, residents cannot show proof of address, obtain credit, enrol their children in school, open a bank account, or access a range of government or private sector services.

Women are disproportionately affected by a lack of secure land tenure due to weak laws, customs and practices that deny women their rights and deprive them and their families of the documented benefits of secure land tenure.[1]

Homes, land, resources and properties serve as the foundation for individual and societal economic and social well-being, as well as for our ability to thrive. It is therefore evident as to why 13 out of the 17 SDGs — including 59 targets and 65 indicators — relate to land and resource rights. Goal 11, focused on making cities and human settlements more inclusive, safe, resilient, and sustainable cannot be realized unless the issue of land rights is addressed.

Image: Cadasta Foundation

Informal waterfront settlement, Port Harcourt, Nigeria

Left out of formal land systems

By some estimates, 70 per cent of the world's population lives without securely documented land and resource rights.[2] Unfortunately, governments of developing countries are, for the most part, failing to cost-effectively and equitably document and manage land rights for the most vulnerable people.

It is estimated that one in four people worldwide feels insecure about their land tenure.[3] Obtaining formal land titles is out of reach for many reasons, including inadequate registry and cadastral systems; limited numbers of professional surveyors; overly bureaucratic and manual processes; high transaction costs and corruption; bottlenecks created by vested interests; limited access to government offices; and lack of political will. For example, in Uganda, figures taken in 2015 indicate that, given the number of surveyors in the land office, it would take 1,000 years to document the 15 million unregistered parcels of land in the country.[4]

This scenario is common across continents and countries, leaving the people and communities that depend on their land highly vulnerable to evictions, land disputes, land grabs, illegal extraction of natural resources, and the effects of unchecked development and climate change.

Addressing the data gaps in cities

In urban and peri-urban areas, land vulnerability is threatening efforts to build sustainable cities that keep pace with the burgeoning global urbanization rate. Almost half of the world's urban population lives in informal settlements (also known as slums or shanty towns) where they are socially and politically excluded and lack access to basic public services and amenities.

Underlying the many complexities of unregulated urban population growth is a lack of basic data that could otherwise provide citizens and governments with information to plan and make decisions. Communities and planners need to map data on the number and location of people; location of buildings and infrastructure; type of ownership; residents' livelihood and income data; and whether and where they have access to education, health care, water, sanitation and other services.

Traditional top-down land administration approaches to documenting and recording property rights are not keeping pace with increased demand for land and data. Lack of data increases informality, corruption, and the potential for conflict. Furthermore, it limits government's ability to

Image: CMAP-cmapping.net

Residents studying a map of their community, Port Harcourt, Nigeria

equitably assess taxes, deliver services, or plan for future development. Without these data, it becomes politically and operationally impossible to formalize land and property rights as a foundation of stability and development and to achieve the SDGs.

Yet, there are innovative ways to solve these issues and fill the data gap. Recent technological innovations, including drones, satellite imagery, smartphones with GPS, and cloud computing are making it easier than ever for individuals, communities, and organizations to map and document land rights from the bottom up.

Covering new terrain in the fight for land rights

Cadasta Foundation, a non-profit organization based in Washington DC, US, partners with local governments, international and local organizations, and communities to help solve the foundational issue of land rights. With a focus on areas where governments are failing to provide the public good of equitable and affordable land administration, Cadasta's accessible mobile tools and global platform have helped partners efficiently document, analyse, manage, and share critical land and resource rights information as a first step to city upgrading and longer-term development.

Cadasta's suite of tools and demand-driven training and services empower residents of informal settlements, as well as the organizations and governments that service them, by creating an accessible digital record of land, housing, and resource rights that is georeferenced with demographic, economic, and social data. This ground-level information allows partners to make data-driven decisions and to literally place vulnerable urban communities and their needs on the map.

When an organization or government entity partners with Cadasta, they receive training on how to map boundaries, land parcels, and collect demographic and other information at the household level using simple mobile data collection tools. Cadasta provides free or low-cost access to high-quality geospatial imagery and integration of available drone imagery. The data can be collected offline or online and uploaded onto a global platform, which is built on powerful mapping technology to store and manage land data.

Cadasta supports partners' community engagement through participatory mapping, strategies for gender inclusion, involvement of youth, and conflict resolution. This support includes training partners and community members to record and capture evidence of their property claims using GPS-enabled smartphones and tablets. Communities and their partners are also trained on how to visualize, analyse, and present the data to authorities in order to advocate land tenure solutions.

Cadasta's expertise covers land administration systems, services, technology, and development, and includes specialized skills to support partners working on complex land rights issues. State-of-the-art technology is offered to partners who own and manage their own data, using tools that

Image: Cadasta Foundation

Community data collectors, Odisha state, India

are consistently updated, and integrated offline and online with mobile and desktop applications. Data collected using other tools or traditional paper-based surveys and maps can also be utilized. Data can be automatically uploaded onto a secure, permission-controlled platform with a fully maintained technology stack.

With over 1.5 billion people worldwide who are tenure-insecure, Cadasta provides a link between marginalized communities and high-quality geospatial data and information systems and tools that are focused on documenting, visualizing and sharing data that matters to them.

The Odisha Liveable Habitat Mission

Like many states in India, Odisha has experienced a 27 per cent growth in population in its cities due to rural-to-urban migration. In search of better livelihood opportunities, most of these migrants move into informal settlements. Urban local bodies struggle to provide land for housing as well as basic infrastructure and services such as electricity, sanitation, water, and roads. Without having formal rights to the home and land that they live on, these informal residents are often barred from getting loans for home improvement, starting businesses, accessing basic services, or finding a formal job.

In an effort to document the growing informal settlements and transform the slums into liveable communities, the state government of Odisha partnered with Cadasta and the Indian philanthropic group, Tata Trusts to create the Odisha Liveable Habitat Mission — an innovative project designed to improve the living conditions of informal settlements. Through the project, more than 800 community data collectors were trained and, with the use of Cadasta's technology and services, were able to quickly document and map 123,000 households (to date) to create an official data set of slum dwellings. Once documented, the state government issued 70,000 Certificates of Occupancy with a planned total of 1 million people benefiting from this initiative. Not only was the data used to issue formal land rights certificates, but the data has empowered the Odisha state government to make critical urban planning decisions, making the settlements more inclusive, safe, resilient, and sustainable. Decisions around essential civic urban infrastructure such as housing, roads, drainage, individual household toilets, public toilets, energy-efficient smart LED street lights, constant piped water supply to households, common work sheds, parks and playgrounds, among other amenities, are now being informed by the data collected on Cadasta's tools.

The Human City Project

In Port Harcourt, Nigeria, an estimated 480,000 people are living in informal waterfront settlements that face the threat of demolition by local authorities. The Human City Project, led by the Nigerian non-profit Collaborative Media Advocacy Platform (CMAP), works to support and develop the "strategic and technical capacity of slum communities to participate in the shaping of their city" through rights-based media advocacy, collaborative architectural design, and inclusive urban planning. With the Human City Project, CMAP has

Image: Cadasta Foundation

Chicoco Radio staff training on Cadasta data collection tools, Port Harcourt, Nigeria

Image: CMAP

Children from Port Harcourt, Nigeria, identifying their homes on the newly released map of their community

organized an advocacy platform and campaign to give voice to waterfront residents to oppose further demolition and forced evictions, and show that, like the government, they want to develop their communities. CMAP uses a community participatory process that allows residents to demonstrate their desire and capacity for in-situ development. Mapping capabilities and tools became a critical need for CMAP to better understand the needs of waterfront communities for urban planning and development.

Cadasta partnered with CMAP to train young local mappers to use the tools and platform to improve their data collection, management, and reporting processes. Through this collaboration, CMAP is better able to support residents' efforts to defend their rights and to use the household survey and mapping data to draw the attention of local and state officials to urban planning needs.

Establishing a solid foundation to achieve the SDGs

The Cadasta Foundation believes that communities know their land rights best and that they need to be engaged to find solutions to the most intractable land tenure challenges. Governments also need data and solutions for land formalization in order to make real progress — not only on the land-related SDGs, but across all of the goals.

By advancing the land and resource rights of vulnerable communities from the ground up, these efforts are bridging a digital divide between technological innovation and extreme poverty, between top-down government systems and communities, and between informal and formal rights. Cadasta works to make state-of-the-art geospatial technologies such as high-quality satellite, drone, and other remote sensing imagery, available to people who would otherwise not be able to access or afford it.

Societies, governments, companies, and citizens have to constantly challenge themselves in order to avoid leaving vulnerable people and communities further behind in this data-driven age. One way to do this is to bring technology to the people, teach them how to use it, and empower them to advance their own development aspirations. By doing this in the land space, Cadasta and its partners can support the SDGs, help build more sustainable and resilient cities, and unlock billions of dollars for future development by advancing tenure security.

Kuala Lumpur — delivering the Sustainable Development Goals to the city communities

Mayor of Kuala Lumpur

Kuala Lumpur is a multicultural city of contrasts, with an immense diversity in ethnicity, religious beliefs, traditions, and ways of life. Evolving from a mining town located at the muddy confluence of two rivers, Kuala Lumpur has become Malaysia's capital city, its commercial and financial hub and, more recently, the centre of a knowledge economy, creative industries and tourism.

The city has faced challenges from issues such as inadequate public transport and urban amenities, an insufficient supply of affordable housing, and several other issues associated with urban living. With a current population of 1.86 million that is expected to grow to 2.25 million by 2040, the city was seeking appropriate solutions to ensure that all citizens are able to lead their lives in harmony and comfort.

Kuala Lumpur has seen some of the most dynamic growth in South-East Asia. Its rapid and fast-changing development has generated various opportunities for its citizens; such as employment, education, start-up businesses and many others. Through comprehensive planning and frequent engagement with city residents, Kuala Lumpur is consistently evolving to ensure that it becomes more sustainable and liveable.

As Malaysia's main commercial and services hub, many people enter the city every day for business and employment opportunities, with the inevitable result of traffic congestion. In 2010, for example, the city saw almost 4 million vehicles crossing its ring roads daily. However, the congestion has now significantly reduced due to the provision of a more extensive transportation network including a ring road and greater variety within the rail network system with the addition of the Light Rapid Transit and monorail to complement the existing Malayan Railways commuter services. Today, with the city's Mass Rapid Transit (MRT) service in hand, a route length of 164 km of rail network has been built with five different lines running every day to serve the residents of the city and surrounding areas. The city is also looking into the expansion of modes such as a Bus Rapid Transit system and the establishment of a more comprehensive and integrated public transportation network with the addition of "first-mile, last-mile" services as well as park-and-ride services.

Images: Kuala Lumpur

Taman Midah station concourse — part of the MRT service with a route length of 164 km

In the 1980s and 1990s, the cost of living rose due to the high rate of immigration of people from other cities searching for jobs and education, resulting in expensive rental and purchase costs of housing. The city therefore faced various issues with squatters. To resolve this problem, the city council held a series of engagements with the citizens and as a result, set a target to achieve zero squatters by 2009. Much low-cost public housing has now been built to accommodate squatters and those on low income. There has also been a scheme that has helped many to own a house and to achieve a good standard of living.

Kuala Lumpur's street markets and street food culture attract millions of international visitors per year. Central Market, Leboh Pasar, Petaling Street and Little India are among the most visited areas, where major refurbishment has taken place so that both locals and visitors may better enjoy shopping for local arts and crafts as well discovering Malaysian cuisine, famous for its influences from diverse cultures such as traditional Malay, Indian and Chinese.

The improvement of pedestrian walkways and cycle lanes has further heightened the accessibility and movement of people within the city, especially in the central business district. Various parts of the city are now well connected from the transit stations to offices, malls, public spaces, museums and parks. In addition, the beautification of back lanes project run by the city council has helped people feel safer walking and cycling throughout the city, and has not only increased the aesthetic value of the environment, but also reinforced a sense of belonging to the community working or residing near the lanes. The community itself has now taken on the responsibility of maintaining the back lanes.

Kuala Lumpur has also focused on rejuvenating several areas to provide places where people can meet for leisure. The River

Image: Kuala Lumpur

The project run to beautify the city's back lanes has reinforced a sense of belonging to the community working or residing near the lanes

of Life project, for instance, was initiated to clean and to further enhance the Klang and Gombak Rivers, and has produced impressive results where several areas of the river bank are animated with activities such as cultural performances. The bank has also become a public space where people can exercise, jog, cycle, or relax and enjoy the tranquillity of the river.

Several urban redevelopment and regeneration projects have commenced in order to prepare the city for future growth. For example, the KLCC, an area that was once a horse racing course, has now became a city landmark and is home to the Petronas Twin Towers. The area has not only thrived as an international business hub, but is able to offer shopping, dining and sightseeing activities, and is also where people from around the world gather for international exhibitions.

The Brickfields area, previously a rail depot and unfit for supporting living and working conditions, has been transformed into an integrated transportation hub housing residential and working space, offices and shopping, with seamless connectivity and mobility to adjacent sites that are rich in culture and heritage such as the National Museum and the area around Jalan Tun Sambanthan.

The Tun Razak Exchange, known locally as TRX, is another example of urban redevelopment currently in progress. It will become Malaysia's international financial district with 70 acres of integrated development, excellent connectivity, well appointed public realms and smart and sustainable design.

In addition to the physical development improvements, policies have been introduced to better help the city serve its citizens in providing a better living and working environment. One example is the change in floor space requirements for housing where the minimum space has been increased from 300 to 800 ft^2 to ensure more comfortable living.

City developments have been guided by planning laws, comprehensive urban strategies and various supporting guidelines. In the 1970s, the city created a comprehensive urban plan, subsequently updated in 1984, 2000 and most recently in 2018. A new set of comprehensive urban plans is now being compiled for the next horizon of 2040, tackling current issues and addressing future demands including the global concerns of climate change, sustainable urbanization and city liveability.

There has been a paradigm shift in the city's approach with greater focus on inclusivity and community participation. Public participation has been practiced in the past to a certain extent, particularly in the development planning process and through the Local Agenda 21 Kuala Lumpur (LA21). But, while public participation in urban planning requires further improvement, especially in ensuring a true sense of public consultation, the LA21 has demonstrated a serious commitment to deliver its promise of greater public participation and inclusivity. The city took a two-pronged approach, with a top-down strategic visioning framework defining over-arching objectives, and a bottom-up, problem solving initiative operating to fulfil the framework. The bottom-up initiatives are identified by local communities to solve problems or make improvements within their areas.

Image: Kuala Lumpur

The Kebun-Kebun Bangsar communty urban farm. Locating community gardens in low-income areas has helped improve access to fresh healthy food

Image: Kuala Lumpur

Much low-cost public housing has now been built to accommodate squatters and those on low income

Communities now understand that the city's resources are limited and that their contribution is critical in improving service delivery by the local authority and in realizing the vision for better quality of life. The LA21 Urban Farming Project, for instance, has brought about significant benefits to the communities at large. Locating community gardens in low-income areas has helped improve access to fresh healthy food, especially fruits and vegetables. Excess produce is sold, providing additional income for participating families. Many previously abandoned plots of land are now put to good use.

Policies are now being formulated through the Kuala Lumpur Structure Plan 2040 for greater inclusivity, with focus given to improving access to work, affordable housing, urban services and amenities, smart partnerships and shared responsibilities. The key initiatives under consideration are:

- The implementation of a Neighbourhood Improvement Programme to target older neighbourhoods needing rejuvenation and the improvement to the built environments and social health of the communities.
- Ensuring that the needs of under-privileged communities, disabled persons, children, women, and the elderly are taken into consideration and provided for in urban development, including public transportation, urban facilities, parks and recreational amenities and other urban services.
- Developing more community hubs to provide focal points and facilities in order to foster greater local community activity and bring residents, local business communities and smaller organizations together to improve the quality of life in their areas. The hubs should be accessible to all groups in the neighbourhood that they serve, providing a range of high quality and cost effective services to the local community.

The experiences gained from Kuala Lumpur's various initiatives have served to inform and educate all involved, including the communities, private sector and officers of the city council, towards understanding the requirements for delivering against the Sustainable Development Goals' inclusivity agenda.

Reformation of the welfare delivery system at street level

Jang Ikhyun, PhD, Associate Research Fellow, The Seoul Institute

The city of Seoul is facing rapid changes, especially to its ageing society. In 2017, it was reported that those over 65 years old would account for 13.5 per cent of the entire population. The proportion of the elderly to the population total is expected to keep increasing due to a low fertility rate and an increase in life expectancy. Those increases are closely related to the upsurge in demands on social and health care, and, like most developed countries, welfare benefits such as basic state pension, basic living assurance and social care services are therefore provided to the eligible elderly.

Many of these policies are directly delivered by the local authority, with Seoul Metropolitan Government (SMG) responsible for building an effective delivery system for the social welfare programme. However, SMG has found a critical problem with the delivery system. One of the main issues is that the elderly, who make up the greatest proportion of welfare benefit recipients, have the responsibility of seeking information about the benefits and checking their eligibility for each. Despite SMG's promotion and dissemination of the information on welfare benefits, the elderly are likely to have difficulty in accessing the information, as most are not active users of the Internet or other digital resources. The result of this is that a number of elderly in Seoul suffer from poverty and chronic illness despite their eligibility for many of the welfare benefits and services.

Image: Seoul Metropolitan Government

The evidence is that the ROCSC programme is a useful instrument for bringing about positive change to the daily lives of elderly citizens in Seoul

Launch of the Reach Out Community Service Centre

Elected in 2011, Mayor Park Won-soon has undertaken to expand welfare expenditure in Seoul and to reform the welfare service delivery system. As part of that process, in 2015, SMG launched the Reach Out Community Service Centre (ROCSC) programme.

The city of Seoul consists of 25 Gu district governments, and under each Gu is the Dong, the smallest administrative authority. Community service centres are the administrative offices of the Dong — the final implementer of welfare services. The ROCSC programme has set out to reform the welfare delivery system through the reorganization and augmentation of the community service centre functions with the following steps.

Firstly, the public workforce has been increased in community service centres, each of which has a core role within the welfare delivery system. However, the number of beneficiaries increased by 79 per cent between 2011 and 2014, while the community service centre's public workforce increased by only 18 per cent in the same period. This lack of staff is directly related to the lower quality of the service offered.

The subsequent increase in the workforce has been concentrated on the number of welfare officers and district nurses in each Dong. Between 2015 and 2017, the average number of staff in community service centres increased from 16.2 to 22.8, with the number of welfare officers increasing from 3.3 to 7.3 and district nurses from 0.2 to 1.2. In this case, the welfare officers are mostly certified social workers.

Secondly, based on the increase in the number of welfare officers and district nurses, the community service centres have reformed the process with which they provide the services. Before the ROCSC project, because it was the responsibility of each individual to access welfare benefits and social services, some failed to do so. Now, welfare officers and district nurses are reaching out to the elderly, rather than waiting for them to visit the community service centre.

In Korea, welfare benefit for the elderly is usually provided from 65 years old, so the welfare officer and district nurse offer a universal visiting service to everyone who turns 65. At the visit, relevant information is given, along with advice on how to claim the benefits. District nurses also provide basic health evaluation and counselling to ascertain risk factors on the health status. Health evaluation covers evidence of physical weakness and chronic disease, and the mental health element runs a depression test, suicide tendency test and dementia screening test.

Image: Seoul Metropolitan Government

Health education class conducted under the Reach Out Community Service Centre programme

Universal visiting by the welfare officer and district nurse is also provided to the elderly who turn 70, as they are also identified as a risk group in terms of social care and health care.

The universal visiting service is provided not only to the elderly, but also to the poor and all newborns. In this case, welfare officers and district nurses provide the basic medical tests and arrange social and medical services through networks in the private sector.

Thirdly, based on the joint visits of the welfare officer and district nurse, SMG attempts to provide integrated care to the elderly. In many developed countries, it is highly important to link social care and health care, but this is not straightforward because of the difference in professional backgrounds. With the ROCSC programme, welfare officers have to provide a visiting service with a district nurse, so that they can easily collaborate and share information on the elderly residents. In addition, welfare officers and district nurses are supposed to build the network with the private sector. In Korea, most social and medical services are provided through a private market, so it is highly important for the public sector to work closely with a service provider in the private sector. By building a robust network, welfare officers and district nurses are able to check the health status of the each of the elderly residents and introduce them to relevant social or medical care services. By doing so, the elderly receive a one-stop service in both social and medical care.

Regarding social care, welfare officers act as case managers so that they can link the social care provider to the private regional social welfare institute. In health care, district nurses work closely with private medical clinics, hospitals, dementia support centres, mental health promotional centres and long-term medical treatment services.

The main achievement of ROCSC

In the first year of the ROCSC programme, 80 Dongs were included. That number increased to 283 in the second year (2016) and to 342 in 2017. The ROCSC programme's main achievement has been to identify the blind spots in Seoul's current welfare system. For example, the depression test has been carried out on 85,785 elderly people, with 4.3 per cent of them identified as at high risk of depression. In the same way, 15 per cent have been identified as at high risk of suicide and 7.3 per cent at high risk of dementia. Regarding welfare benefit, 182 cases were found to be eligible in 2016 and 218 cases found in 2017. These people would not have understood their eligibility if the welfare officers had not have found them.

A survey has been carried out to monitor the progress of the ROCSC programme. The evidence is that the initiative is a useful instrument for bringing about positive change to the daily lives of elderly citizens in Seoul. In 2017, almost 74 per cent of respondents that had experienced the ROCSC service agreed that the welfare of Seoul citizens has increased as a result. Over 58 per cent of respondents said that they feel more comfortable with public services since ROCSC projects began, and over 42 per cent reported that they came to understand which services were available to them. Nearly 50 per cent of respondents said that they could solve their economic difficulties through the availability of relevant welfare benefits and medical care that are arranged by the welfare officer and district nurse. Only 6.8 per cent of respondents said that they saw no significant changes in their lives. It is therefore evident that most elderly citizens that have experienced ROCSC services report that they have found meaningful change to their lives.

Conclusion

The ROCSC project was launched to improve the welfare of citizens by reforming the administrative process behind the delivery of welfare and health care. In particular the focus is on reaching out to citizens, rather than waiting for them to visit the public office. This is very fitting for the aged society, as most have difficulty in accessing information using electronic devices, or have mobility issues when visiting local authorities. Outreach is possible through the augmentation of the public sector workforce, especially the increase in the number of welfare officers and district nurses. ROCSC also aims to provide integrated care to the elderly through joint visits of the welfare officer and district nurse, and building up the network through the private sector in social care and medical care.

Over four years, ROCSC has reformed the street-level administrative system for welfare and health-care service and has transformed the Dong into the platform of welfare and health service at the community level. The Dong office now has a core role to connect and coordinate welfare and health provision as a service hub. All services are better integrated and focused through a Dong Office. Elderly people now have easier access the social and health-care services, and enjoy more integrated services.

In 2018, ROCSC 2.0 was introduced by Mayor Park Won-soon, focusing on more integrated care to every person in need of it, including the elderly. The project's achievement places it a dominant strategy for making Seoul one of the more age-friendly cities for the future.

Image: Seoul Metropolitan Government

The ROCSC system facilitates coordination between the various sectors so that a range of residents' issues, including health, can be reviewed at once

Image: Seoul Metropolitan Government

Health-care services provided at a senior's home

Tackling sub-Saharan Africa's urban population growth — cases on the effects of economic development financing

Leena Sobahi, Financial Expert; Ahmed Mohameden Mohamed Sidiya, Project Officer; Shahad Khidir, Marketing Expert, Arab Bank For Economic Development in Africa

The world's urban population is swelling and six out of the ten countries with the highest urbanization rates in the world are in sub-Saharan Africa where the Arab Bank for Economic Development in Africa (BADEA) operates, thus making it a vital component in the region's development agenda. Urban living is linked to improving development indicators such as enhanced health services, higher school completion rates, safer roads and improved water and sanitation facilities. Many cities face challenges with population influx due to the pressure it exerts on the infrastructure and provision of basic services. BADEA has, through its economic development financing to governments throughout sub-Saharan African countries, contributed to strategic plans helping cities to expand to accommodate urban population growth and to make them safer and more sustainable.

The following projects illustrate BADEA's interventions based on SDG 11 perspectives, specifically with regard to:

- Reducing the number of deaths and the number of people affected by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations
- The environmental impact of cities, paying special attention to air quality and municipal and other waste management.

Image: BADEA

State University of Zanzibar, United Republic of Tanzania. To meet the demands of the socioeconomic development in Zanzibar, this project aimed at creating opportunities for training professionals in education, the arts, sciences and engineering, locally instead of the limited opportunities available at universities in the continental part of Tanzania or abroad

Coastal protection, Benin

The coast of Benin is strongly affected by the currents of the Atlantic Ocean and these effects were intensified and accelerated after the construction of the port of Cotonou in 1963. It has been found that the sea has covered approximately 400 m of land over the past 30 years and caused the erosion and accumulation of dust and sand near the port at the rate of about 1 million m^3 per year.

Over the past decade, attention has been paid to environmental problems of a significant size, especially that of rapid and increasing erosion of the coast and its effect on coastal cities. The policy of the Benin government for protection of coastal erosion includes the study and knowledge of the factors leading to the erosion of beaches in order to put an end to it and to preserve the land.

In order to achieve the objectives of the state policy in the environment sector, the Ministry of Environment, Housing and Urbanization has established a strategy based on the implementation of political, legal, economic and communications mechanisms. Based on this scope, BADEA committed to financing the reconstruction of 7.5 km of the coast east of the capital, Cotonou, by constructing seven anti-drift barriers, each of which ranges from 160 to 260 m long, consisting of stones of different sizes, as well as clearing an estimated 700,000 m^3 of sand from the beach embankment. The project aims to protect social and economic facilities, including homes, schools, diplomatic buildings, recreational and entertainment grounds, shops, hotels and light industries, all threatened by the erosion of the eastern coast of Cotonou.

The project area covers two sections of the Cotonou municipality and two sections of the Simi Kabudji municipality. According to the statistics of the study, there are approximately 200,000 people living in this area, and it is characterized by the existence of several economic establishments, numbering about 36 institutions in various fields. The region also has several important tourist facilities and is currently threatened by erosion. The inhabitants of the region also practice traditional fishing, agriculture and the exploitation of sand quarries.

The Benin government's goal is to protect the population from damage caused by the sea and, by developing beaches, Benin will be able to achieve economic recovery and create jobs for citizens, contributing to the alleviation of poverty.

Cocody Bay rehabilitation, Cote D'Ivoire

In Sub-Saharan Africa, approximately 80 per cent of the urban population has access to an improved water source, compared with 53 per cent of the rural population, and access to improved sanitation facilities in urban areas is almost twice that of rural areas. In the case of Abidjan, the Gulf of Cocody, which separates parts of the capital, has been polluted as a result of the dumping of solid waste and sewerage. This occurred because of the significant deterioration in the urban environment after the civil war, especially with a growing urban population attracted by investments in the economic development of Abidjan.

In order to achieve the objectives of the state policy in the environment sector, the Ministry of Environment, Urban Health and Sustainable Development was established with responsibility for determining the state's environmental policy and the protection of natural resources. The ministry is working to make the environment sector a source of wealth and to raise the standard of living, as well as supporting the economy for sustainable development by developing harmonized policies on the rational management of the environment in the rural and urban areas.

BADEA's financing targeted the protection of Cocody Bay and the combating of pollution resulting from environmental imbalances related to sanitation networks and seasonal floods, thus improving the site's overall environment. The project will provide social, touristic and commercial facilities around the bay, to receive investments in various fields. This will create income-generating economic activities and new employment opportunities. The project will also have a positive impact on improving the health of the local population and encourage the return of fishermen to the area to improve their productivity.

The project extends from Abidjan city centre to Grand-Bassam city, located 40 km to the east of the capital. Cocody Bay is the natural extension of Ebrie Lagoon in central Abidjan, which extends from its west to Grand-Bassam. Several rivers flow into this lake, the most important of which is the Comoe River. The project was divided into several phases with BADEA contributing to the financing of Phase III — the reopening of the mouth of Comoe River to the sea at Grand-Bassam city, facilitating the flow of sea water into Ebrie Lagoon, and thereby renewing its water naturally. The components comprise civil engineering works to construct two protecting walls for the mouth against sea waves, works to protect the sides from erosion, removing trees, undertaking sand removal from the mouth and reusing it to protect the sites threatened by erosion, and strengthening Assini bridge.

Image: BADEA

Butare city water supply, Republic of Rwanda. This project aimed at providing Butare city with its potable water needs and improving the local population's health by reducing the risk of waterborne diseases

Water supply and sanitation, Cape Verde

The city of Praia (the capital of Cape Verde) suffers from a lack of natural water resources and a deterioration in the quality of available water. The city's drinking water needs are met by desalinating seawater through three inverse osmosis plants — a technology with the lowest energy consumption. The total production of the existing plants is about 15,000 m^3 per day. The city also benefits from the production of groundwater, through the tubular wells in Joao Varela, Santa Clara and Monte Vaca, with a total production of 1,760 m^3 per day.

The city also has a sewerage system with a network of 143 km of pipelines, two pumping stations in Cha d'Areia and Lem Ferreaira and a treatment plant, which was expanded to manage 8,000 m^3 per day in 2007. The treated water is discharged into the sea through a 700 m-long pipe. The volume of treated water is low due to the low network penetration rate, which currently stands at around 24 per cent. The network also suffers from the low efficiency of mechanical and electrical equipment of the treatment plant and pumps, which are prone to failure due to both poor maintenance and rusting caused by high humidity due to proximity to the ocean.

The project area covers the neighbourhoods that constitute the extension of the city centre plateau from the north and includes 18 neighbourhoods with a total area of approximately 2.5 km^2, representing about 12.5 per cent of the city area and currently housing about 75,000 people, or about 50 per cent of the capital's population. Connection to drinking water supply and drainage networks in the region is about 20 per cent and 17 per cent respectively, but these rates do not exceed 15 per cent in some neighbourhoods regarding the supply of drinking water, while in some neighbourhoods,there is no sewerage network.

The project will expand the drinking water network through the extension of a second primary pipeline of 6 km, expanding the distribution network to a total length of 75 km. Additionally, the project will connect 1,500 users to the network and rehabilitate the pumping station. The project also envisages the expansion of the sewerage network with 90 km of new pipelines and the connection of 2,500 new users as well as the installation of a 15 km primary line to transport wastewater to the treatment plant. The project will also rehabilitate two existing pumping stations and the treatment plant.

It is in this context that BADEA has decided to finance a project in the city of Praia to expand and improve the sewerage network and the supply of drinking water to the neighbourhoods around the centre of the city, contributing to the improvement of health conditions, reduction of health risks, betterment of sanitation, revitalization of key development sectors, and improving the living conditions of the population in general.

Image: BADEA

Power transmission to Pemba Town, Republic of Mozambique. This project provided a supply of electricity from a hydropower source to Pemba to meet current and future domestic, industrial and touristic needs. It also expanded the transmission network to the north of the country to facilitate the development of cities and villages in that region

Image: BADEA

Maputo City coastal protection, Republic of Mozambique. The project falls within the government programme for the development of infrastructure in the capital, Maputo, and the project aims at the prevention of the continuous erosion of Maputo coast, for the protection of public and private properties and prevention of deterioration of the environment

Supporting the drinking water quality control laboratory, Cote d'Ivoire

Annual water consumption in Cote d'Ivoire is estimated at 1.2 m^3, representing approximately 1.3 per cent of renewable water resources. Water availability is far greater than consumption needs and there is great stress on groundwater to supply drinking water (around 90 per cent of needs). Surface water is rarely used due to the risk of pollution, especially in industrial and populated areas such as Abidjan and its suburbs.

The government has set targets to develop and increase water production in both urban and rural areas, as well as developing and expanding domestic sewage and rainwater drainage facilities and developing water resources management, thus increasing the proportion of drinking water supply to meet national needs in urban and rural areas to reach 82.5 per cent in 2015.

To this effect government has established a drinking water quality control laboratory, which is managed by The National Office of Drinking Water. The laboratory was built on an area of 1,200 m^2 and designed according to international standards. The area currently being used is 500 m^2, with two chambers for biological laboratory tests, three chemical testing rooms and a public facilities hall. The laboratory houses an important part of the equipment but still lacks apparatus for testing for inorganic compounds and metals. The staff, whether existing or yet to be hired, lack the necessary experience and require training on water quality standards and measurement. The laboratory is in the process of accreditation (currently at 60 per cent).

To be able to perform its tasks in the best manner, and in accordance with applicable standards, BADEA agreed to finance the project with US$ 300,000 (non-refundable grant) as well as procure the necessary equipment and the services of a consultant to assist in the operation of the laboratory and the training of the staff. The assistance includes the supply of chemical apparatus for the analysis of organic and inorganic components in drinking water, and special equipment for preparing samples. In addition the services of an expert will be extended for 12 months in order to develop a programme for studying the quality of water with organic and inorganic components, assisting the laboratory in developing a practical implementation programme, and training staff on analytical methodologies for organic and inorganic compounds, among other operational improvements.

Globally, cities account for the majority of economic growth, a trend that is on a fast growth trajectory. Over the next 35 years, the population in cities is estimated to expand by an additional 2.5 billion people. Governments throughout sub-Saharan Africa have acknowledged the importance of sustainable cities as a vital component for economic development and, with the help of development financing institutions such as BADEA, will aim to bridge the gap for resilient infrastructure with special focus on public health, social welfare, economic development, and infrastructure — basic, social and economic.

Tokyo Smart City Studio — an urban systems design approach

Yoshiki Yamagata and Takahiro Yoshida, Global Carbon Project Tsukuba International Office, National Institute for Environmental Studies, Japan

Located in the north-eastern part of Tokyo at the foot of the SkyTree, Kyojima is a traditional Japanese residential environment. The district is characterized by old wooden houses, narrow alleys, and shopping streets frequented by locals. The Kyojima area is also known to be highly vulnerable to the risk of disaster from flood, earthquake and fire, but, although that risk questions the neighbourhood's sustainability, there is nevertheless a tight community life with high social capital.

Smart city development, together with Internet of Things (IoT) applications, are revolutionizing urban management and planning, fixing various urban issues, and creating climate compatible, low-carbon, resilient urban environments. In step with these advances, the Global Carbon Project-Tsukuba International Office[1] (GCP), a Future Earth initiative, has been coordinating and steering an Urban and Regional Carbon Management project for over 10 years. Building on that experience, the GCP organized a workshop — Tokyo Smart City Studio: Urban Systems Design Approach — during March 2019, in collaboration with the University of Tokyo, and Georgia Institute of Technology, US, among others. The objective was to develop smart city solutions that can positively revitalize the local economy, stimulate healthy lifestyles, reduce the environmental footprint, and enhance the safety, security, and resilience of the study area, ultimately contributing to achieving the Sustainable Development Goals. The Studio brought together more than 40 multidisciplinary students from Japan and the US, and professional researchers in the fields of urban planning, transport planning, and architecture from more than 10 universities and institutions.

Kyojima was selected as the case study for its multifaceted challenges. The historical district survived the 1923 Great Kanto Earthquake as well as firebombing during World War II. Certain characteristics of the area, such as its irregular block shapes, can be traced back to the Edo period. Today, Kyojima is predominantly a dense residential area with multiple narrow streets criss-crossing throughout. A high proportion of these high-density neighbourhoods are wooden houses built on alluvial soil, making them prone to fire risk and earthquake. The narrow streets are also barriers to emergency vehicles, and firebreaks between buildings are nonexistent. The area is at, or below, sea level and situated in close proximity to the Sumida river, making it highly susceptible to flooding. These threats make Kiyojima a strong concern for the local authority. Several attempts have been made to redevelop the area but were always met with strong local resistance. Socially, the area has a high proportion of ageing population, yet it has the potential to attract younger residents with its affordable housing stock.

The six-day Tokyo Smart City Studio featured a range of activities such as verbal presentations, a creative brainstorming session, and seminal discussions. To begin with, representatives from Tokyo's Sumida ward welcomed participants, providing them with background information on the local neighbourhoods, and presenting the ongoing urban development projects in Sumida, such as a road realignment project that aims to increase the clearance gaps between buildings as a safety measure. The presentation was followed by a lively discussion between participants and representatives on the challenges faced by the local authority in ensuring the area's livelihood and safety. A wide variety of work was then discussed relating to smart cities including the overriding theoretical and empirical issues. Several success stories were presented and discussed in a demonstration of how smart city technologies can contribute to enhancing mobility, resource efficiency, economic productivity, and disaster management.

The Studio also proposed two overarching concepts, which integrated design solutions to illustrate the possible futures of Kyojima, namely the Multigenerational Interactive Lifestyle (MIL) and the Evolving City.

Image: Tokyo Smart City Studio

Typical example of Kyojima housing

Image: Tokyo Smart City Studio

Landscape of Kyojima

Image: Tokyo Smart City Studio

Image: Tokyo Smart City Studio

The Smart City Studio workshop in progress

The MIL concept seeks to facilitate the population's social cohesion and the livability of the neighbourhoods through a transition towards a carbon-neutral and circular lifestyle. The concept focuses on the implementation of adjustable microgrid units, contributing towards the economic and social revitalization of the area. The microgrid will enable the neighbourhoods to generate their own energy and even make a profit from selling the excess. The new green energy sharing company can attract visitors to the area to learn about its success, which could be capitalized through the construction of a Climate Change Museum. The museum would showcase the story of Kyojima and also provide spaces for conferences, exhibitions, and start-up companies. In addition, Kyojima's transport system will shift towards non-motorized modes, with walking and cycling especially encouraged. The shift will be emboldened by physical infrastructure changes such as pedestrianization, a pocket park, and the availability of virtual augmented stimulation in terms of gamification and augmented reality.

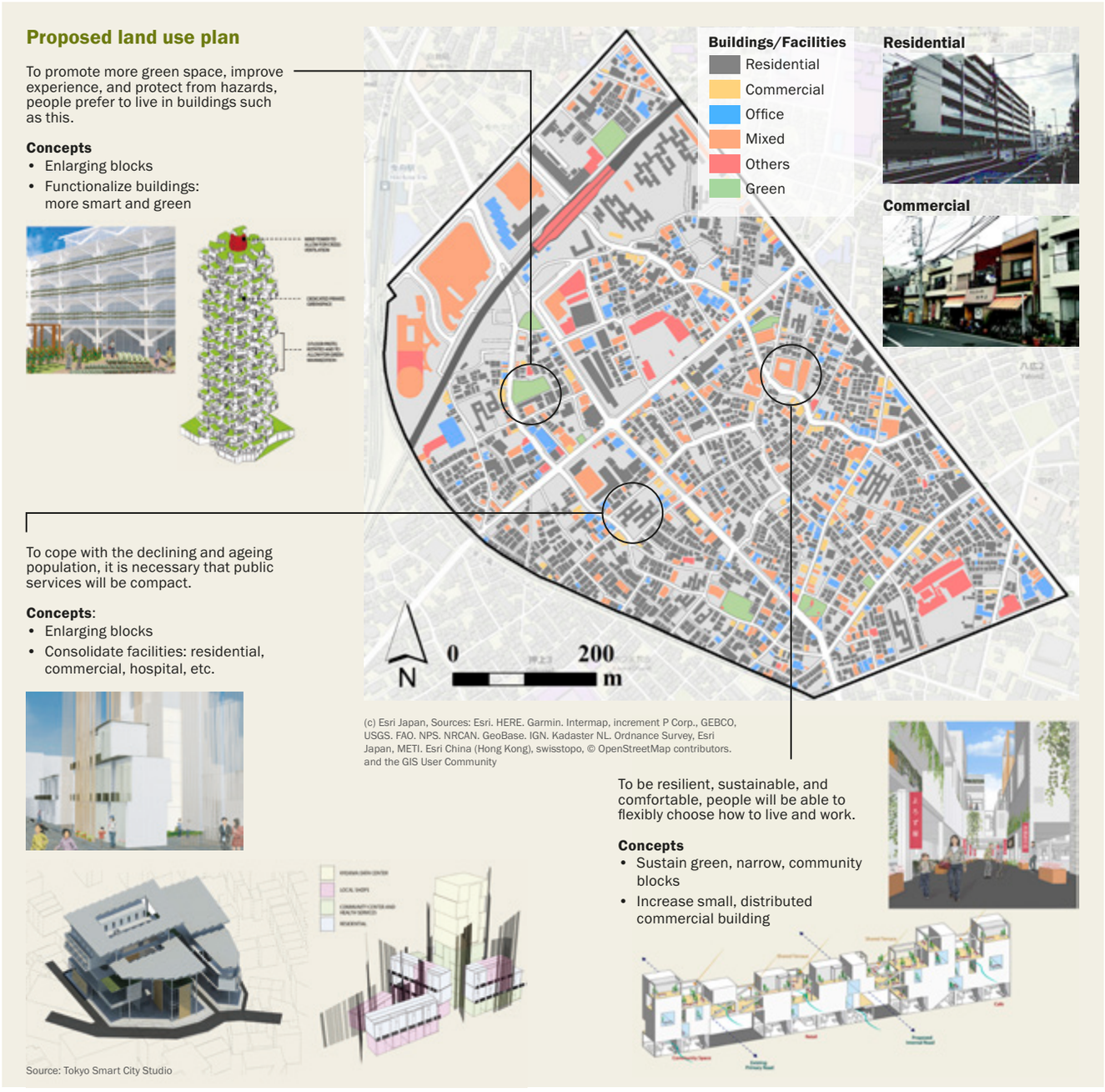
The Evolving City concept is designed to facilitate a modular and ageing city through adaptable infrastructures. The concept stems from a recognition that the needs, desires and culture of urban residents are dynamic, thus their corresponding environments should also adapt to support them accordingly. The impetuses of this concept are: respect of local culture and addressing economic vitality and tourism; integrating connections and addressing spatial and dynamic values; and stimulating economically resilient and sustainable communities. Implementing the concept involves identifying

buildings and zonings that should remain unchanged and/or require adjustment and remodelling. It also involves the construction of multipurpose mobility hubs that provide public space, storage, parking spaces, and emergency assembly points for residents.

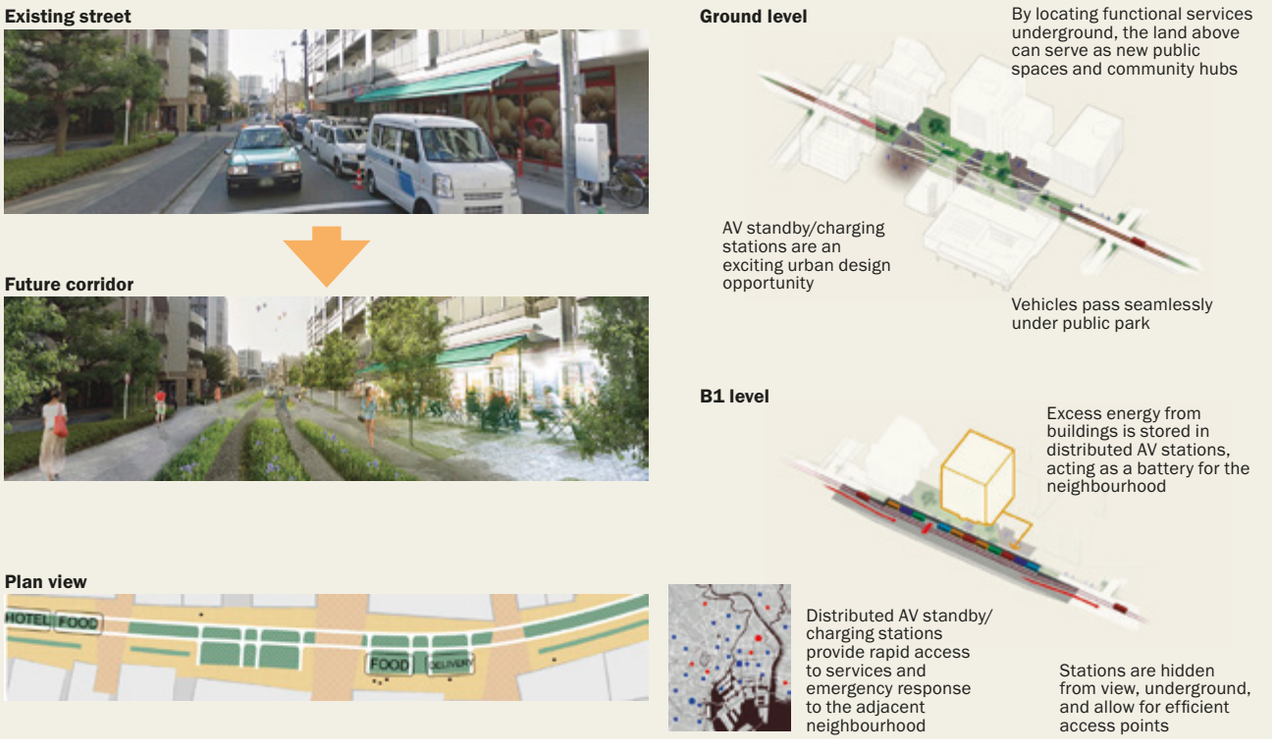
The Studio participants presented their design solutions and integrated concepts to representatives from the Sumida ward and to the public. Several audience members asked questions regarding the research topics as follows:

- With the current and projected technological advances, is it necessary to expand existing roadways to accommodate current cars and emergency vehicles?
- Should current efforts in urban development consider the emerging innovations that can help to address the causes of urban failure?
- While these results are specifically useful to Sumida Ward and Kyojima, how can these research agendas be applied in a wider context, such as for the benefit of neighbouring wards and also of areas outside of Japan?

In order to mitigate and adapt to climate change risks, it is necessary for cities to be changed, and important to establish a new concept design for climate-resilience. In Japan, where urban land is fragmented and there are many small, old buildings scattered throughout the cities, such land use has problems not only in the landscape and residential environment but also in energy efficiency and safety. If landowners can work together to agree on a better design at the block level, the economic value will increase, and the environmental burden will be significantly reduced. Furthermore,



Future streets installed with next-generation housing and mobility services



Source: Tokyo Smart City Studio

it is important to rebuild beautiful landscapes that meet the aesthetic standards inherent in the Japanese sensibility if the entire community is to be developed. To achieve this, it is necessary to present designs for climate-resilient smart cities that take into account not only buildings but also traffic and human movement, and to seek consensus on the changes.

Outside of Japan, some advanced examples of smart city development projects utilizing ICT have emerged. In Spain, for example, an EU-funded urban system — Smart Santander Project — has been designed with an IoT platform. Much attention has been paid to research that uses the latest ICT techniques to simulate urban design, and Google and others have started a project in Toronto, Canada. In the development of smart cities in the future, it is important to combine smart mobility such as self-driving cars and a sharing economy.

The GCP team has therefore been working on a design study based on the concept of a Japanese-style (wafu) smart city. In Japan, smart cities are often perceived as applying urban planning with high environmental energy performance, utilizing ICT. Research has now begun on the design of an urban system of the smart city that includes the perspective of maintaining or regenerating the original Japanese-style landscape and the connections between people. Fortunately, in Tokyo, many of the traditional areas remain and are readily available as reference. So, GCP is considering using the IoT to create a town where all people, including the elderly and foreign tourists, can stay and enjoy walking in a Japanese-style city. For example, the streets of the Kawagoe and Kita-Shinagawa have attracted the attention of young people as popular Japanese-style spaces, but the challenge for the future will be whether or not street-level considerations, with their crowds of diverse people, can become the core ideal of the Japanese smart city with the design of a more comfortable and sustainable "street" utilizing the IoT.

Smart city, a concept that uses ICT to improve the convenience of life and the environment, is being developed around the world. However, in the management and design process of smart cities, the most important elements — housing and mobility — are often independently developed. Although there have been data utilization infrastructure services related to smart cities such as FIWARE (Future Internet WIRE: software for the next-generation Internet infrastructure, developed by the European Union), no information service platform has yet been developed to design and support smart cities considering the interaction between housing and mobility, such as how the new mobility system will affect the way people live. The next-generation mobility system is equipped with a vehicle-to-community function (technology to share stored electricity with communities), which can supply electricity to houses and offices in a distributed manner in the case of a disaster. In addition, the possibility of developing car-sharing and mobility services, such as Toyota's e-Palette and others, that can be used for multiple purposes such as transportation, logistics, and goods sales is being demonstrated.

The GCP research team is developing future urban design scenarios that take into account the next generation of housing and mobility through international workshops on urban system design.

New opportunities for scaling up non-sewered sanitation sustainably for developing countries

Papa Abdoulaye SY, Lead Global Urban Development Specialist; Sami Ahmed Faruqi, Manager, Social Infrastructure, Global Practices, Islamic Development Bank, Jeddah, Kingdom of Saudi Arabia

Unsafe sanitation is a serious problem that is becoming more urgent as the global population increases and trends such as water scarcity and urbanization intensify. Approximately 4.5 billion people — more than half of the world's population — practice either open defecation or use unsafe sanitation facilities and services.[1] To be effective, sanitation must be carefully managed at all stages, from the point at which waste is collected and contained to the method by which it is transported and treated. Gaps or breaks at any stage allow harmful human waste to flow into surface water and fields where children play and people of all ages live, eat, drink and bathe.[2]

According to the UN-Habitat, globally, one in eight people live in slums. In total, around a billion people live in slum conditions today.[3] Slums are characterized by a lack of access to water supply and/or improved sanitation. When central or local governments fail to provide for their citizens' most basic needs, people are left with a disorganized mix of services to empty latrine pits and dispose of waste, often with little regard for cleanliness, either for workers or nearby residents. Without access to systems for removing human waste, almost 100 million urban dwellers have little option but to practice open defecation. The remaining 600 million people rely on toilets that do not fulfil minimum requirements of hygiene, safety or privacy, including dirty and crowded communal toilets, and rudimentary pit or bucket latrines. Communities near water may use 'hanging' latrines suspended over a river or lake, where human waste drops directly into the water. Streets and common areas quickly become open sewers and rubbish dumps.[4]

Poor sanitation, which is widely accepted as a chief contributor to waterborne diseases, is the cause of more than 1,200 deaths of children under five years old per day — more deaths than caused by AIDS, measles, and tuberculosis combined. Inadequate sanitation and hygiene were the cause of more than half a million deaths from diarrhoea alone, in 2016.[5]

Advantages of promoting on-site sanitation for achieving SDG 6

On-site sanitation (i.e. non-sewered sanitation) is a system in which excreta and wastewater are collected, stored or treated at the place at which they are generated; common examples being pit latrines and septic tanks. The fact that the waste is not transported eliminates the need for installing a sewerage system, pumping station, power station or expensive wastewater treatment plant at the end of the process. On-site sanitation does not require high capital expenditure or substantial operational and maintenance costs, and can therefore be a cost effective and very low maintenance option for providing access to sanitation in an affordable way, especially in developing countries.

Leveraging financing for scaling up on-site sanitation

Within member countries (MCs) of the Islamic Development Bank (IsDB), at least 3 out of the 57 have among the world's poorest records on urban sanitation.[6] To tackle this issue, the Bank has been resolutely engaged in providing solutions and helping MCs to achieve SDG 6 target 2 — by 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

Between 2012 and 2018, IsDB has financed several sanitation projects, promoting the use of on-site sanitation, for a cumulated amount of US$ 184 million, in Indonesia, Bangladesh and Conakry, Guinea. In order to scale up and to help the least developed of its MCs to achieve SDG 6, the Bank is using innovative financing, as in the Lives and Livelihoods Fund (LLF) initiative.[7]

The LLF is an innovative financing mechanism, combining traditional project-based modes of a multilateral development bank operating through large-scale interventions, with the considerable buy-down potential of grant-based donors. It is a global compact, bringing together development partners to unlock US$ 2.5 billion of financing on concessional terms to lift millions of people out of poverty and save thousands of lives. For instance, the Conakry sanitation project in Guinea was financed through LLF for an amount of US$ 54 million with a 30 per cent grant element. Several other sanitation projects are under IsDB's review for financing through the LLF mechanism.

Using transformative sanitation technologies[8]

Another opportunity to scale up on-site sanitation can be found in the use of transformative sanitation technologies. Since 2011, the Bill & Melinda Gates Foundation has been working to develop a portfolio of innovative sanitation technology such as the reinvented toilet and new kinds of human waste treatment technologies, that give governments and utilities an advantage at transformative approaches to an old

Typical scene of unsafe sanitary conditions, with hanging latrines suspended over a ditch or canal

problem. The Bill & Melinda Gates Foundation has primarily invested in early research and development — the riskiest phase of a technology innovation process — and the development of international standards, in order to establish a high benchmark for these innovations, while simultaneously removing barriers for companies and governments that want to be early adopters. These include the reinvented toilet, the omni-processor, and the omni-ingestor.

- **Reinvented toilet**: through this programme, launched in 2011, the Foundation has worked with leading engineers and scientists to design low-cost toilets that do not require connections to the electrical grid, water supply, or sewers and that fully process human waste. These no-sewer toilets do not require drains, pipes, continuous electricity, or treatment plants. Instead, they are self-contained units that treat a household, building, or community toilet's sewage on-site, at a low cost to users.
- **Omni-processor**: this might be called the 21st-century treatment plant: machines designated "omni-processors" process waste, kill pathogens, and convert the resulting materials into products that can be sold, such as clean water, electricity, or fertilizer. Omni-processors can be used to augment existing sanitation services within a city, as part of a faecal sludge treatment plant, or complementing a wastewater treatment plant, while potentially providing new revenue streams.
- **Omni-ingestor**: While some families are currently able to have their septic tanks and pit latrines emptied by vacuum trucks, many others cannot because the pits and tanks are too far from a road or too difficult to access in a narrow alley, or because their contents are too dry for traditional vacuum pumps to empty them. Often the service simply costs too much or is so unreliable that it does not help a family safely manage waste.

Using a community based sanitation approach — the Sanimas model

In February 2013, IsDB approved the financing of US$ 100 million for a community based sanitation project in Indonesia named "Sanimas". The project's main objective was to tackle the health issues induced by open defecation and poor sanitation by providing community based infrastructure for sanitation in 1,800 locations in 46 cities across 13 provinces. Sanimas uses a demand-responsive approach i.e. communities are showing their commitment and willingness to join the project by signing and accepting its requirements. This approach has been established as a better alternative to using centralized sanitation infrastructure that is unable to cope with the geographical nature of Indonesia and the type of population targeted.

The eight centralized sewerage systems in Indonesia generally do not cover poor residential areas, many of which lack even

the most basic sanitary infrastructure. Due to large investment costs, it must be anticipated that, even if a few more centralized sewerage systems were to be constructed, large-scale sewerage programmes are unlikely to improve sanitation significantly for the urban poor. Therefore, the Sanimas Community Based Sanitation project specifically targeted the poor, in recognition of the clear quantifiable link between unsanitary conditions and poverty in the urban communities of Indonesia. Across the environmental spectrum, practitioners now accept the direct and many indirect links between poverty and environmental degradation as well as quality of life.[9]

The approach of Sanimas Community Based Sanitation

Taking into account the limited awareness of the community about water sanitation and hygiene and its lack of understanding about community-driven sanitation technologies, the project will allow sufficient time for a community empowerment process. Community Facilitators (CFs) will assist local communities to develop their own action plans for sustainable sanitation services and improved hygiene and health environments. The process will start with the establishment of a long list of communities showing their interest to participate. Roadshows will be organized in each city, providing information on community-driven sanitation, health and hygiene issues, and procedures and criteria to participate in the project.

Districts will be chosen to participate in the project based on specific selection criteria. CFs will inform and train community members to:

- Identify issues and needs related to health, hygiene and sanitation
- Formulate comprehensive and sustainable sanitation plans with specific investment plans to be financed through government financing
- Prepare technical design
- Implement civil works
- Formulate and implement operation and maintenance plans to ensure sustainability of the completed facilities.

In order to ensure that community sanitation facilities constructed under Sanimas will be integrated in city development plans and linked to the sewerage system, only districts located in cities with an approved City Sanitation Strategy (CSS) will participate in the project. To ensure support from the respective city administrations, local governments will provide a firm letter of conformation documenting their readiness to participate in Sanimas and to make specific contributions to support community-led sanitation development.

Image: Sanimas IsDB, 2018

Community toilet facility with waste treatment plant

Image: Sanimas IsDB, 2018

Waste treatment plant with decorated manhole covers in a garden area

Image: Sanimas IsDB, 2018

Waste treatment plant with balancing pond

Types of community sanitation facility implemented with Sanimas
Each community will discuss, select and prioritize the list of facilities that they would like to implement from a given list — the 'open menu' — comprising:

- Construction of public bathing, toilets and washing facilities
- Construction of communal sewerage systems and wastewater treatment plants
- Implementation of disposal/reuse systems.

The Sanimas project will contribute to providing improved sanitation to some 14.5 million people, spread over 3.5 million households including 337,000 poor families and households in 13 provinces throughout Indonesia. The immediate outcomes would see a reduction of the number of people using open defecation in urban areas from 14 per cent to less than 5 per cent by 2019, and an increase in the level of coverage from 51 per cent in 2010 to 63 per cent by 2019. Sanimas will promote the use of several tools such as community-led total sanitation, participatory health and sanitation transformation, and hygiene behavioural changes.

Similarly, in Bangladesh, IsDB is implementing a water and sanitation project in 23 municipal corporations (*Pourashava*) with a cumulative target of 1 million people and for a cost of US$ 90 million out of which US$ 30 million is dedicated for the construction of sanitation facilities. The immediate outcomes of this project will see the number of people using improved sanitation facilities increase from 57 per cent in 2013 to 75 per cent by 2022, and the number of households with access to regular solid waste collection services from 55 per cent in 2015 to 90 per cent by 2022.

Finally, in Conakry, Guinea, IsDB is implementing an integrated sanitation project comprising storm water drainage, solid waste management and on-site sanitation for a cost of US$ 54 million including US$ 16 of LLF grant in the two most populated districts of the capital city. The key results anticipated in the districts of Ratoma and Matoto are:

- 1.7 million inhabitants will be protected against flooding and will benefit from the regular collection of solid waste
- Sludge treatment will increase from 0 per cent in 2017 to 500 m^3/day in 2022

Image: Sanimas IsDB, 2018

Waste treatment plant designed for use as a playground

- The number of cases of malaria, diarrhoea, schistosomiasis, and typhoid will be halved for children under five years old
- Several hundred jobs will be created both directly and indirectly.

The way forward

These are living examples of how non-sewered sanitation can be scaled up for reaching out to the poorest households and giving access to improved sanitation in a sustainable way. Ultimately, all of these efforts will help in achieving SDG 6 for IsDB MCs.

At the Reinvented Toilet Expo, Beijing, China, 2018, Bill Gates, talking about these new opportunities, stated: "Today, we are on the cusp of a sanitation revolution. It is no longer a question of if we can do it. It's a question of how quickly this new category of off-grid solutions will scale. We don't know exactly how long that will take, but we do know it can't happen fast enough." In the same vein, during the Transformers summit that took place in Cambridge, UK in December 2018, the President of the IsDB Group, Dr. Bandar M.H. Hajjar, said: "Unsustainable cities are burdening the future of our societies and, without definitive commitment to invest in innovative technologies, our cities will remain unprepared for the challenges associated with rapid urbanization."

Smart Cities Mission — creating 'lighthouses' for urban change in India

Rahul Kapoor, IRAS, Director; Avni Gupta, IES, Deputy Director,
(Smart Cities), Ministry of Housing and Urban Affairs, Government of India

Cities are considered engines of a nation's economic growth. In 2011, India, with a population of 1.2 billion, recorded 31 per cent of its people as living in urban areas, contributing 63 per cent to GDP. With 40 per cent of the population expected to be living in cities by 2030, there is a need for a comprehensive strategy for city development. However, urban areas have their own challenges in terms of physical, social, economic and institutional structures that compromise quality of life and diminish the attraction of people and investment in cities, thereby stagnating their growth. Also, the risks that cities are facing due to natural disasters, abnormal weather patterns, increasing pollution levels, and imminent threats from global warming are emerging as serious challenges.

The best way to deal with these challenges is to embrace them as an opportunity, and this is the approach taken by the Indian government. Central government policymakers decided on a hierarchy of programmes in a three-tiered approach across all towns and cities. At the first level, the biggest problems of poverty alleviation, cleanliness and housing are being addressed in all Urban Local Bodies (ULBs) by three of the programmes: the National Urban Livelihood Mission, the Swacch Bharat Mission and the Pradhan Mantri Awas Yojana. At the second level, water supply, sewerage, green spaces, and capacity-building on urban planning are being addressed in 500 cities through the Atal Mission for Rejuvenation and Urban Transformation. Finally, at the third level, the Smart Cities Mission (SCM) is being implemented in 100 cities to provide core infrastructure and improve the quality of life using smart solutions. These 100 cities are designated 'lighthouse' cities in order that they become models for other projects, providing guidance for replication and learning in areas such as the use of digital technology, urban design, urban planning, and all sectors affecting quality of life, economy, environment, and innovative urban finance.

The SCM was launched in 2015 by the Government of India, with innovation at its core, beginning with the selection of 100 cities that was based on the spirit of competitive and cooperative federalism. Each of the cities competed with each other for selection in multiple rounds, and prepared their smart city proposals in consultation with all stakeholders, involving extensive exercise of citizens' engagement. Such an approach aims to make a tangible difference to citizens' quality of life in terms of their aspirations. The 100th city of Shillong was selected in June 2018.

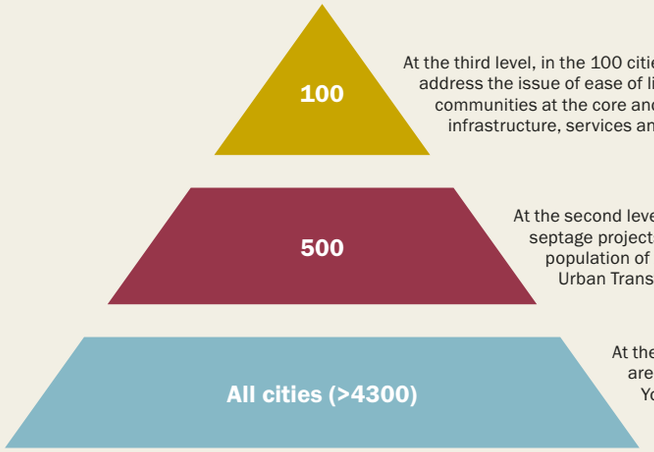
The SCM is being implemented with the strategic components of Area-Based Development (ABD) and Pan-City initiatives. ABD can adopt the strategy of city improvement (retrofitting), city renewal (redevelopment) and city extension (greenfield development), or a combination of the three, in a defined compact area ranging from 50 acres for redevelopment to 500 acres for retrofitting. Under the Pan-city initiative, the city would apply smart solutions covering infrastructure city-wide.

The winning cities are required to implement their Smart City proposals within a period of five years from the date of selection. They would be eligible for government grants amounting to US$ 14 billion. The total size of the SCM is estimated at US$ 30 billion, with more than 5,000 projects planned for implementation over a five year period, and with a variety of funding sources such as grants, public private partnerships (PPPs), and convergence with other schemes. The cities were encouraged to leverage the government grant and raise funds for their projects through innovative sources of financing, and to develop sustainable revenue models for their projects.

The SCM is also unique due to its method of project implementation. Instead of a silo approach where individual projects are implemented by different line departments, projects under SCM were to be implemented in an integrated and coordinated manner by special purpose vehicle (SPV) companies that were incorporated to implement the Smart City Proposal. The SPV becomes the point of convergence between other national and state urban programmes, integrated and evidence-based planning and innovative financial models such as municipal bonds and land value capture. The projects in smart cities range across sectors including mobility, heritage and urban spaces, water supply, complete streets, waste management, energy, and governance.

Three years after the SCM's launch, cities have begun to show a promising start in project execution, notwithstanding some constraints. Since the mission envisaged many new processes and technologies being introduced within the smart solutions, extensive knowledge and capacity-building would have been required in the cities as well as the new SPVs that were formed to design and implement the projects. However, to begin with, the existing systems of governance

Transforming urban landscape 3-level strategy



At the third level, in the 100 cities are being developed under the Smart Cities Mission to address the issue of ease of living by evolving new paradigms of urban governance with communities at the core and the increased use of digital technology to improve urban infrastructure, services and utilization of resources

At the second level, the focus is on basic infrastructure such as water supply, sewerage/septage projects and green parks. This is being implemented in 500 cities with a population of 100,000 and above, through the Atal Mission for Rejuvenation and Urban Transformation, and covers over 60% of the urban population of India

At the first level, poverty alleviation, affordable housing and sanitation are the three biggest challenges. The Deendayal Antyodaya Yojana-National Urban Livelihoods Mission, Pradhan Mantri Awas Yojana–Urban, and Swachh Bharat Mission–Urban initiatives are implemented in all ULBs

were not adequately positioned to address these dynamically evolving demands of the SCM. The new mechanism of governance and project management through SPV required delegation of administrative and financial powers from the existing line departments and utility service providers, with the pace of delegation of powers uneven across the various states. The project implementation constraints include availability of clear encumbrance-free land; lack of market participation in Tier 2 and 3 cities; project financing limits from banks and other financial institutions; lack of data culture in cities; interoperability and scalability of systems; and interdepartmental coordination issues between various line departments.

The cities' readiness to face these challenges has been demonstrated by the progress made as the SCM crosses the halfway timeline. Up until March 2019, cities had invited bids for 64 per cent of projects, while 43 per cent have already been completed or are being implementated under the mission. The contribution of PPP projects under the SCM is 21 per cent of total projects. The progress under PPP has been encouraging with 18 per cent of total bids invited being under PPP. There has been noticeable success with PPP projects in sectors such as housing, waste-to-energy, solar rooftops, public bike sharing, parking management, smart cards, and transport hubs. Encouragingly, their progress has not only been limited to large cities, but there has been success in smaller towns as well. Similarly, convergence projects that are being implemented by other government missions have contributed over 21 per cent of the total bids invited under the SCM.

At this juncture, with the project implementation gathering pace, the way ahead for the mission would be to consolidate a clear vision of the nature of sustainable and resilient cities. New technologies and processes such as Internet of Things, artificial intelligence, edge devices, machine to machine, and integrated command and control centres bring with them new challenges and opportunities for the cities. After all, many of the projects are being implemented for the first time and are still experimental, with usage cases still under development. The importance of standardization of processes and procurement has been realized as the SCM progresses to address issues such as vendor lock-in, model replicability challenges, difference in protocols, software applications (either the interfaces or the underlying data models) that don't talk to each other, and solution silos with limited sharing or standardization. The SCM has partnered with Bureau of Indian Standards and other world standards development organizations to develop smart cities standards for India. A range of standards is needed to help the smart cities meet their potential and address issues at different levels, such as the interoperability of several smart urban components, sensors and devices deployed within the city; security concerns; and decision-making. The SCM has prioritized its goals for standardization as centred on habitat, mobility, infrastructure and ICT. Standardization will help in making systems work together efficiently and effectively in facilitating adoption of new technologies, which is critical for scaling up of smart cities.

Although the future of governance is data driven, most of the cities in India are yet to achieve readiness to adopt the change. Much data is being generated although it exists in silos. Each line department or agency has its own data sets, with very little exchange or analytics happening at the time of writing. Moreover, many of the systems work within a closed architecture that affects interoperability, and cities undergo vendor lock-in with these systems.

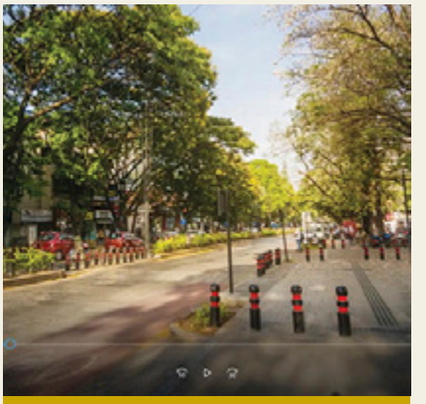
The SCM has recently launched the DataSmart Cities strategy to instill a 'culture of data' in Indian cities. The strategy aims to establish three foundational pillars — people, process, platform — together with a suggested roadmap with which cities will be able to improve their readiness for intelligent use of data in addressing complex urban challenges. It will lead to a complete ecosystem transformation through institutional structures and data alliances at national, state and city levels.

Realizing the importance of easier access to information, data and knowledge in providing an enabling platform for

Smart Cities Mission strategy

Area-based development

Redevelopment
- City renewal
- Old slum areas
- Core city areas
- Area of 50 acres minimum (25 acres for NE cities)



Retrofitting
- City improvement
- Local area planning
- 24 x 7 water supply
- Area of 500 acres minimum (250 acres for NE cities)

Greenfield development
- City extension
- Satellite towns
- Integrated townships
- Area of 250 acres minimum (125 acres for NE cities)

Pan city development

City-wide smart solutions (at least one)
- Electronic service delivery
- Intelligent traffic management systems
- Smart metering and management
- Integrated multi-modal transport systems
- Video crime monitoring

Integrated smart solutions through command and control centre

Basic infrastructure and services

researchers, innovators and city administrators, an open data portal (smartcities.data.gov.in) has been developed under the SCM that provides open access to the enormous data available from 100 smart cities. This portal allows Indian smart cities to publish their data sets in the public domain for open innovation, research, co-creation and for designing products and services using emerging technology. The evolution, from opening up government data to the creation of a platform for data shareability, has been identified as the next logical step under the DataSmart Cities Strategy. To this end, the SCM has set up the India Urban Data Exchange, which allows users to exchange real-time data through a neutral, secure and open platform, and enables disparate and independent city systems to work together seamlessly and securely for data exchange.

Existing stakeholders, with a business-as-usual approach, do not have ready solutions to the many pressing problems faced by cities. There is therefore a danger that cities will stagnate in their growth objective. To overcome these challenges and find solutions, it is necessary to seek innovators that may be within the city itself, those among business start-ups, the student community, and academia. The SCM understands the necessity for creation of an ecosystem wherein the innovators become engaged with the cities to improve the overall quality of life. Accordingly, a dialogue has been initiated with other government programmes such as the Atal Innovation Mission; Startup India; and the Accelerating Growth of New India's Innovations programme, to foster the creation of an ecosystem for innovation in smart cities, enabling local area development, harnessing technology and providing a boost to the economy.

There are several other initiatives being run under SCM: the City Investment to Innovate Integrate and Sustain challenge; Smart Cities Digital Payment Awards; Ease of Living Index; Municipal Performance Index, and the India Smart Cities Fellowship and Internship Programme. These initiatives are designed to maintain the spirit of challenge adopted in the initial stage of the mission, and to benefit the cities by way of capacity-building, better planning and development.

Although the SCM was launched as a five-year programme for cities, the road to smartness is a journey with its own educative value. As people begin to experience a paradigm change in the ecosystem and realize the impact of these changes around them, they will begin to imbibe them by way of behavioural and cultural change. This mission is just the beginning to embark on the path to smartness.

Water-for-energy in a climate change context — lessons learned from Cuenca, Ecuador

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With the world's focus prioritized on adapting and mitigating climate change-related risks and hazards, the Sustainable Development Goals (SDGs) have become the guiding principles from which to usher nations and cities across the globe towards a more socially, economically and environmentally sustainable future. In achieving the SDGs, water is a crucial sector, forming the basis of sustaining modern human settlements. However, water should not be considered in isolation and urban managers and decision makers should take into account the multiple ways in which the management of water resources interacts with other urban sectors. In recent years it has been acknowledged that the urban water-energy nexus is of particular importance.

The impact of climate change dynamics has a multiplying effect when the interlinkages between the water and energy sectors are taken into account. This also applies to the generation of climate change co-benefits that derive from adaptation and mitigation initiatives implemented at the urban level and that address the water-energy nexus. Recent developments and research findings in water management and their implications for the energy sector are brought to sharp focus at Cuenca, Ecuador, and its attempt to achieve a climate-resilient and sustainable future in line with the SDGs.

An urban nexus highlights the intertwined connections of various flows and systems within a particular urban space. The water-energy nexus occurs when humans use water to generate energy, and also when energy is consumed to access water resources. The nexus reveals substantial trade-offs and opportunity costs associated with the ways water and energy are used. A better understanding of the water-energy nexus is essential for optimal resource planning that fosters the efficient use of scarce resources. The level and nature of such interactions between the two sectors are multi-directional and showcase a high degree of interconnectedness between different urban systems. The urban impact on water resources and the resultant water scarcity is not only a future risk but, when coupled with climate change, represents a serious potential hazard.

Optimizing the utilization of the energy-water nexus becomes an important premise for sustainable urban development worldwide. This requires an in-depth understanding of the complex and pervasive connections between energy and water in urban areas, and calls for integrated and coordinated approaches that promote synergistic pathways between standalone water and energy systems.

The urban water metabolic cycle has two components: the flows in various stages of the water metabolic cycle, and the energy input demanded by these various stages of water cycle for various processes such as extracting, pumping, treating, and storing. The generation of the energy required has an environmental footprint, which can be expressed as greenhouse gas (GHG) emissions in the form of equivalent carbon dioxide emissions (CO_2e). The level of CO_2e emissions of the energy generation process can be used as an indicator of the sustainability of the process, in line with widely used climate change mitigation and adaptation frameworks. The prime focus of this article is therefore on the water flows, associated energy consumptions, and the related GHG emissions from the water sector. These indicators are utilized to gauge the adaptation and mitigation benefits and co-benefits that water-energy saving technologies could potentially contribute to the water-energy nexus in the urban water cycle.

Learning from Cuenca

Cuenca is a mountainous city in the Andes, the third largest city in Ecuador with a population of some 500,000 inhabitants, and located at an altitude of between 2,350 and 2,550 m above sea level. Ecuador is rich in water resources with numerous rivers arising from the Andean glaciers and high precipitation for the most part of the year. However, changes in the climate over the past decades have resulted in a variety of repercussions that pose risks to the country's availability of natural resources. By way of illustration, Ecuador has recorded sustained increases in temperature, changes in the frequency and intensity of extreme events such as droughts and floods, changes in the hydrological regime, and the retreat of glaciers. Due to this, the national government has been proactive in attempting to nullify and prevent the threats that climate change poses. The National Climate Change Plan (2015–2018) is one such effort setting the national climate change strategy and objectives up to 2025.

Cuenca is known for the abundance of water supplies which come from four rivers — Tomebamba, Machangara, Yanuncay and Tarqui — and is the centre of Ecuador's energy transition from fossil fuels to hydroelectricity. However, the increased energy use in water treatment plants before and

Image: Xavier Fernando Bravo Guerrero

Forest of polylepis trees and mosses that characterize the wetlands of the Cajas National Park, that absorb and regulate the flow of water into streams and rivers

after its utilization increases the need to study the water-energy nexus of the urban water cycle and its repercussions. In addition, current and future climate change dynamics threaten to bring unforeseen scenarios for Cuenca and for human settlements in general. With Cuenca relying heavily on its abundant water resources from the Andean glaciers for water and energy, it is essential to ensure that this interdependency of water and energy cycles is resilient in the face of uncertain future climatic scenarios.

Analysis of the Cuenca experience emphasizes that technologies such as rainwater harvesting and solar water heaters are 'no regret strategies'. These technologies enable the conservation of water and energy resources, or make their consumption more sustainable in the face of two kinds of future uncertainty: gradual changes such as climate change, and system shocks such as natural disasters and energy price spikes.

Regarding climate change dynamics, water-energy saving technologies reduce water-related energy consumption and mitigate GHG emissions and therefore should be considered as important tools that symbolize the adaptation and mitigation co-benefits. Most importantly, they have been found to be suitable for cities with water scarcity as well as water abundance. Despite playing very different roles, both these technologies contribute strongly in making the water-energy nexus more resilient and robust. By way of illustration, rainwater harvesting has the following advantages:

- **Flood risk reduction.** The flood reduction benefits of green urban infrastructure have been well documented. Due to impermeable urban roads and buildings, rainwater fails to recharge groundwater but instead adds to the water to be managed by downstream areas, creating long-term stresses on groundwater levels upstream, and flooding issues downstream.
- **Water losses to sewage.** Collecting rainwater helps retain high quality of rainwater in on-site storage tanks, ensuring less water flow to the sewerage. The reduced volume of water to sewerage equates to a lower volume of wastewater requiring treatment before discharge downstream. This reduced flow of wastewater therefore saves treatment costs, energy input required, reducing GHG emissions as a result.
- **Evaporative cooling of buildings.** Rainwater harvested from water collecting measures can be used to cool buildings. Water is the cheapest and most effective method to cool a building, with no energy invested in air cooling devices such as air-conditioners. This usage of harvested rainwater has huge implications for the energy sector. Less energy required to cool buildings implies lower stress on the water-energy nexus in the energy sector.
- **On-site local water supply avoids reclaiming and reusing water resources multiple times, 'cascading from a higher to a lower quality'.** Stormwater or rainwater becomes a resource to increase local sustenance, reducing the reliance

on water from centralized water grid systems, and thereby strengthening the resilience of the water sector of the city preparing alternative sources of water for droughts as well as holding stormwater upstream, mitigating floods.

By contrast, solar water heating, which involves the conversion of sunlight into heat for water heating using a solar thermal collector, can be considered a technological medium through which the water sector helps to generate renewable energy. In Ecuador, solar water heating installations would reduce residential dependency on LPG gas cylinders for hot showers and could be combined with the national government's electric induction stoves programme. This would contribute to SDG 3 by reducing respiratory illnesses due to indoor air pollution; SDG 7, with LPG fuel switched to hydroelectricity; and SDG 11 by improving air quality and the environmental impact of cities. Solar water heating therefore exemplifies the synergetic relationship between implementing programmes related to both the water and energy sectors and elucidates the importance of transdisciplinary multi-sectoral governance as a way of finding solutions that maximize resource efficiency and impact across various sectors and stakeholders.

Image: Xavier Fernando Bravo Guerrero

Around 270 lagoons at El Cajas National Park sustain the descent of fresh water from the Andes mountain range

Image: Xavier Fernando Bravo Guerrero

The fast-flowing rivers of Cuenca, giving life to the city

Conclusion

Both rainwater harvesting and the use of solar water heaters would not only be water saving but also energy saving, fostering a transition from fossil fuels to renewable technologies that have been a high priority in the mitigation plans of cities and countries across the globe. To fully capture the potential of these technologies, a holistic approach should be used by urban managers and decision makers, so that benefits are expressed based on a few simple indicators such as water quantity, energy demand, GHG savings, and monetary savings, to support initial pilot economic feasibility studies. These should however be complemented by surveys of consumer behaviour to understand the cultural acceptance of these technologies by urban residents.

It should be pointed out that besides these advantages, rainwater harvesting and solar water heaters are technological solutions that are not only able to increase the efficiency of water distribution systems, contributing to the rise in sustainable management of water and also energy resources, but they can also be considered low-impact development (LID) strategies because they are easy to implement and relatively inexpensive. This makes them attractive solutions for local governments in developing and transitional countries, which might not have abundant resources at their disposal. LID strategies are replicable at household, community and even city level. Furthermore, LID strategies and harvesting are useful for all extreme weather scenarios, for example during droughts where they help in providing alternative mechanisms to collect and store water, as well as during floods where they help in reducing run-offs and managing stormwater.

Sustainable city-making and smart urban solutions in Seoul

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As developing cities seek more efficient solutions to their many urban development issues in a bid to achieve the SDGs, Seoul is being viewed as a global benchmark for sustainable development. Although each city has a unique story and vision for the future, the common interest in Seoul can perhaps be explained by two main factors.

Perhaps the foremost reason is that many lessons can be learned from Seoul's history of extraordinarily rapid development. Having been reduced to almost total ruin in the aftermath of the Korean War in the mid twentieth century, Seoul has been able to develop into an exemplary metropolis in the comparatively short span of 50 years. While many advanced cities around the world have had the benefit of hundreds of years of urbanization and development history, Seoul was able to industrialize, modernize, and completely transform itself within a fraction of that timescale. The Seoul of today is a mixture of tradition and modernity, a public transport-oriented city featuring premium transportation infrastructure available for use at affordable prices. It is also a model of urban safety, where each corner of the city can be visited during the night hours without concern.

As the city's population has more than doubled over the past 50 years, Seoul has had to make efforts to develop, expand, and modernize key infrastructure such as transportation, water management, and solid waste management. The Seoul Metropolitan Government is also now actively pursuing a wide range of urban regeneration initiatives, both large and small, in a push towards the efficient advancement and management of the city, all in the service of sustainability.

Image: SUSA

Seoul, South Korea in the 1950s; one of the least developed countries in the world at that time

These experiences can serve as invaluable references for developing cities around the world in order to avoid long and costly trial-and-error approaches to sustainable urbanization.

The second reason for international interest is that Seoul is a true smart city that seamlessly integrates ICT into virtually all aspects of its public services to improve the quality of life for all residents. Seoul's transition to becoming a smart city began in 2008, with the concept of a "ubiquitous city," one of South Korea's first large-scale efforts to converge the country's advanced memory chip and mobile technology with public service provision and urban development. However, the concept of a ubiquitous city, where public services and urban development took a predominantly top-down and supply-driven approach, has steadily been shifting towards a smart city concept, where citizen needs and demands are the primary drivers of public services and policies.

As Seoul began to actualize the smart city concept so as to accurately gauge and reflect the needs of residents in service provision, big data analytics and ICT began to play an ever greater role in policy formulation and implementation. Two prime examples of big data analytics in action in public services are: Seoul's Night Owl Bus, a series of public bus routes specifically designed for the late hours using mobile call data to model population movement patterns at night; and a Big Data Business Environment Analysis Service, that collates and provides real-time market information for small businesses.

Although such smart city frameworks and assets are extremely beneficial for highly developed cities, they may prove to be absolutely invaluable for many cities in developing countries that are projected to urbanize at almost unprecedented rates in the near future. The reason for this is that, considering the challenges that many developing cities face, such as insufficient infrastructure, and the lack of capital and expertise to develop them, adopting a smart city framework can enable them to develop in a cost and energy efficient manner, while ensuring that the city evolves in a more socially inclusive way. A smart city framework can also provide a comprehensive system to minimize, or altogether avoid common issues that accompany urbanization such as zoning-related problems, traffic congestion, increasing crime rates, and environmental pollution.

Ultimately, the concept of a smart city provides a framework for cities to minimize the socioeconomic costs of urban development while simultaneously raising the quality of life for its residents. Seoul's most recent efforts to create a

Image: SUSA

Present-day Seoul, a model of urban advancement and prosperity as a result of sustainable development

sustainable urban environment can largely be divided into two overarching vectors: improving the physical environment of deteriorating and dilapidated urban spaces, and providing convenient public services based on ICT, artificial intelligence (AI), and big data technologies, all while minimizing resource and energy inefficiencies.

The Seoullo 7017 project is perhaps the most representative example of the city's recent efforts to improve dilapidated urban spaces. This project, in essence, was to renovate a highway overpass, constructed in the 1970s and approximately 1 km in length, into a pedestrian walkway. Completed in 2017, the new walkway now serves not only as a pedestrian-friendly throughway that connects walkers to 17 nearby neighbourhoods, but also as a much needed public space featuring rest areas, gardens, and even small cafes. Due to the densely packed nature of the neighbourhoods in the area, the popularity of the Seoullo 7017 pedestrian walkway has also had a noticeable effect in attracting a significant increase in visitors and foot traffic to surrounding areas, quickly reinvigorating the socioeconomic environment of previously run-down and dilapidated areas of the city. As a result, the Seoullo 7017 project is now counted as one of Seoul's major urban regeneration success stories, alongside more well-documented cases such as the Cheonggyecheon Stream Restoration project of the 2000s and the construction of the Dongdaemun Design Plaza of 2014.

Although there is a vast array of convenient public services based on ICT, AI, and big data in Seoul, there are several that stand out as particularly poignant case examples spanning a wide range of sectors. The world-renowned TOPIS, a major component of Seoul's intelligent transport service, is one such example in the transportation sector. TOPIS, the city's integrated transport operation and information platform, collects and analyses transportation-related big data from throughout the city round the clock so as to provide convenient services for Seoul's residents including bus operation information, arrival times, and traffic forecasting, among many other vital functions. Also, data collection and analysis functionalities from TOPIS, as well as its linkages to other major city management systems, allow it to serve as the city's integrated urban management hub, supporting continuous city monitoring, diagnostics, and scientific policy-making and implementation.

Seoul also actively integrates data analysis assets and frameworks into its service provision and public facility development planning. For instance, by utilizing transportation card usage data, the city has been able to analyse public transportation usage and movement patterns of the elderly and other vulnerable social groups. As a result, the city has been able to plan for the installation of more escalators and elevators, or prioritize physical improvements and routing optimization to make transfers easier and more accessible at

those stations most heavily used by the vulnerable. Seoul is also sparing no efforts to attempt to become one of the safest cities in the world. Begun in 2018, the Ansimi service is a prime example of this initiative. With women's safety as a particular focus, the service enables a user's mobile phone to automatically send location information to the user's family and the city's control centre when triggered in cases of emergency or distress. Once the control centre receives an alert, it can then monitor the relevant location through means such as networked CCTVs, and coordinate responses and the dispatch of personnel such as police officers. A number of other smart urban safety initiatives have also been implemented, such as the children's safety tracking service, the lone elderly home care service, and the city's intelligent fire prevention system.

Seoul is also endeavouring to share its rapid development history and experiences of smart city transformations with the global community. To that end, in late 2015 the Metropolitan Government established the Seoul Urban Solutions Agency (SUSA) in order to conduct knowledge exchanges, build global partnerships, mobilize resources, and provide policy advisory, consulting, and project implementation support for those cities around the world that can benefit from Seoul's knowledge and experiences. SUSA works to assess and understand the specific challenges and issues being faced by a particular partner city, and delivers tailored urban solutions packages in order to support the sustainable development of cities around the world. Through a wide partnership network consisting of public and private sector partners, both Korean and international, SUSA is able to connect and leverage a range of knowledge and resources in order to tackle the development challenges of partner cities. With these resources at its disposal, SUSA has already made a noticeable impact with overcoming the most urgent and pressing issues of cities around the world, such as Buenos Aires, Argentina; Kampala, Uganda; and Colombo, Sri Lanka.

One prime example of SUSA's close cooperation with partner cities can be found in Kiev, Ukraine, where work thus far includes consulting on night bus route optimization and the Kiev Smart City Master Plan. The night bus route optimization consulting was an initiative to benchmark Seoul's Night Owl Bus system and apply a similar big data analytics methodology to establish night bus operation routes in Kiev, while the Smart City Master Plan was an initiative to analyse and assess the strengths and shortcomings of Kiev to develop a customized smart city master plan for the city. These joint initiatives began with initial discussions on cooperation to improve transportation in Kiev at the Conference on Big Data organized by the World Bank Korea Office in 2016. Following these initial discussions, SUSA and its private sector partners co-developed a consulting project, utilizing funding from South Korea's National IT Promotion

Image: SUSA

Seoullo 7017, a former highway overpass converted to a pedestrian walkway to serve as a pleasant and lively urban space

Image: SUSA

Seoul's modern transportation ecosystem featuring the Bus Rapid Transit network

Agency to improve Kiev's transportation systems through the utilization of mobile data to establish night bus routes in the city. As part of the initiative, a study tour to Seoul was also organized for public officials from Ukraine with funding support from the World Bank Group. In 2018, following the success of this initiative, SUSA and Kiev established a transportation-focused smart city master plan for efficient urban diagnostics, smart city management, and much improved public decision-making processes based on benchmarking various advanced systems and platforms in Seoul, such as TOPIS. Based on these proven prior collaborations, SUSA and Kiev are currently planning more joint initiatives to complete Kiev's transformation into a smart city, and realize its visions and strategy for the future.

In addition to SUSA's work coordinating directly with a particular partner city, SUSA also works closely with various international development organizations to produce development knowledge that can benefit wider audiences. One example of this is SUSA's work with the World Bank Group, UNESCO, the University of Seoul, and Seoul Metropolitan Government in 2017 to co-produce the policy report, *Seoul's Experience in Cultural Heritage, Sustainable Tourism, and Urban Regeneration*. Throughout modern history, a number of factors such as war, natural disaster, and poorly planned urban development have all contributed to the deterioration of significant historic sites, cultural heritage sites, and traditions. Conversely, such cultural assets not only remind us of our history and cultural roots, but can be a tremendous, albeit sometimes overlooked, economic boon, as evidenced by the tourism sector's growing contribution to regional GDP as well as the various positive externalities associated with it, such as job creation, more inclusive growth, and poverty reduction. In this context, finding the balance between the preservation of history and culture with the need for growth, development, and modernization is a key policy challenge facing many developing cities.

It is against this backdrop that the case of Seoul can serve as a pertinent benchmark for other cities as, although Seoul is an ancient city with hundreds of years of history, much of this history has unfortunately been near irreversibly damaged following the Korean War. Thus, this collaborative project has resulted in the publication of a joint policy report that sets out to document and recount several case studies of the technical and operational best practices of Seoul's journey to preserve and restore heritage sites, regenerate dilapidated areas of the city, and promote sustainable tourism, so that it may assist practitioners strengthen their policy-making, planning, and implementation efforts in pursuit of balanced urban development, economic growth, and cultural preservation.

Ultimately, Seoul's recent transformation to one of the most advanced metropolises in the world was possible only due to the sustained support and knowledge exchanges from developed cities elsewhere. Indeed, Seoul and South Korea have been one of the very few success stories of an aid-recipient that has been able to become an aid-donor. Based on this transformative experience, SUSA and Seoul remain dedicated to becoming a trusted urban solutions provider and partner in order to support other cities around the world to develop in a sustainable manner and improve global quality of life.

Building resilience in Mexico City

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Throughout its history, Mexico City has suffered the impact of various kinds of disaster, such as flooding, landslides, and especially earthquakes, the latter producing the highest rate of recorded fatalities in the city[2].

According to a report by the United Nations Office for the Coordination of Humanitarian Affairs, 153 people died in the earthquake that took place on 19 September 2017, with a magnitude of 7.1 Richter degrees. On that occasion, the earthquake response protocols were quickly activated, the degree of destruction urged the mobilization and assistance of international search and rescue teams, and emergency status was declared in 16 municipalities of Mexico City. In all, 52 people were rescued, 1,929 were assisted and 2,500 were placed in sheltered accommodation. In terms of infrastructure, four hospitals were affected, 38 buildings collapsed, and it was estimated that 500 to 600 damaged buildings required structural revision.

The priorities established by Mexico's president at that moment were: to search for and rescue people trapped in collapsed buildings; give medical attention to affected and injured people; facilitate support for people in damaged buildings through providing sheltered accommodation; deliver food supplies; re-establish public services; assess infrastructure damage for rehabilitation and reconstruction; demolish buildings with permanent damage; and remove disaster rubble.

Since this event, more measures in risk management and civil defence have been taken in order to make Mexico City less vulnerable in the face of this natural phenomenon. To fully understand this, some concepts first need definition.

Risk management is the analytical framework of reference of public policies and it outlines steps that can be analysed as follows:

Image: Luis Cardel

Disaster responses to the earthquake on 19 September 2017, which struck with a magnitude of 7.1 Richter degrees

- Know the multifactorial causes that provoke risks (identification). Once analysed, the plans and programmes to reduce risks and gain permanent control (forecasting, prevention, mitigation) should be applied in order to avoid major disaster
- Provide help to the population (assistance) as well be able to reverse the process of social construction of risk, and also avoid new risks that could emerge (rehabilitation and reconstruction)
- Strengthen the capacity of the government and civil society by means of action that encourages resilience.

The Sendai Framework for Disaster Risk Reduction 2015–2030 represents the next step of the Hyogo framework 2005–2015 to give continuity to global actions in favour of risk management. The United Nations Office for Disaster Risk Reduction defines resilience as the capacity of every system, community or society facing a threat, to resist, absorb, adapt and recover from the negative effects in a quick and efficient way, considering the prevention and restoration of their structures' basic functions.

The international community has agreed to make efforts in favour of resilience projects. In 2019, as a part of the United Nations, Mexico presented to the Chamber of Deputies the National Plan of Development (2019–2024) that includes the public policies of the present administration in which the main lines of action are focused on three points:

- Justice and rule of law, referring to disaster prevention in which the main objective is to build a more resilient, sustainable and safe country
- Well-being, where territorial regulation is very important for the construction of resilience
- Economic development, related to integral risk management in the federal, state and municipal levels of government.

On the basis of international and national commitment, the Civil Defence Secretariat of Mexico City has included integral risk management and resilience as a part of its attributions and responsibilities. It is estimated that the possible saving made for each US$ 1 invested in disaster prevention responses is US$ 5.[3] The main goal of the new Civil Defence and Risk Management Secretariat of Mexico City is to reduce and control the risks of natural disasters through the coordination of policies and actions taken out among the different orders of government, involving participation by the private and public sectors, and establishing the corresponding principles and criteria of the Integral Risk Management and Resilience Plan.

Image: Luis Cardel

Mexico City has decided to create a policy that visualizes the ecosystems as huge advantages to resilience, with unique and synergetic properties that include flood mitigation and assisting in adaptation to climate change and its multiple consequences

Another fundamental purpose is to work with policies that include a transversal approach to planning and participation, taking into account the knowledge of risk, so that major risks can be avoided as a result of a best and improved response.

After the 2017 earthquake, various measures were taken by the Secretariat including the establishment of two specific projects.

The Seismic Resilience Project

This project focuses on strengthening Mexico City's resilience and preparedness against future seismic movements. In 2019 specifically, the Secretariat has put forward efforts to reduce the city's housing infrastructure vulnerability and strengthen the city's buildings to better endure future seismic movements. This effort has three main objectives: to identify and prioritize the buildings that, based on their structural characteristics, would be most vulnerable to future seismic movements and thus need attention; to define a critical route to inspect and intervene in the totality of vulnerable buildings; and to ascertain the resources and timeline required to improve Mexico City's housing infrastructure resilience. This project was made with the help of a management consultant company on the basis of contributing to solving the city's problems and satisfying the policy of involving the private sector in public projects.

The Seismic Emergency Plan

This project involves the participation of several groups in various workshops with government institutions such as, among others, Citizen Security Secretariat, Digital Public Innovation Agency, Heroic Firefighters Department, Medical Emergency and Rescue Squad, and Ministry of the Navy. The main objective of these workshops was to define the zones of major risk in the city in order to make a more efficient response during an emergency, helped by the regionalization of areas. The project is in its final phase before release.

Other programmes

A Programme of Risk Prevention Committees by Quadrant has also been established, with the main objective of encouraging the public to work together with the authorities to create an institutional infrastructure for risk management — improving territorial resilience through participatory governance, with the use of a Participative Risk Atlas. The Quadrant is the basis of a major programme initiated by Mexico City's government in 2019, that divides the city into quadrants in order to establish more efficient coordination, not only for this programme but for all institutions that need to improve their organization, considering Mexico City's population of 9 million.

Image: Luis Cardel

Evidence of structural damage caused by the earthquake on 19 September 2017, in which 153 people died

Concurrently, a volunteer network is planned for 2019, in which the Secretariat will train an estimated 10,000 volunteers in risk management, civil defence and resilience, in order to reinforce the response capacity of the city.

The new General Direction of Resilience, brought into operation under the Secretariat, has a long-term focus on inclusive and sustainable development, social well-being, and common interests. It is set up to support and coordinate actions in innovative projects for building resilience, resulting in a fair and inclusive society through the integration of various sectors — academia, civil society, private enterprise and government — that promote a more adaptive transformation to face the social, economic and environmental challenges now and in the future. Projects currently planned are:

- The establishment of a resilience council that works as a consultative body to aid the promotion of resilience on the basis of a territorial and inclusive approach, parallel to the objectives of sustainable development, the 2030 Agenda, the Sendai framework for risk reduction and the New Urban Agenda. The council would be set up to create and integrate mechanisms for innovative projects
- Adaptation based on social ecosystems considering, as with all large cities, that Mexico City faces huge social and environmental challenges. One of the proposals is the conservation of the nature reserve, which covers about 60 per cent of the land. This area is not only the basis of the original ecosystems in Mexico City's watershed, with its biodiversity and endemic species, but it also has multiple environmental benefits such as water recharging from the aquifer, regulation of the local climate, and mitigation of pollution in urban areas. It has therefore been decided to create a policy that visualizes the ecosystems as huge advantages to resilience, with unique and synergetic properties that include flood mitigation and assisting in adaptation to climate change and its multiple consequences
- The organization and realization of the First International Congress of Integral Risk Management and Resilience in Mexico City, which will focus on the theme of cities, in order to promote the actions necessary to encourage and increase resilience in the communities and to share and exchange relevant experiences.

Natural disasters have affected Mexico City in the past and it's unknown when they are going to happen again, Seismic events, especially, will recur and could even become more critical. The city is conscious of the magnitude of the problem and understands that it cannot work alone and with a separation of authorities from society. The Mexico City government is aware of the compromises necessary to make a less vulnerable metropolis. Taking examples from around the world, where participative projects have been initiated, the most important lesson is that working together with the community can create a more prepared, organized and therefore a more resilient city.

Image: Luis Cardel

Mexico City is located in the Valley of Mexico, on the Trans-Mexican Volcanic Belt in the high plateaus of south-central Mexico[4]

Linking social and economic development with disaster resilience to enhance evidence-based decision-making in Guatemala

Damon Coppola, Senior Disaster Management Specialist; Cassie Stelow, NDPBA Program Manager; Dr. Joseph Green, Epidemiologist and Health Risk Specialist; Dr. Erin Hughey, Director of Global Operations, Pacific Disaster Center

Increasing recognition of the link between disasters and development has given rise to a common understanding that sustainable development gains cannot occur without investment in disaster resilience. It is likewise understood that social and economic development are predictive of resilience. In a recent effort to accurately gauge disaster resilience at national and subnational levels, Guatemala has successfully incorporated a broad array of development indicators into the risk assessment process.

Explicit references to an inherent relationship between disaster vulnerability and development progress appear in both the 2030 Agenda for Sustainable Development (2030 Agenda) and the Sendai Framework for Disaster Risk Reduction (Sendai Framework). The ever-expanding body of literature supports their inclusion while suggesting a need for more effective integration of policy goals in the Development and disaster risk reduction (DRR) communities. The dominant perspective has often been too concentrated on just one side of the issue, namely the influence of dramatic, persistent, and increasing hazard risk on nations' social and economic development. A predisposition to the availability heuristic — the result of an unrelenting stream of graphic disaster imagery and information — feeds this bias. Such partialities, inherent or otherwise, may cause practitioners to overlook or discount conditions where poor or stagnant development is equally to blame for having laid the groundwork for more frequent and severe disasters, long before they strike.

Guatemala is a country where the link between disasters and development is particularly evident. The Central American nation's geography and climate are complementary sources of a complex hazard exposure profile that includes volcanic eruptions, floods, cyclones, landslides, and earthquakes. This diverse portfolio has, by several accounts, positioned Guatemala among the world's top 10 countries most frequently impacted by disasters. The nation's compact size and the broad-reaching destructive impacts of its hazards have resulted in a series of disaster-driven economic shocks that have often topped 2 per cent of GDP and even exceeded 20 per cent following a particularly strong earthquake (1976). High disaster costs — measured in the damage and destruction to infrastructure, schools, hospitals, homes, and businesses and disruptions to social and other services from which they are derived — have slowed the nation's progress towards meeting its Millennium Development Goals as it did in the case of the Sustainable Development Goals that succeeded them.

But a similar phenomenon is true elsewhere. Guatemala's disaster-development relationship is reciprocal, and recognition that persistent and multidimensional economic distress was a principle vulnerability driver in past disasters (and would continue to be so without a drastic change in course) has grown considerably. In addition to a poverty rate that included over 60 per cent of the population, Guatemala was also affected by poor, or in some places non-existent access to information technology, high gender inequality, a constant presence of political upheaval, and several other significant factors. These development challenges together suggested that disaster impacts would be even larger and more damaging for the country than might be exhibited in more developed and therefore resilient locations.

A methodical and thorough examination of Guatemala's complex risk basis was needed to interrupt the cycles of vulnerability and disaster impact that had plagued the country for decades. In May of 2016, Pacific Disaster Center (PDC), an applied research center at the University of Hawaii, and the Guatemala National Coordinating Agency for Disaster Reduction (CONRED) established a formal partnership to conduct a joint countrywide disaster preparedness

PDC case study: improving access to education

A review of vulnerability data revealed a disparity between primary school enrolment and the average number of years of schooling in Guatemala. Access to secondary education appeared to be limited, leading stakeholders to prioritize investment in school infrastructure. Through the NDPBA, which examined risk assessment data through a multidisciplinary lens, it was discovered that secondary school-aged boys were frequently pulled out of school to assist with family agricultural practices. The NDPBA recommended an alternate approach wherein investment focused on improving irrigation methods and increasing farmers' access to new technologies, thereby allowing boys to remain in school. Improvement in this development indicator (average years of schooling) correlates closely with reduced disaster vulnerability and improved recovery and reconstruction outcomes.

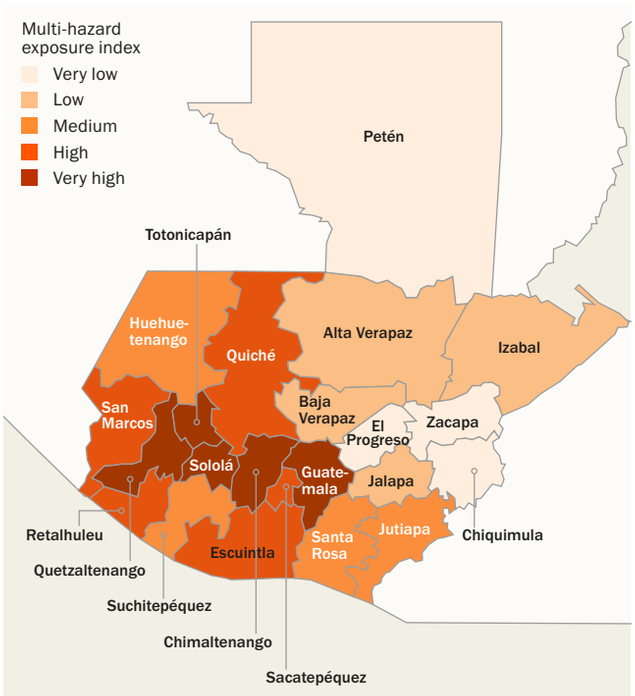
Image: Pacific Disaster Center

Guatemala's national disaster management organization, CONRED, along with the country's national civil defence agency view risk and vulnerability assessment results using PDC's DisasterAWARE platform during the final workshop of the NDPBA assessment

assessment. PDC's National Disaster Preparedness Baseline Assessment (NDPBA) methodology was utilized, taking a holistic approach to the evaluation of risk and resilience at departmental (provincial) level.

The NDPBA methodology is notable in that it is designed to identify, capture, and quantify development factors that exhibit a direct and significant correlation with risk or resilience outcomes. The programme supports stakeholders' efforts to identify and understand the relationship between economic and social development indicators and the frequency and severity of disaster outcomes. It is understandably more difficult to capture how a development gap, such as a low adult literacy rate, might have led to more severe disaster outcomes, than it is to connect a direct disaster's impact, like that of a hospital's collapse, to the achievement of health-related development goals. To address this challenge, NDPBA leverages technical experts with working knowledge of current development and disaster research. Together with in-country partners these issues are examined to help provide context and understanding to difficult questions related to development and disaster outcomes.

Over the course of 12 months, a multidisciplinary team worked to better understand Guatemala's broad development and disaster management domains. Collaborative stakeholder information and data exchanges occurred in

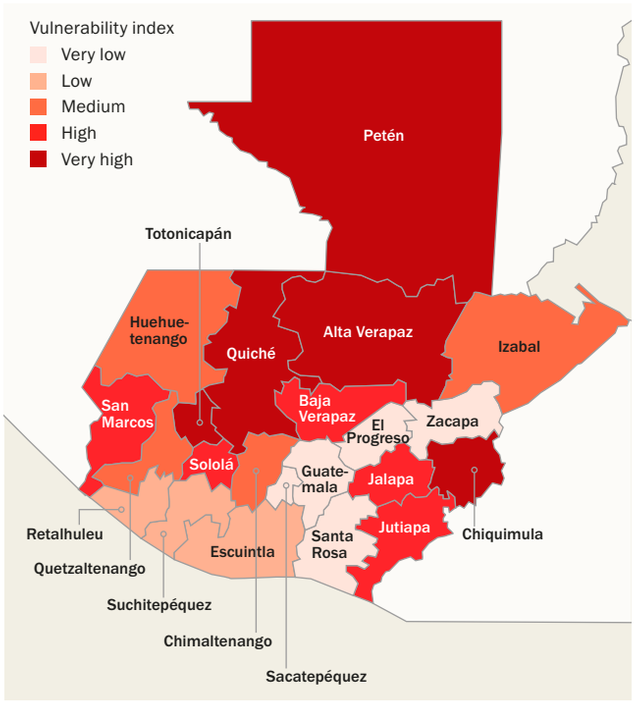


Distribution of multi-hazard exposure index scores across departments with relative ranking of each department

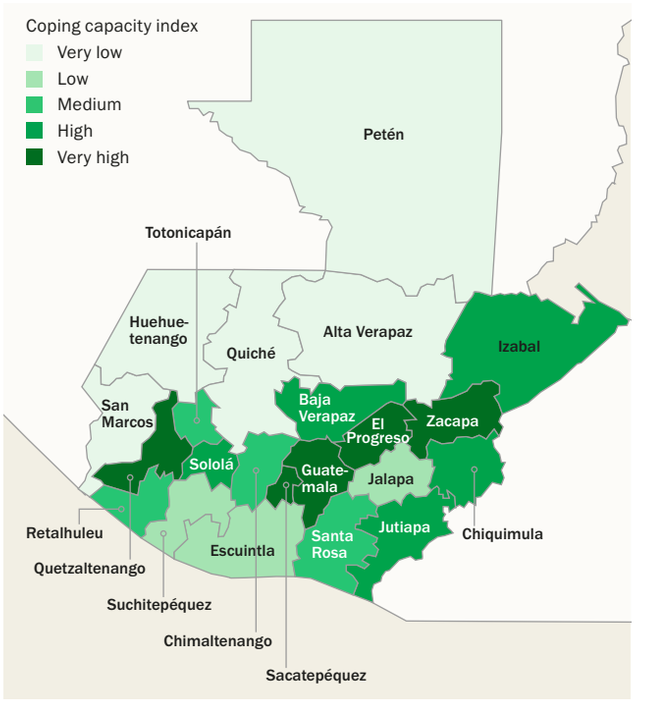
both group and individual settings, co-facilitated by PDC and CONRED staff. Using the standardized NDPBA methodology, partners from the national, subnational, and local governments, as well as the non-governmental organization, academic and international community, mapped exposure to the country's major hazards and identified over 40 development-related indicators that were correlated with either an increase or decrease in disaster resilience for those hazard types. These factors were categorized as either risk-increasing elements of vulnerability, or risk-reducing elements of coping capacity. Taken together, the data and information provided a comprehensive measure of relative resilience. By factoring multi-hazard exposure into the equation, a multi-hazard measure of risk was achieved.

Stakeholders identified five hazards with significant influence on the country's risk profile for inclusion. Exposure maps, which accounted for people, property, systems, and other elements present in hazard zones subject to potential losses, were developed both individually for specific hazards and together across all five. Magnitude thresholds

Population pressures	Gender inequality	Access to information	Vulnerable health status	Economic constraints	Access to clean water	Environmental stress
5-year avg. annual population change 5-year avg. annual urban population change Prevalence of food insecurity	Female to male labour ratio Female to male education enrolment Proportion of female seats in parliament	Adult illiteracy rates Average years of schooling Primary school enrolment Households without internet, television, radio Gross enrolment in education	Infant mortality rate Maternal mortality rate Life expectancy Prevalence undernourished Percentage of disabled Prevalence of dengue and malaria TB incidence	Economic inequality Poverty Age dependency ratio	Households with piped water Households with sanitation	Change in forest area Drought



Above and left: Guatemala NDPBA vulnerability assessment themes and distribution of vulnerability index scores across departments



Below and right: Guatemala NDPBA coping capacity assessment themes and distribution of coping capacity index scores across departments

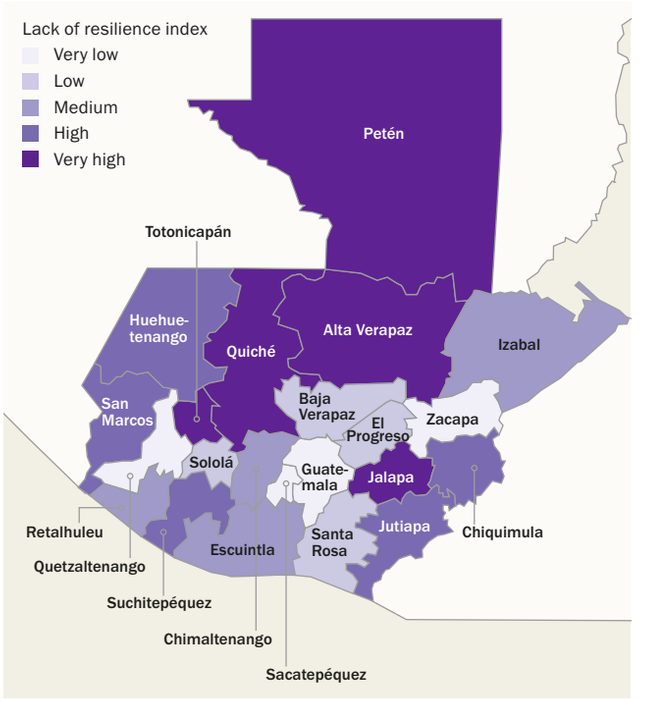
Environmental capacity	Economic capacity	Governance	— Infrastructure — Health care capacity	— Infrastructure — Communications capacity	— Infrastructure — Transportation capacity
Reforested areas Percentage of protected areas	Remittance per capita GDP per capita Business per capita	Citizen participation Household garbage collection services Crime rate	Hospital beds per 10,000 persons Nurses/physicians per 10,000 persons Vaccination coverage	Households with fixed telephone access Households with mobile telephone access Access to electricity	Port and airport density Road and railway density

were established for each hazard to accurately depict where disasters were most likely to occur. The analysis confirmed that seismic activity and tropical cyclone winds were the most significant source of Guatemala's hazard exposure, affecting over 98 per cent and 75 per cent of the population respectively. Smaller proportions of the population are also exposed to volcanic activity (45 per cent), flooding (11.5 per cent), and landslides (8.5 per cent).

Analysis of Guatemala's vulnerability identified 25 key contributing factors, which were grouped into seven assessment themes. These included: environmental stress; vulnerable health status; clean water vulnerability; access to information; economic constraints; gender inequality; and population pressures.

The assessment enabled a comparison of vulnerability across all 22 departments, both for individual factors and as a collective measure. Alta Verapaz department was found to have the highest total vulnerability and ranked highest on several individual measures of vulnerability, including information access, clean water, and population pressure. Totonicapán was ranked second in terms of risk, and Petèn third.

Development gains that result in the reduction of vulnerability, and by extension, risk, are also identified and incorporated into the NDPBA. Collectively termed "coping capacity," such factors are grouped into six themes that include: environmental



Distribution of resilience index scores across departments, and relative ranking of each department by resilience score

Department	Multi-hazard risk	Multi-hazard exposure	Vulnerability	Coping capacity	Department risk level
Quiché	1	9	4	20	Very High
Totonicapán	2	5	2	11	Very High
Chimaltenango	3	2	13	14	Very High
Alta Verapaz	4	18	1	21	Very High
San Marcos	5	10	8	18	High
Escuintla	6	7	17	16	High
Sololá	7	3	10	6	High
Guatemala	8	1	22	5	High
Retalhuleu	9	8	18	12	High
Huehuetenango	10	12	11	19	Moderate
Suchitepéquez	11	11	15	15	Moderate
Jalapa	12	17	6	17	Moderate
Jutiapa	13	13	7	9	Moderate
Quetzaltenango	14	4	14	1	Low
Izabal	15	16	12	10	Low
Santa Rosa	16	14	19	13	Low
Baja Verapaz	17	15	9	7	Low
Sacatepéquez	18	6	21	2	Low
Chiquimula	19	20	5	8	Very Low
Petén	20	22	3	22	Very Low
El Progreso	21	19	16	4	Very Low
Zacapa	22	21	20	3	Very Low

Guatemala Multi-Hazard Risk (MHR) Index scores and component indices

capacity; governance; economic capacity; health-care capacity; communications capacity; and transportation capacity. Several indicators are highly correlated with disaster resilience even where direct or obvious links to disaster risk management are not present. For instance, measures of low crime victimization and availability of household refuse collection are often linked to effective response planning and more effective public safety capabilities. Increased economic capacity is also correlated to resilience measures, including the ability to absorb immediate economic impacts and mobilize more comprehensive response and recovery services.

Assessment of coping capacities in Guatemala identified three departments with the greatest deficiencies. However, what is most valuable to development and disaster risk reduction planners alike are the derivations of these three outcomes. Again, Petén was ranked among the top three departments according to how the assessment score contributes to risk. In that case, poor governance and weak infrastructure impacted outcomes most profoundly. Huehuetenango ranked second, on account of poor economic capacity. And finally, Alta Verapaz was given third ranking due to its combination of weak infrastructure and economic challenges.

Department-level resilience is derived in the NDPBA by combining vulnerability and coping capacity scores. This measure provides a more comprehensive understanding of how each department will likely fare if presented with a future disaster event. Resilience is, however, hazard-independent and can therefore be utilized for additional hazards not accounted for in the initial NDPBA assessment. Resilience alone does not account for the likelihood of disaster events. The inclusion of exposure data is required for use in prioritization of risk-informed decision-making wherein allocations of limited resources is necessary.

The analysis provides a measure of multi-hazard risk, which is derived when vulnerability, coping capacity, and multi-hazard exposure are combined. The product of this calculation represents a powerful tool to both development and disaster risk reduction practitioners in that it supports the comparison of risk intensity across the country's geographic regions. It also allows for greater insight into the influence posed by the many individual risk contributors. Focused interventions will require such details given the certainty of budgetary constraints and capacity limitations. For instance, although Petén was ranked highest for its vulnerability, and lowest for its coping capacity and resilience, the fact that it has almost no exposure to the five hazards considered to be most likely to affect Guatemala, its multi-hazard risk ranking is among the three lowest.

Rarely will a single intervention address all aspects of risk across each of a nation's regions, and the NDPBA is designed to assist in the prioritization of the most effective solutions to meet location-defined requirements. For Guatemala, understanding that 98 per cent of households in Alta Verapaz have no internet access and fewer than 50 per cent have television access revealed a significant barrier to the transmission of preparedness information, event notification, and the issue of warnings. Petén, on the other hand, was recognized as having much wider information-access but experienced greater gender inequality. Such knowledge enables practitioners to focus interventions in a way that is cognizant of the need for gender-based access to resources. Through the completion of the NDPBA, Guatemala was able to gain clarity regarding the complex relationship between social and economic development. This knowledge promoted more efficient resource allocation and greatly supported the decision-making capabilities of national and subnational development and DRR stakeholders.

Alta Verapaz — highest vulnerability (1 of 22 departments)	
Information access vulnerability Very High (Rank: 1 of 22) **Clean watrer vulnerability** Very High (Rank: 1 of 22) **Population pressures** Very High (Rank: 1 of 22)	Investments in infrastructure, especially telecommunications and water, will increase the population's ability to respond to and recover from disaster, reducing vulnerability

Totonicapán — second highest vulnerability (2 of 22 departments)	
Information access vulnerability Very High (Rank: 3 of 17) **Population pressures** Very High (Rank: 3 of 17) **Economic constraints** Very High (Rank: 4 of 17)	Investments in communication infrastructure such as cell towers, internet and television will provide access to disaster information and education

Petén — third highest vulnerability (3 of 22 departments)	
Population pressures Very High (Rank: 2 of 22) **Clean water vulnerability** Very High (Rank: 3 of 22) **Gender inequality** Very High (Rank: 4 of 22)	Investments in water and sewerage infrastructure, and a focus on policies to control / support population changes, will decrease the department's vulnerability in the event of a disaster

Examples of department-level vulnerability drivers in Guatemala

Sino-Singapore Tianjin Eco-City — a model for sustainable urbanization

Sino-Singapore Tianjin Eco-City Investment and Development Co., Ltd. (SSTEC)

Across the Rainbow Bridge, 45 km from the city centre of Tianjin municipality in northern China, is an eco-city with well-designed green homes, thriving industries, lush greenery and clear waterways, where a growing population of people live, work, play and learn in harmony.

Image: SSTEC

This is the Sino-Singapore Tianjin Eco-City (Eco-City), a flagship government-to-government project between Singapore and China that was launched in 2008. Over the past decade, through eco-smart urban planning concepts and technologies, the formerly barren plot of saline-alkaline wasteland has been transformed into a resource-efficient, ecologically friendly, economically sustainable and socially harmonious city.

Collaboration between Singapore and China to develop a model for sustainable urbanization

According to projections by the Population Division of the United Nations Department of Economic and Social Affairs, the world's urban population is expected to grow by another 2.5 billion by 2050, with close to 90 per cent of the increase taking place in Asia and Africa.[1] China, in particular, is experiencing urbanization at an unprecedented pace, with its urban population expected to reach 1 billion by 2030 based on the current growth rate.[2]

Image: SSTEC

The Sino-Singapore Tianjin Eco-City's transformation from a saline-alkaline wasteland (pictured top) to a thriving eco-city over the past decade has seen it become a leading model for sustainable urbanization

Sino-Singapore Tianjin Eco-City's 26 KPIs

Healthy ecological environment		Social harmony and progress		Dynamic and efficient economy
100% potable water	Zero loss of natural wetlands	≥ 60% recycling rate	100% barrier-free access	≥ 20% renewable energy utilization
Carbon emission/unit GDP, 150 ton-C/US$ 1 million	Noise levels 100% meet environmental noise standards in urban areas	≤ 120 l water consumption/ person/day	≤ 0.8kg domestic waste generation/person/day	≥ 50 R&D scientists and engineers /10,000 labour force
Grade II ambient air quality	Grade IV water standards	≥20% public housing	Free recreation and sports amenities within 500 m	≥ 50% non-traditional water source
≥ 70% native vegetation	≥ 12 sqm/person in public green space	100% non-toxic waste treatment	100% services network connectivity	≥ 50% employment-housing equilibrium index
100% green buildings		≥ 90% green trips		

Integrated regional cooperation
Promote a safe and healthy ecology to encourage green consumption and low carbon operations
Adopt innovative policies to ensure the improvement of surrounding areas
Preserve history and culture to give prominence to the river estuarine cultural character
Promote regional development through sound economic and administrative policies

Urbanization in China has been driven by the desire for economic development, better employment opportunities and an improved quality of life. However, urbanization is often accompanied by rapid industrialization, leading to the increased use of natural resources, growing energy consumption, reliance on fossil fuels and a rise in greenhouse gas emissions. The resulting damage to the environment can affect the health and quality of life of the urban population.

It was against the backdrop of rising concerns over the effects of global climate change, and the environmental, social and economic costs of rapid and large-scale urbanization in China, that then Chinese Premier Wen Jiabao accepted a proposal by then Singapore Senior Minister Goh Chok Tong in April 2007 for Singapore and China to collaborate on an eco-city project that would serve as a model for sustainable urbanization in China. The Tianjin site was chosen from four candidate sites after considering its non-arable land conditions, lack of water resources, surrounding infrastructure, ease of accessibility and commercial viability.[3] On 18 November 2007, Singapore and China signed a framework agreement which made the Eco-City the first in the world to be jointly developed by two countries.

Strong structural foundations to support sustainable development

The challenge faced by the multidisciplinary team tasked to transform the large plot of non-arable land, salt farms and polluted water bodies in Tianjin into a sustainable eco-city was a complex one. It required the institutionalization of discussion and coordination mechanisms at macro, working and operational levels to facilitate consensus between both countries on all aspects of the project. The Tianjin Eco-City Administrative Committee (ECAC) was designated as the local authority responsible for all government administrative functions within the Eco-City.[4]

The Sino-Singapore Tianjin Eco-City Investment and Development Co., Ltd. (SSTEC) — a 50–50 joint venture between the private sectors of the two countries, with the Singapore Consortium led by the Keppel Group and the Chinese Consortium led by Tianjin TEDA Investment Holding Co., Ltd. — was established to serve as the master developer, and work closely with ECAC to develop infrastructure and residential, industrial and commercial properties within the 30 km^2 Eco-City.

To formulate a robust structural framework to guide the Eco-City's planning and development, experts from both countries shared their knowledge and experience in urban planning and sustainable development, covering areas such as environmental protection, resource conservation and water and waste management. Based on these insights, the governments of both countries jointly formulated a comprehensive set of 26 quantitative and qualitative key performance indicators (KPIs) covering various aspects of social, economic and environmental development, and a holistic masterplan to guide the Eco-City's development.

Underpinning the KPIs and the masterplan were key guiding principles in the form of the "Three Harmonies", namely, harmony between people and the environment; harmony between people and the economy; and harmony among people. These were coupled with the "Three Abilities", which envisions the Eco-City as a practicable, replicable and scalable model of sustainable urbanization for other cities in China and beyond.

Urban sustainability initiatives in the Eco-City

With a firm foundation in place, initiatives were launched to drive the Eco-City's sustainable growth and development, through optimising the use of limited resources and creating a clean and pleasant urban environment.

Maximising land use through a compact urban layout

To give full play to a compact urban layout that would facilitate intensive and efficient use of land resources, a three-tiered land use planning concept was implemented, comprising Eco-Cells (basic 400 m x 400 m building blocks), Eco-Communities (made up of four Eco-Cells), and Eco-Districts (made up of several Eco-Communities). Each Eco-Community was equipped with a neighbourhood centre and free recreational facilities, while each Eco-District was equipped with integrated residential, commercial and industrial spaces, to meet a variety of needs within a walkable distance.

Meeting water supply needs through the efficient use of water resources

To overcome environmental constraints, both traditional and nontraditional sources of water were tapped to meet the Eco-City's long-term water supply needs. To achieve the KPI of 50 per cent nontraditional water utilization, a comprehensive water management system was set up to treat wastewater, recycle water, collect rainwater and desalinate seawater. This entailed the rehabilitation of a large, highly toxic sewage pond now known as the Jing Lake, and the establishment of a water reclamation centre to produce 21,000 m^3 per day of recycled water (with future expansion capacity of 42,000 m^3 per day) for non-potable applications such as landscaping, cleaning and construction needs. To achieve the KPI of 100 per cent potable water, a regular water quality monitoring mechanism was established to conduct real-time checks on the quality of water from source to tap.

Conserving energy and resources through 100 per cent eco-friendly buildings

All buildings in the Eco-City were designed to comply with the Green Building Evaluation Standard (GBES) developed by experts from Singapore and China, which has stringent environmental criteria that require buildings to conserve land, energy, water and materials, and develop green indoor and outdoor environments. The eco-friendly buildings are best exemplified by the Low Carbon Living Lab in the Eco-Business Park.

Low Carbon Living Lab

The Low Carbon Living Lab (LCLL) is a high-quality office building built by SSTEC with the strong support of ECAC, Singapore's Ministry of National Development, the Building and Construction Authority (BCA) of Singapore and the former International Enterprise (IE) Singapore. Since commencing operations in 2013, the LCLL has been awarded the Singapore Green Mark Platinum Award, the China Green Building Design and Operation Label 3-Star Awards, and the GBES Platinum Award.

Based on a climate and environment oriented design, the LCLL embodies the successful integration of environmental, eco-technological and social principles. Passive design features to control temperature and enhance natural ventilation and lighting, utilization of solar, geothermal and wind energy, and green operations and facilities management have all enabled the LCLL to substantially reduce its energy consumption and carbon emissions.

Compared to similar office buildings in Tianjin, the LCLL's annual energy consumption is 30 per cent lower, equivalent to 171 tons of coal and 427 tons of carbon dioxide. Through installing a water consumption monitoring system, rooftop rainwater harvesting and utilization systems and water savings fittings, the LCLL has also achieved 50 per cent nontraditional water use. 30 per cent of materials used to construct the LCLL is recyclable, three times that of GBES requirements.

Climate-Oriented Design
Optimal building shape, size and orientation
Minimal northern facade openings
Maximum glass and windows on southern facade
Natural air flow

Experience natural daylighting
Large skylights and windows in the southern facade and solar pipes at the basement car park
Sun shading devices and light-shelves

High performance envelope
Double/triple glazed, dual silver layered, low-E coated glass filled with argon
Double-skin vertical green facade

Energy efficient M&E services and renewable energy systems
Exhaust heat recovery system
Renewable energy systems

Intelligent building management system
Building automation system
Energy management system and energy wall

Green building operation
Green facilities management teams
Green building operation guideline

Air purification technologies
High efficiency air filter
CO_2 sensors

Vertical greenery systems
Green roof
Indoor garden and green wall

Water-saving measures
Efficient water-saving sanitary fixtures
Rain water harvesting and reuse
Use of non-traditional water
Water usage monitoring

Use of environmentally friendly materials
Steel structure
Extensive use of construction recyclables

Source: SSTEC

Image: SSTEC

Residents enjoying nature up-close at Huifeng Creek, one of many scenic attractions located within walking distance of the Eco-City's residential communities

Image: SSTEC

Residents have actively contributed to the Eco-City's environmental protection efforts by using the smart waste collection platforms that are conveniently located around the neighbourhood

Ensuring a good quality of life through a healthy ecological environment

Extensive green (vegetation) and blue (water) networks were woven into the Eco-City's urban fabric, to achieve the KPI of preserving at least 70 per cent of native vegetation and with zero loss of natural wetlands. Plentiful accessible green spaces, such as the Eco-Valley that runs through the entire city, enabled improvements in air quality, the reduction of urban heat and noise, and the promotion of healthy and active lifestyles. The Eco-City's three main water bodies — the Ji Canal, Old Ji Canal and Jing Lake — were also linked to facilitate waterfront developments and water-based recreational activities to enrich residents' lives.

Reducing environmental damage through green transportation and renewable energy

To reduce greenhouse gas emissions released through the combustion of fossil fuels, green modes of transportation were prioritized in the Eco-City's urban plan. A comprehensive public transport network serviced by low-emission buses was put in place, as were dedicated pathways to encourage the use of non-motorized modes of transport such as cycling and walking, to meet the KPI of having 90 per cent of trips completed via green transportation. The integrated use of green and renewable energy sources such as solar energy, geothermal energy and wind energy further lowered the reliance on fossil fuels and contributed to the reduction of the Eco-City's carbon footprint.

Protecting the environment through waste management and recycling

An efficient waste management and recycling system was introduced to protect the environment in the Eco-City. To achieve the KPI of a recycling rate of at least 60 per cent, an initiative was launched to encourage residents to sort

Image: SSTEC

Solar-powered bus stops around the Eco-City are equipped with smart functions such as the provision of Wi-Fi access, news updates and real-time information on bus arrivals, enabling residents to make the most of their daily commutes

domestic waste and deposit recyclable waste at smart waste collection platforms in their neighbourhoods, in exchange for credits that could be redeemed in exchange for daily necessities at shops. To minimize wastage of resources, both the recyclable and non-recyclable waste were collected and further sorted before being reused for other purposes such as organic fertilizers and electricity generation.

Creating a smart and sustainable future

Ten years on, the Eco-City has triumphed over its harsh environmental conditions to blossom into a vibrant, innovative and sustainable city. An unwavering commitment to its founding vision and principles, the coordinated and tenacious efforts by all parties involved, and an enterprising approach to green development were integral to the progress made.

The Eco-City is being increasingly regarded as a leading model for sustainable urbanization. Recent domestic and international accolades suggest that other cities in the region may now seek to learn from its developmental experiences. The Eco-City was selected as the happiest eco-city in China in 2018 in an annual survey conducted by Xinhua News Agency's Oriental Outlook Magazine and Liaowang Institute. Its Southern District overcame competition from top district projects worldwide to be awarded the Sustainable City Grand Prize at the Green Solutions Awards 2018, which was held in conjunction with the Buildings Day of the 24th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP24). Notably, Singapore and China signed an agreement in September 2018 to replicate the Eco-City's development model in Chinese cities as well as in other Belt and Road regions.

Despite significant progress made over the past decade, the Eco-City is constantly reinventing itself and striving to remain at the forefront of sustainable urbanization, by regularly refreshing its KPIs, updating its masterplan and trialing the latest eco-smart solutions to enable more sustainable and sophisticated lifestyles. A Public Utilities Operations and Maintenance Centre integrates big data across key municipal services to enable efficient organization of limited resources. In addition, renewable energy-powered smart lamp posts and bus stops are both equipped with smart functions to support municipal operations. These are among a slew of smart initiatives which are now being implemented to drive the Eco-City's transformation into an eco-smart city.

The future is filled with exciting possibilities for the next phase of the Eco-City's development, while it continues to be a leading reference for other cities and communities worldwide that are treading a common path of sustainable urbanization.

Ensuring the sustainability, inclusiveness and resilience of Australia's cities

Cameron Ross, National Manager, Communications, Planning Institute Australia

In terms of both population and land area, nowhere is the accelerating growth of the world's cities more visible than in Australia. Close to 90 per cent of Australians live in cities, with the two largest, Sydney and Melbourne, covering an area of approximately 10 times that of New York City. And, despite government efforts to direct population growth towards smaller regional centres, Australia's large urban centres continue to grow strongly. By 2050, Greater Sydney and Melbourne will be approaching megacity status, with populations of around eight million each.

To the uninitiated, Australia might appear to be a country with almost unlimited room for growth and expansion. However, there are constraints to the country's "carrying capacity". For the most part, the topsoils are thin and deficient in phosphorous and trace elements. Rainfall is low and unreliable, and much of the inland area is arid and incapable of supporting sizable human settlements.

An estimated 80 per cent of Australians live within 50 km of the coastline; but here the impacts of rapid urban growth and other megatrends are becoming more pronounced and severe. When Australian central governments embraced high immigration policies in the optimism-filled post-war years, there was little appreciation of, or indeed curiosity about the consequences of continued urban sprawl. Australia was not unique in that respect; many developing countries around the world framed their future goals in terms of manifest destiny, embracing a readiness to alter the natural environment to fit those goals. However, the consequences of untrammelled urban growth — congestion, environmental degradation, housing affordability, and infrastructure pressures, among others — have become too great to ignore, even in a relatively prosperous country.

The advent of global megatrends such as climate change have added urgency to calls for more sustainable urban growth models. Because Australia has always been prone to droughts, bushfires and cyclones, local councils have been exemplars in embedding disaster resilience and sustainability into their growth strategies — more so than state, territory or federal governments, or the private sector.

Inner-metropolitan councils embarked on such initiatives well before 2015, when the United Nations General Assembly resolved to set the 17 Sustainable Development Goals (SDGs). Nonetheless, SDG 11, with its specific objective of making "cities and human settlements inclusive, safe, resilient and sustainable" has become the inspiration for renewed efforts to improve the liveability and functionality of Australian cities. Progress to that end has been patchy, however. In part, this is a legacy of Australia's federated governance structure, which vests fiscal and other powers with the national government (the Commonwealth) but devolves planning responsibilities and service delivery to the states, territories and local government.

Over the past two decades, the populations of Greater Brisbane, Sydney, Melbourne and Perth have expanded rapidly in response to high overseas immigration levels set by the federal government. Indeed, the country's population growth rate is one of the highest in the Organisation for Economic Co-operation and Development. But dependence on Commonwealth funding for service delivery and infrastructure expenditure has meant that state and local governments have struggled to provide the extra housing and infrastructure needed to accommodate strong urban growth. These difficulties have been exacerbated by the absence of an explicit national urban policy and by the unwillingness of past federal governments to exert strong national leadership on urban land use planning and cities policies.

In this national policy and leadership vacuum, the Planning Institute of Australia (PIA) has sought to advance the understanding and importance of good planning and how this is intrinsic to the efficient functioning of cities and the country's future prosperity and well-being. PIA is the peak professional body of strategic and development assessment planners in Australia, representing 5,250 professionals. Its three core activities are providing leadership and contemporary education and professional development for student and qualified planners; broadening the profession's reach and influence through research, advocacy, networking and outreach; and engaging with government and industry to stress the importance of qualified and competent planning professionals and to drive demand for their services.

It has also devoted considerable energy and resources in highlighting not just the importance of adequately planning for and responding to twenty-first century challenges but of having a nationally agreed vision for Australia's future. This would enable better functioning and more liveable cities and regions while ensuring that Australia was able to meet its obligations under international treaties such as the Paris Agreement on Climate Change, the Sendai Framework for Disaster Risk Reduction, and the SDGs.

As part of its efforts to generate an informed national debate about the importance of long-term planning in dealing effec-

Image: Planning Institute Australia

Participants at a workshop during the Planning Institute of Australia's 2018 National Planning Congress in Perth, Western Australia

tively with emerging or future trends, PIA has undertaken two major research reports in the past three years. The first of these was the publication in 2016 of *Through the Lens: Megatrends Shaping our Future*. This is a document examining globalization (including the scope and direction of technological change and the future of work), demographic changes occurring in Australia, and the likelihood of climate change and resource scarcity. The medium and long-term implications of these trends were canvassed in detail.

PIA's intention was that the report should serve as both a catalyst for planners and policymakers to develop more detailed policy responses to future growth or megatrend scenarios, and as an educational resource. With public consumption in mind, PIA strove to ensure that the report's language and layout was as accessible as possible, with a range of infographics and engaging visual elements deployed.

In June 2017, a federal parliamentary committee began an inquiry into the Australian government's role in the development of cities, looking specifically at city planning and sustainable urban development, focusing on how to transition existing capital cities, and how to develop new and existing regional centres. In its inquiry submission, PIA called for the Commonwealth to show greater leadership on the future growth of cities, towns and regions and to develop "a sustainable and integrated national settlement strategy that helps coordinate urban development activities at all levels of government while also placing existing sectoral policies within a spatial and sustainability context".

Community perceptions that Australia's growth and development continues to be mismanaged — or at the very least planned without due regard to long-term goals or aspirations — prompted the Institute to research and produce and publish a second report in late 2018, *Through the Lens: The Tipping Point*. This report makes clear that living conditions in Australia's cities and regions are worsening, with key indicators of this being rising incidents of congestion, more expensive housing, and poor access to work and to community facilities. It also cites "spatially blind" Commonwealth policies and a lack of integrated strategic planning frameworks at the state or city level as significant contributing factors. The report's chief purpose, however, is to outline in detail what a National Settlement Strategy would comprise and how it would be negotiated and delivered.

Australia's adversarial political culture has frequently worked against past reform efforts and, recognising this, the Institute has stressed the need for bipartisan support for any putative National Settlement Strategy at both federal and state government levels.

In a major boost for PIA's advocacy, the aforementioned federal parliamentary committee's report on the development of Australian cities published in 2018 unanimously recommended that the federal government develop a "national plan of settlement" setting out "a vision for our cities and regions for the next 50 years and beyond".

The next phase of PIA's strategy to build momentum for a National Settlement Strategy — briefing federal and state legislators and policy makers and seeking the endorsement and support of other organizations in the Built Environment sector — is now well advanced.

To maximize the chances of securing broad political backing, PIA has avoided any suggestion that it has prepared a detailed and road-ready document. Instead it has outlined

the concept in a way that allows key politicians, and their parties, to readily claim a proprietary interest. Suggestions that a National Settlement Strategy would require changes in jurisdictional roles (always a sensitive subject in a federation) have been similarly discounted.

The Institute is also emphasising the importance of starting a national conversation to shape the strategy's growth and evolution, the better to convince legislators that they have the community's imprimatur to act.

The National Settlement Strategy is the most notable example of PIA's advocacy at macro level, but it engages in other smaller-scale collaborative and educational activities that align with SDG 11. It is a member of the federal Parliamentary Friendship Group for Better Cities whose mission statement is: "We will work together to make Australia's capital and major cities more liveable, more resilient and more productive". PIA hosted a presentation by professor of urban policy at RMIT University in Melbourne, Jago Dodson, on how national spatial planning and policymaking has been used in South Korea and Germany to tackle inequality, deliver better infrastructure and create world-class places.

PIA has used its links with the Commonwealth Association of Planners and the Global Planning Network to facilitate collaboration with Pacific Island nations where effective responses to climate change planning and management have been hampered by a lack of professional and institutional capacity. And it has sought, where possible, to learn from Australia's indigenous peoples about how to better manage land and water interactions.

In 2017, responding to a stipulation of the state of Queensland's newly reformed Planning Act that the state's land use and environmental planning system should "value, protect and promote indigenous knowledge, culture and traditions", the Queensland Division of PIA developed a draft policy to provide direction to the profession about how best to incorporate this in planning activities. This policy was produced jointly with researchers from James Cook University's Centre for Tropical Urban and Regional Planning, and the Institute continues to work with academics and others to raise awareness of indigenous planning at forums and conferences.

Image: Planning Institute Australia

Thomas Gardiner MPIA with his 2017 Queensland Young Planner of the Year Award at PIA's National Awards for Planning Excellence in 2018

Image: Planning Institute Australia

PIA National President Brendan Nelson RPIA (Fellow), left, presents the Federal Minister for Cities, Urban Infrastructure and Population, Alan Tudge, with a copy of *Through the lens: The Tipping point*

Housing in Australia's big cities is notable for being among the world's most unaffordable, certainly in terms of average annual earnings, with high-priced housing repeatedly cited as a significant threat to the inclusiveness of Australia's cities. PIA has been energetic in advocating corrective measures, stressing the need for a holistic approach to alleviating affordability challenges rather than simply increasing land or building supply as state governments have tended to do historically, and with limited success.

The Australian housing market is broadly transitioning from a suburban family-oriented model to an inner urban lifestyle model, and the Institute has argued that if governments took greater account of this — for example, by adjusting housing investment incentives and taxation settings and mandating greater housing diversity and adaptability — real estate prices (and hence affordability) would stabilize.

The requirement for housing, buildings and infrastructure to be built or retrofitted to withstand the current and future impacts of climate change is another major PIA advocacy goal. In its submission to a senate inquiry on this matter in 2017, the Institute noted that improving the capacity of planners to make a positive contribution was vital to developing and implementing effective mitigation and resilience strategies.

An important component of PIA's efforts to foster professional expertise and leadership is identifying and honouring outstanding examples of planning at state and local government levels. Each year the Institute's state divisions organize, judge and confer awards in a dozen categories: the winners later vying for recognition at PIA's National Awards for Planning Excellence. One of the categories, Planning Champion, is reserved for non-planners, the aim being to recognize and promote active community engagement with planning processes.

It is the public's desire to preserve and enhance the liveability of their communities that will ultimately determine the success of efforts to shore up the sustainability, inclusiveness and resilience of Australia's cities. First-class urban planning — respected and supported by principled, effective government — is needed to give effect to that sentiment, and PIA remains committed to achieving this over the long term.

Smart Dubai — towards becoming the happiest city on Earth

Dr. Aisha Bint Butti Bin Bishr, Director General; Dr. Okan Geray, Strategy Planning Advisor; Zeina El Kaissi, Head of Emerging Technology and Global Partnerships; Meera Al Shaikh, Senior Project Manager, Smart Dubai Office, UAE

Dubai is one of the seven Emirates that constitute the United Arab Emirates (UAE) in the Gulf region with a population of over 3 million people. Dubai is a regional, vibrant economic hub with strategically competitive sectors such as tourism, trade and logistics, real estate, retail, financial services, health care and education. It is equipped with the world's busiest airport, the world's tallest building and the 9th largest port in the world.

Dubai's economy has grown 11-fold between 1975 and 2008 rendering it the fastest-growing economy in the world over the same period. During the past two decades, numerous strategic ICT and digital transformation initiatives in the city has altered and digitized various aspects of life. Dubai incorporates 'smart design' into its fabric and has been able to fuse cyber and physical infrastructure and systems while rapidly expanding to accommodate the next projected 30 million visitors by 2020.

Dubai has already achieved world-class leading city status with respect to various SDG 11 indicators as highlighted below.

Housing: No one lives in slums, and there are no homeless or informal settlements in Dubai. All households have registered titles.

Access to basic services: Dubai has achieved 100 per cent potable water supply and authorized electrical service, 100 per cent sustainable access to improved water source, and 100 per cent of the population has access to sanitation facilities as well as wastewater collection and treatment. The UAE, represented by Dubai utilities organization DEWA, maintained its first place globally, for the second consecutive year in all of the Getting Electricity indicators in the World Bank's *Doing Business 2019* report.

The city's population has access to health-care facilities. And Dubai is well known as one of the safest cities in the world. One hundred per cent of the population has completed primary education, and the secondary and tertiary education rates are high.

Access to Transport: Dubai with its high income and high GDP per capita status also has a high percentage of private vehicle ownership, a well-established modern multi-modal transport infrastructure on sea, land and air with an extensive public transport network, and is currently expanding its bicycle routes substantially across the city.

Inclusive and sustainable urbanization: Dubai has a relatively low population density, a high female participation rate in the workforce and a long-term urban plan.

Environment and resilience: Dubai has had no natural disaster related deaths. It has 100 per cent regular solid waste collection. Dubai has achieved competitive results, surpassing major European and American utilities in efficiency and reliability; electricity transmission and distribution networks losses were reduced to 3.3 per cent compared to 6–7 per cent in the US and Europe, while water network losses were reduced to 6.6 per cent compared to 15 per cent in the US, which is one of the best results in the world. Dubai has also achieved one of the lowest records of customer minutes lost per year (CML) in the world — 2.39 CML compared to 15 minutes in Europe.

Long-term strategies related to SDG 11

Dubai has already developed several long-term strategies in addition to short and medium targets. The ciy's Carbon Abatement Strategy entails reducing carbon emissions by 16 per cent by 2021. The Dubai Clean Energy Strategy aims to provide 75 per cent of the city's energy from clean energy sources by 2050, 25 per cent by 2030 and 7 per cent by 2020. Dubai is currently building the world's largest single-site solar energy park with the initial phase already operational. Dubai's Smart Autonomous Mobility Strategy has a clear-cut target of transforming 25 per cent of all journeys in the city into driverless by 2030 and 12 per cent by 2021.

Smart Dubai initiative

The Smart Dubai initiative was launched in 2014 by vice-president and prime minister of the UAE, and The Ruler of Dubai, His Highness Sheikh Mohammad Bin Rashid Al Maktoum, to focus the city's unified effort towards its most valued asset — its people. The vision of Smart Dubai is: "To become the happiest city on Earth."

Dubai also aims to become the smartest city in the world by harnessing digital innovation. It aims to take its smart city transformation to a level such that digital transformation has a significant and positive impact on the city. Smart Dubai, therefore, strategically embraces technology innovation to make city experiences seamless, safe, personalized and efficient, delivering an enhanced quality of life and ensuring sustainability.

Image: Smart Dubai

Smart Dubai launched in 2017 its five-year smart city strategy Smart Dubai 2021

Numerous actual implementations as well as proofs of concepts have been undertaken as part of the Smart Dubai initiative, such as massive Internet of Things (IoT) systems, data analytics, blockchain, hyperloop projects, innovative 3D printing initiatives, autonomous vehicles and drones trials, robotics, and artificial intelligence (AI) applications.

Smart Dubai strategy: Smart Dubai launched in 2017 its five-year smart city strategy Smart Dubai 2021 which encompasses six dimensions: living, governance, environment, economy, mobility and people. The strategy also entails four cross-sectoral initiatives:

- Creating seamless city experiences and a paperless city
- Using shared and open data as a strategic asset to achieve city impact
- Creating internal government efficiency as a strategic competitive advantage
- Establishing a global and city-wide robust inclusive ecosystem accelerating Smart Dubai implementation.

Seamless city experiences

The vision of "becoming the happiest city on Earth" has brought together Dubai entities to enhance and optimize various city experiences. Smart Dubai has formed a unique community of individuals designated "Happiness Champions" in more than 50 public and private sector entities to diffuse the culture of happiness through technology advancement.

City experiences implementation: An initial target of 100 city experiences was selected to be co-designed with the involvement of numerous stakeholders from public and private sectors as well as customers (users) of city experiences by adopting a design thinking and bottom-up innovation approach. Dubai city experiences directly impact and touch the daily lives of people in such cases as starting a business, commuting, driving, renting or buying property, travelling to Dubai, and enrolling in schools. Redesigned city experiences touch the lives of individuals, businesses and visitors in Dubai.

Enhancing city experiences with emerging technologies: Smart Dubai has adopted several emerging and disruptive technologies including blockchain, AI, and IoT to achieve strategic competitive advantage during the sectoral transformation of the country.

Dubai AI strategy: In 2016, Smart Dubai announced its first AI pilot application for what would become Rashid — the city's AI enablement layer. It was expected that much of the city's entrepreneurial community would look forward to opening businesses in the city, which is why, during Rashid's launch phase, Smart Dubai teamed up with the Department of Economic Development in Dubai, with Rashid assisting all new entrepreneurs with details on documentation and legalities for opening a new business. This function is still live and can be accessed on the Department of Economic Development website or via Dubai Now. Due to the success of Rashid's pilot phase, it can now answer questions related to any government query.[1]

In 2017, Smart Dubai announced the city's AI roadmap and, since then has been working with partners across the city to implement AI wherever possible. The AI roadmap has identified 104 AI use cases, out of which 43 are currently being implemented, working with 13 government entities, and spanning 10 industry sectors.

Dubai IoT strategy: Dubai is a highly connected city with broadband Internet penetration surpassing 95 per cent and

mobile penetration exceeding 250 per cent. Smart Dubai 2021 aims to further connect Dubai city resources and infrastructures. Water and energy networks (through smart meters), sewerage, drainage, waste management networks, buildings, traffic lights, ports, and seashores will be connected and monitored, enhancing city resilience. Several use cases in different phases are being implemented as part of Dubai's IoT strategy.

Happiness meter for city experiences: In line with the vision to become the happiest city on Earth, Smart Dubai has implemented a simple yet powerful tool — the Happiness Meter to measure city experiences from more than 4,000 touchpoints. From its launch in 2015 until the end of 2018, more than 22 million votes have been collected from 172 entities and the overall happiness rating has reached 90 per cent at the city level. The Happiness Meter provides the city leadership with real-time access to happiness results creating transparency and an immediate feedback tool to city administrators for enhancing city experiences.

Dubai Paperless Strategy

His Highness Sheikh Hamdan Bin Mohammad Bin Rashid Al Maktoum, Crown Prince of Dubai and chairman of The Executive Council of Dubai, launched the Dubai Paperless Strategy in 2018.

The Dubai Paperless Strategy addresses technology, legislation and cultural issues in order to digitize 100 per cent of government services by 2021, with no paper being used for any internal or external transactions, thus reaching a pinnacle in city digitization. The strategy entails the redesign of all main city sectors including mobility, energy, environment, society, education, health and public services, and related city experiences.

It is estimated that, after 2021, the strategy will save over 1 billion sheets of paper annually, amounting to the saving of approximately 130,000 trees and over US$ 350 million annually.

Data as a strategic asset

Smart Dubai launched two major and complementary initiatives called Dubai Data and Dubai Pulse.

The Dubai Data initiative aims to achieve seamless, efficient, personalized and safe data governance and data sharing at city level, contributing to Dubai's smart transformation, whereas Dubai Pulse forms the new digital backbone as the city platform built as a result of a public-private partnership.

The shared and open data have been identified as strategic assets for enhancing city experiences and happiness. Hence Dubai Data Law, Dubai Data Policies, Dubai Data Standards and Dubai Pulse are the key building blocks (enablers) for data. City-level Dubai Data Champions have been designated from both public and selected private sector entities. Well-defined curriculum-based training and skills boosting programmes have been conducted to accelerate data management and data science skills.

Data impact: By 2021, open and shared data has the potential to add approximately US$ 2.8 billion to Dubai's economy every year. Opening government data alone will result in an added value in the range of US$ 1.2 to 1.8 billion annually by 2021.

Internal government efficiency as a strategic advantage

Synergies in strategic ICT implementation such as IoT and data platforms, AI based systems, blockchain platforms, digital identity and payment, and common back-office functions compelled Smart Dubai to undertake an extensive approach for implementing shared ICT services and infrastructures.

Smart Dubai — shared ICT services: Smart Dubai has implemented and delivered more than 60 shared ICT services utilized by more than 50 entities — today more than 90 per cent of all Dubai government employees and more than 95 per cent of Dubai government budgets are managed by a single shared system. A total of US$ 1.2 billion savings were

Image: Smart Dubai

The Dubai Paperless Strategy addresses technology, legislation and cultural issues in order to digitize 100 per cent of government services by 2021

Image: Smart Dubai

Smart Dubai aims to stay at the forefront of technological innovation for smart sustainable cities

achieved in just over a decade. Smart Dubai has saved US$ 5.6 for every US$ 1 spent for its shared ICT services.

A robust global network and a city-wide ecosystem

Smart Dubai has flourished into a highly vibrant and productive ecosystem critical for its smart sustainable city transformation with a very broad stakeholder representation and engagement.

Smart Cities Global Network: Smart Dubai aims to stay at the forefront of technological innovation for smart sustainable cities. It launched Smart Cities Global Network in April 2018, the first of its kind, aiming to be the prominent international network of smart cities. Smart Dubai extends its partnership approach to all individuals and entities with a passion for advanced technology and Fourth Industrial Revolution breakthroughs.

Global knowledge building: Smart Dubai has taken leadership and co-leadership roles in global initiatives undertaken by esteemed organizations such as the World Economic Forum, International Telecommunications Union, United for Smart Sustainable Cities, Global Happiness Council, SDG 11 Global Council, and the Hyperledger Foundation to exchange and create knowledge.

Startup support: The Dubai start-up and entrepreneur community forms the foundation for application of emerging technologies in city services within the context of the Fourth Industrial Revolution.

Dubai Blockchain Strategy

Smart Dubai is currently leading the implementation of the Dubai Blockchain Strategy which intends to make Dubai the first city government to run all applicable transactions on blockchain by 2020. It entails an initial 20 well-defined public and private sector use cases and an implementation roadmap both of which significantly benefit from third party elimination, transaction ledgers, smart controls and/or automation.

As part of the strategy, Smart Dubai also runs several initiatives to attract the necessary talent to the region for the development of the technology.

Smart Dubai launched the Global Blockchain Challenge in 2017 to bring the world's best blockchain start-ups to implement their solutions in Dubai. Additionally, Smart Dubai also launched the Dubai Smart City Accelerator to attract global talent and entrepreneurs to Dubai to solve local challenges using emerging technologies. The accelerator was launched in 2017 and run by the Startupbootcamp network. It is an intensive programme supporting innovative companies in blockchain, AI, IoT and connectivity, urban automation and mobility, and open data, among others.

Smart Dubai is also collaborating with an ecosystem of start-up financial support and other accelerators. Hence, Smart Dubai is striving to become the smartest and the happiest city on earth with a broad range of strategic and focused initiatives at city level.

Cities facing common challenges — the Ibero-American case

Pablo José Martínez Osés, Director General; Javier Roibas, Departamento de Comunicación, Unión de Ciudades Capitales Iberoamericanas (UCCI)

The twenty-first century will be remembered as the period in which humanity became a predominantly urban species. According to forecasts of the United Nations and other international institutions, 54 per cent of the world population already lives in urban environments (in 1950 it was 30 per cent) and in 2050 that number will have increased to 68 per cent. But, if the figures of the global urbanization processes are instructive, the phenomenon is overwhelming in Latin America and the Caribbean.

Global city data

Earth's surface occupied by cities	2%
Primary global energy consumed by cities	75%
World GDP generated in cities	75%
Greenhouse gases emitted by cities	50–60%
Waste generated in cities	70%

According to data from the Inter-American Development Bank, 10 cities generate one third of the region's GDP.[1] By 2025, just six cities will, together, be home to 100 million people — Mexico City, 24.5 million; São Paulo, 23.2; Buenos Aires, 15.5; Rio de Janeiro, 13.6; Lima, 11.5; and Bogotá, 11.4. With these numbers, it is easy to understand why Latin America is the most urbanized region in the world, with 80 per cent of its population residing in cities.

A consequence of the current model of development is a demographic concentration in large cities. This has opened a global debate that questions the efficiency of the asymmetry of power between cities and states. As local governments are aware, first-hand, of the consequences of the intensification of the urbanization processes, the need has arisen to seek solutions to the daily problems associated with this new scenario.

Another consequence is the strength of civil society, increasingly determined to participate in the decisions that affect its day-to-day life. In that sense, traditional administrative structures must be reformed and opened up to allow the voice of citizens to be taken into account.

The crucible of issues that occupy day-to-day municipal management and that are included, not all of them directly, in the Sustainable Development Goals (SDGs), include the increase in waste, emergence of new business models that conflict with traditional sectors, opportunities offered by new technologies, management of public spaces, mobility, the price of housing, air pollution, migratory flows, and the generation of employment.

The growing demographic concentration is the result of the search of people for better opportunities for their lives around the dynamism of cities, which at the same time, concentrate the greatest harmful emissions, biodiversity losses and pressure on water and land resources. The challenges of cities in the coming decades are the challenges of the planet. The possibilities of transformation and transition towards ecologically, economically and socially sustainable models depend on how cities face the challenges.

Each city addresses these issues in a different way and attends to demands based on multiple variables, such as the amount of available resources and information and the priorities established in the social contracts between the institutions and the population, among many other factors.

The Union of Ibero-American Capital Cities (UCCI — its initials in Spanish) operates within this context. Created in 1982, the UCCI is an organization to which 29 cities of the Iberian Peninsula, Latin America and the Caribbean belong, representing a population of well over 120 million people. Since 2016, the organization's main task has been the promotion of a global model of sustainable development that responds effectively to major local, regional and global challenges through cooperation and knowledge exchange between cities.

The current global context is far distant from that of 1982 and so, in 2016, the cities that are part of the UCCI network decided to adopt a new direction and to align its strategic plan with the international roadmap marked by both the New Urban Agenda and the 2030 Agenda and its SDGs. Although these are agreements reached by national governments, they will not be implemented without a new multilevel articulation, in which cities have been empowered, acquiring competencies and capacity for effective dialogue in the international community.

There is still a long way to go, but thanks to networks such as the UCCI, global decision makers have begun to be aware of the empowerment of cities and their vanguard position in the transformation of the current development model. Likewise, the SDGs have been adopted by a large part of the international community and civil society as the way of

Image: UCCI

Celebrations in La Paz, Ibero-American Capital of Cultures, 2018

connecting the great global challenges with the new scenario of human concentration in cities and, from there, to look for solutions. The new UCCI strategy has a very strong relationship with multidimensionality, interdisciplinary thinking, transitioning, and new relationship models consistent with the revolutionary approach established by the 2030 Agenda.

The biregional conception of the UCCI and its presence in other municipal and international networks (it has been a member with consultative status of the Economic and Social Council of the United Nations since 1989) facilitates the development of its global advocacy strategy, in which external action is strengthened for cities and their positioning as key contributors to global sustainability.

The UCCI proposes to address the challenges of the new world scenario by structuring its activity in four strategic areas conceived as interlinkage spaces for the whole of action: Equality and Social Development, Territory and Sustainable Economy, Governance, and Culture, an aspect that was not contemplated in the configuration of the 2030 Agenda and on which there is a broad consensus from the local sphere to consider it as the fourth pillar of sustainable development.

The four blocks in which UCCI strategy is structured respond to the tested principle of 'think globally and act locally' to promote a balanced progress in society that considers development as a multidimensional process, such as political, economic, environmental, cultural and social.

To transfer these concepts to the field, which can sometimes be somewhat alien to citizenship, the local implementation of the SDGs has been promoted. In this sense, one of the lines of work of the UCCI, largely due to the demand of the cities, is the improvement of citizen participation. As already stated, one of the main consequences of the new scenario is that local governments seek imaginative solutions to the challenges arising from agglomeration in urban environments. In their search, cities see the UCCI as a reliable source of accumulated knowledge and a space in which to share experiences, as there are usually examples of other UCCI cities having overcome similar circumstances.

One of the most outstanding examples of the practical utility of this exchange of knowledge between cities and networking that favour institutions such as the UCCI is CONSUL, the software developed by the City of Madrid in 2015 to manage citizen participation. This tool is linked to SDG 11 (sustainable cities and communities); 16 (peace, justice and solid institutions); and 17 (alliances to achieve objectives), as it enhances citizenship participation with which people and communities can contribute ideas and decide on issues that affect the entire arc of the SDGs. The use of this tool by local governments implies a democratic exercise as well as the degree of transparency demanded by society and the fact that institutions need to recover the trust of citizens.

The CONSUL open software, which has been an international success, having received the United Nations Public Service Award in June 2018, is being used in several UCCI cities — Montevideo, La Paz, Quito, Bogota, Buenos Aires,

Guatemala City and, soon, San Salvador. In the rest of the world more than 70 local authorities are already implementing the software to engage their citizenship.

Here, three significant aspects are combined. Firstly, a city is positioned internationally at the forefront of the transformation of the current model of development. Secondly, UCCI networking has helped a local initiative to become global and benefit the population of multiple cities worldwide. Finally, the empowerment of the city has come conjointly with the empowerment of the citizenship.

Another initiative that supports the network is that developed by the district office of Bogotá, which has created a digital tool to bolster the follow-up of the district administration's commitments to improve the confidence of the citizens in their institutions. Once again, we are witnessing a replicable example in other Ibero-American cities that are experiencing a similar situation.

Since the UCCI adopted the new Urban Agenda and the SDGs of the 2030 Agenda as a roadmap for its activity, it has developed more than 300 initiatives in Ibero-America in which around 9,000 people have participated.

All of this is directly linked to the efforts made over the three previous decades to build networks of trust, both with cities and other national and supranational entities and organizations, as well as the alliances that today support the work of promoting a culture of peace and the defence of human rights — the two main axes variously present in all of the organization's initiatives.

The UCCI is a faithful defender of municipalism, from the conviction that cities are the fundamental scenario in which the contradictions between discourse and political, economic and social reality must be resolved. These contradictions are at the base of the crisis of sustainability of the planet, a crisis that does not admit delays or excuses.

Image: UCCI

Medellìn is the capital of Colombia's mountainous Antioquia province. Metrocables link the city to surrounding barrios and offer views of the Aburrá Valley

Activity summary/number of participants 2016–2018, UCCI

Activities per year	Culture	Governance	Sustainable territory and economy	Equality and social development	Total
Nº of activities 2016	17	32	18	6	73
Nº of activities 2017	19	53	18	14	104
Nº of activities 2018	25	86	27	17	155

Participants per year	Total
Nº of participants 2016	923
Nº of participants 2017	1,227
Nº of participants 2018	6,864

Source: UCCI

The world's most liveable city[1] — managing the threat of population growth, moving earth and rising sea levels

David Chick, Chief City Planner; Moana Mackey, Chief Advisor to the Chief City Planner, Wellington City Council, New Zealand

Wellington, New Zealand's capital, is listed by Deutsche Bank as one of the world's most liveable cities. Residents enjoy a high quality of life; a strong sense of community and identity; an edgy vibrant culture; the lowest carbon emissions per capita in Australasia, and a compact urban form that is loved by residents and visitors alike. Geographically constrained by the surrounding hills and the harbour at the heart of the city, planners face significant challenges with stronger than expected population growth, rising sea levels, and the ever-present threat of earthquakes. What will keep Wellington thriving is how city leaders and the communities prepare to meet these challenges.

Currently, Wellington ranks highly on a number of different liveability scales and most recently ranked first on the Deutsche Bank scale for two years in a row. Contributing to the score are such factors as the natural environment of the town belts and the coast, the creative and arts scene, an inclusive and diverse culture, world-class restaurants, a compact city centre, and a very stable and growing economy.

Wellington's harbour acts as both a much loved recreational area and an important port — the main sea link between the North and South Islands. The city's hilly topography is created by the fault line on which it sits, and the sea that borders it. Like the rest of the world, Wellington is

Image: Neil Price

In 2013, a severe southerly storm caused widespread damage along the south coast of New Zealand's North Island

dealing with the effects of climate change. City leaders and communities are not ignoring the challenges, and conversations continue as Wellington grapples with significant decisions and challenging compromises.

Wellington is a small city with a resident population of 216,300. However with 80,000 more people expected to reside in the city within the next 25 years, it faces some serious challenges given natural geographic constraints. These are small numbers on a global scale but the potential impact on a compact city is significant.

With limited greenfield opportunities available, a third of all growth is currently going into the central city. This is desirable from both an environmental and public health perspective — reducing the need for car ownership and promoting active transport — but if not properly managed could negatively impact the very qualities that attract people to Wellington in the first place. The central city is also highly prone to seismic activity and the impacts of climate change which means that difficult trade-offs will be required if the central city continues to stimulate the greatest percentage of growth.

While the city grows, it needs to do so in a way that reduces emissions, given the impacts of climate change on a harbour city with extensive coastlines and many coastal communities. The city has to prepare for more water, both in terms of a rise in sea level and changing weather patterns that will result in more severe and frequent storms and floods. The optimal mix of hard (pipes) and soft (green) infrastructure will be critical in managing water in the following decades. A co-design process has been piloted with one of the coastal communities that is already bearing the brunt of climate change, allowing it to ultimately determine its future, with discussions around a fair funding mechanism.

Seismic activity

The challenges presented by climate change are exacerbated by the seismically active nature of the city. The area was formed millions of years ago by two tectonic plates pushing into each other. Maori legend has it that Wellington harbour was originally a lake. Two water dragons (taniwha) lived in the lake, called Ngake and Whataitai. One day, Ngake managed to jump over the edge of the lake and into the sea. Later, his brother Whataitai went to follow, but he didn't realize it was low tide and fell short — he smashed open the harbour entrance, and died, turning to stone, and forming the area that overlooks the city. Today it's called Te Motu Kairangi — the Miramar Peninsula. It is said that when the sea is rough, Ngake still comes home to rest close to the harbour, and when the sea is calm he is out exploring Te Moana Nui a Kiwa — the Pacific Ocean.

Image: Neil Price

The city of Wellington has evolved between the natural harbour and surrounding hills

Image: Neil Price

Port, railway tracks and roads damaged after the 2016 Kaikoura earthquake

New Zealand lies on the Pacific Ring of Fire and earthquakes are a fact of life. The 1855 earthquake caused the land to lift, converting the Basin Lake into the Basin Reserve sports ground of today. The 1942 earthquake encouraged the construction of resilient buildings, and the Christchurch earthquakes of 2011 and 2014 strengthened attitudes as to how people and communities need to be at the centre of every civic decision.

In November 2016, Wellington was impacted by a magnitude 7.8 earthquake, centred some 230 km away in Kaikoura on the east coast of the South Island. Despite the distance, the earthquake highlighted the extent of Wellington's vulnerability — particularly in the central business district where there was significant damage to the port and a number of commercial buildings. Since that event, the City Council has played an active role in working with building owners to carry out remedial and strengthening work — a project that will be ongoing for many years, given the complexity of engineering decisions and difficulties accessing financing. The personal toll on affected residents and building owners cannot be underestimated and elected members and council staff have been at the forefront of helping those affected to navigate the system while at the same time lobbying for greater central government assistance and improved regulatory powers for local government. And, while difficult, this recovery period has however opened a window of opportunity to shape the future of the city.

Population growth

Population growth has implications for all aspects of the city, including housing affordability, movement, urban form and function, provision of lifelines, infrastructure and liveability. Accommodating this level of growth will require infrastructure investment on a scale not seen before and in places not considered before. Over the next 25 years, Wellington will need to build 30,000 more dwellings, significantly increase investment in transport infrastructure, and deliver increased capacity in drinking water, wastewater and stormwater infrastructure. This must be done in the context of the complex and interlinked challenges and opportunities that come with seismic activity and adapting to climate change and ultimately deciding where people are placed.

The role of the Wellington City Council is to ensure that all of those moving parts are coordinated and well managed so the city retains its culture and character. The challenge is always how to engage the public in a way that ensures ownership of outcomes and helps inform sufficiently to make the tough decisions.

In 2017, in the wake of the Kaikoura earthquake, Wellington City Council embarked on an engagement campaign — Our City Tomorrow — bringing together into one conversation the three major drivers of change facing the city: "Our population is moving. The earth is moving. Our sea and climate is moving." The Council admitted to the communities that it didn't have all of the answers and that it wanted the public to take part in developing solutions. In avoiding a natural tendency to jump quickly to solutions, the Council proved its commitment to collaborate positively, despite the challenging nature of the decisions required.

The Our City Tomorrow campaign was the precursor to discussions on the Long Term Plan (LTP) that, for the benefit of the community, outlines the investment intentions over the next 10+ years. To ensure that the LTP remains relevant and accurate, the content is reviewed, and public feedback requested, on a draft plan every three years.

As a result of the Our City Tomorrow engagement, the Planning for Growth initiative was identified and, in May 2019, opened for public consultation. The outcome will inform a new spatial plan and result in a comprehensive and full district plan review. The last district plan review took place in 1994, having taken six years to complete, and has been operative since 2000.

In 2019, Wellingtonians will consider a number of scenarios about how the city can grow, with suggestions on ways to accommodate growth while asking the public to consider questions of housing choice; transport; natural hazards; the natural environment and open space; community gathering spaces; heritage and cultural values; and infrastructure such as water and drainage.

Some compromises will need to be made, for example areas currently protected for character may need to be revised given that they are built on the best quality land. But protecting character and promoting quality intensification do not

Buildings with unreinforced masonry

After the 2016 Kaikoura earthquake, Wellington City Council identified 113 buildings in the central business district that needed remedial work. Some of those buildings were constructed with unreinforced masonry (URM) that could break and fall during an earthquake. That work is now complete. URM elements are not reinforced with steel but made of clay brick, concrete block or stone, held together with lime or cement mortar. In the 2011 Christchurch earthquake, 39 people were killed and more than 100 people injured by URM buildings.

Image: Neil Price

Wellington faces the threat of rising sea levels

have to be mutually exclusive, and the Council will lead discussion on the reconciliation of those two ideas.

Growth requires more housing that is both affordable and of high quality. Through the Planning for Growth initiative, planning settings need to be agreed that consider the dwellings required for population growth as well as the demographic make-up of that growth — particularly in the central city, which is, for example, home to a number of tertiary institutions. The flow-on effects for suburban areas also require consideration.

Wellington is currently engaging with central government over a transformative transport package that will unlock urban development potential and further enable sustainable and resilient growth.

City leaders support the public's aspiration for a compact city that is inclusive, green, resilient, vibrant and prosperous. The consensus is for a better public transport and more opportunities to walk and cycle around the city — all while accommodating the challenges of climate change, a growing population, and an ever-present seismic threat. The test of success will be the way in which the city leads its communities through genuine, collective decision-making.

Image: Justine Hall

The CubaDupa festival is an inclusive celebration of arts and culture that takes place in Cuba Street in the heart of the city. Buildings with unreinforced masonry are visible in the background

Activating citizen engagement through the State of South African Cities People's Guide

Stacey-Leigh Joseph, Executive Manager: Programmes, South African Cities Network

By 2030, more than 70 per cent of South Africa's population will be living in urban areas, the highest in Africa.[1] While the rate of urbanization is lower than in other parts of the continent, the imperative to develop more effective plans and instruments that will facilitate inclusive, sustainable, and productive cities remains. However, in addition to grappling with the implications of global trends and population movements, South African cities must address the historical planning and development practices that have rendered cities unequal, unsustainable, and unjust.

In South Africa, addressing historical imbalances needs to be aligned with thinking and interventions related to the kind of future cities we want.[2] This places tremendous pressure on city governments that have to make critical trade-offs and tough decisions in a resource-constrained environment while the demand for services and opportunities increases daily with the growth of urban populations. The reality is that interventions in current and future cities have to be seen as simultaneous projects rather than a focus on one at the expense of another.

Given its already high rate of urbanization, South Africa's cities are the drivers of economic development and, even though they struggle with high levels of informality, inequality and unemployment, they continue to be a magnet for people searching for economic opportunities. Their economies are relatively strong and, over the past 25 years, they have seen significant transformation through investments in the built environment that have improved access to jobs and services. There have also been significant changes in the local government policy space over the past two decades, most notably the role envisaged for local government and cities, in particular, to drive the spatial transformation agenda for South Africa.

To deliver on this mandate, in a context of growing pressure and declining resources, requires capability, capacity, and resources at local government level. It also requires that there is space for learning, innovation and the platforms for engagement. Importantly, it necessitates communities of practice and partnership as urban development and governance is not the responsibility of city governments alone. Urban local governance requires multiple actors in society across government, civil society, the private sector, and academia, to collectively design and implement the desired city that is able to cater to the needs of all of its residents.

The South African Cities Network (SACN)[1] was established in 2002 as a learning network of South Africa's largest cities to support them in driving effective urban interventions. Through the exchange of information, experience, and best practice, the SACN encourages the promotion of good city governance, shared learning and partnerships, and the collection and analysis of the strategic challenges facing South Africa's cities.

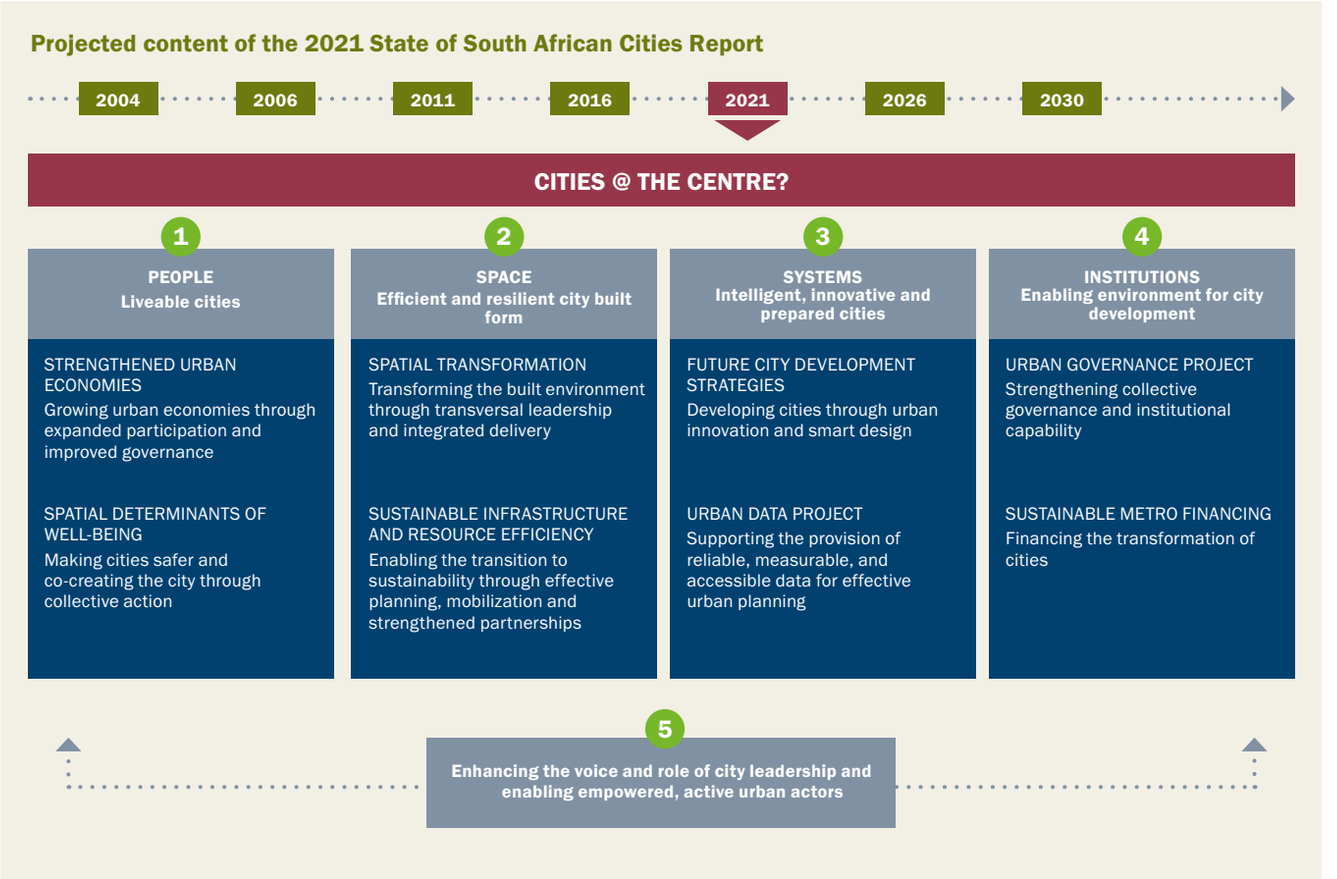
The work of the SACN has provided five-yearly perspectives on the performance and conditions of cities, in the form of its flagship State of South African Cities Reports (SOCR). Over the past 17 years, four editions have been launched to coincide with the electoral cycle for local government, aimed at influencing debate and engagement within the broader public, but also to assist incoming administrations in understanding the context, challenges, and opportunities of the cities they will govern. The report is now well-established as:

- **A barometer** that provides evidence for the progress in relation to the roles, targets, and outcomes that have been set
- **A tool** that analyses the key challenges and opportunities for cities
- **An agenda-setter** that communicates essential messages about the future of cities and provides support for incoming leaders and officials.

SACN's work makes the case for cities as productive spaces that are both inclusive of people and allow for urban residents to co-produce the city. Through research focused at deepening economic intelligence, SACN makes the case for expanded economic interventions that recognize and acknowledge informal economic activities. It also argues for the inclusion of marginalized voices in society, especially those of young people who are increasingly making up the majority of the urban population. However, without transforming the spatial

State of South African Cities Reports

2004 Cities are important and can be drivers of social change
2006 The apartheid form remains largely unchanged
2011 Cities are resilient but face key pressures and vulnerabilities requiring intervention and support
2016 Cities have been effective drivers of local and national development but all actors have to pull together
2021 Cities @ the Centre



configuration in South Africa to be more accessible, equitable, and just, inclusion will not be achieved.

Spatial transformation needs to go hand-in-hand with more sustainable and resource-efficient practices. Recent droughts in cities such as Cape Town and Port Elizabeth, and flooding that has caused significant deaths in Durban, illustrate how crucial it is to link investments in the built environment to environmental factors and demonstrate that sustainable interventions and climate change mitigation are not stand-alone, optional issues but rather integral to how cities are planned and developed.

SACN research also argues for effective governance that enables leadership and management of cities that drive integrated planning and development. The research shows that having strong leadership and administrative capability are crucial success factors for good governance.[3] Where this kind of leadership is not evident, poor management, corruption, and maladministration worsen a local government administration that is buckling under the pressure of providing transformative outcomes.

Finally, SACN conducts research on city finances. Its biennial State of City Finances reports[4] focus on how to sustainably finance cities to achieve productive, inclusive, sustainable, and transformed urban outcomes. The most recent 2018 report highlights that cities as well as their citizens are in crisis. While municipalities have to find money to keep providing services and meet long-term development goals, the worsening economy is having a detrimental impact on its residents and tax base.

The 2021 SOCR has as its theme the question: Are Cities at the Centre of Urban Development? Using a governance lens, this report seeks to explore the institutional and operational mechanisms and leadership that may be required to reach the goals represented in global, continental, and national policy frameworks such as the SDGs, the New Urban Agenda, the African Agenda 2063, South Africa's own National Development Plan 2030 and the Integrated Urban Development Framework.

The 2016 SOCR noted that achievement of the above mentioned goals requires all of society to be active participants in local governance. It makes the argument that "spatial intervention requires coordination and the active intervention of government, the private sector, knowledge institutions, and civil society"[5] and that "innovation… occurs in that cooperative space where government, the private sector, knowledge institutions, and civil society meet — the quadruple helix".[6]

To support the engagement of other actors, a growing practice of the SACN has been the creation of a People's Guide, to accompany the main SOCR in strengthening the active engagement of a broad constituency in urban issues. The objective of the guide is to move beyond the academic language of the SOCR, making it accessible for ordinary people to actively engage with their cities and the city administrations, and to understand the collective and integrated nature of urban planning in order to bring about effective change. The 2016 People's Guide[7] provides an overview of the main findings of the SOCR and urban local government, making the case for why cities matter, and including a call

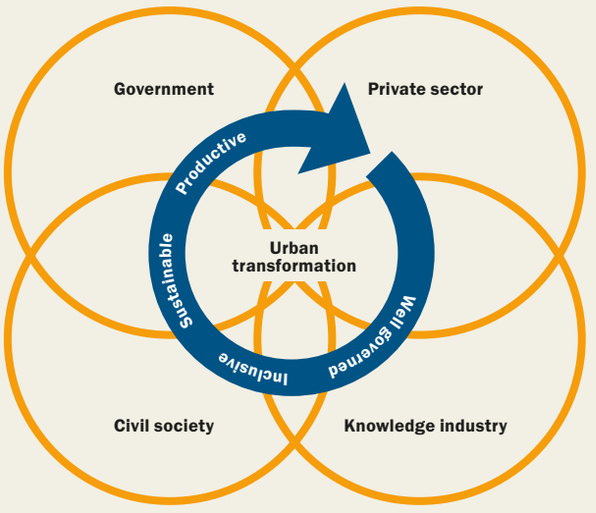
to action for the involvement of a broader range of actors in the development of South African cities.

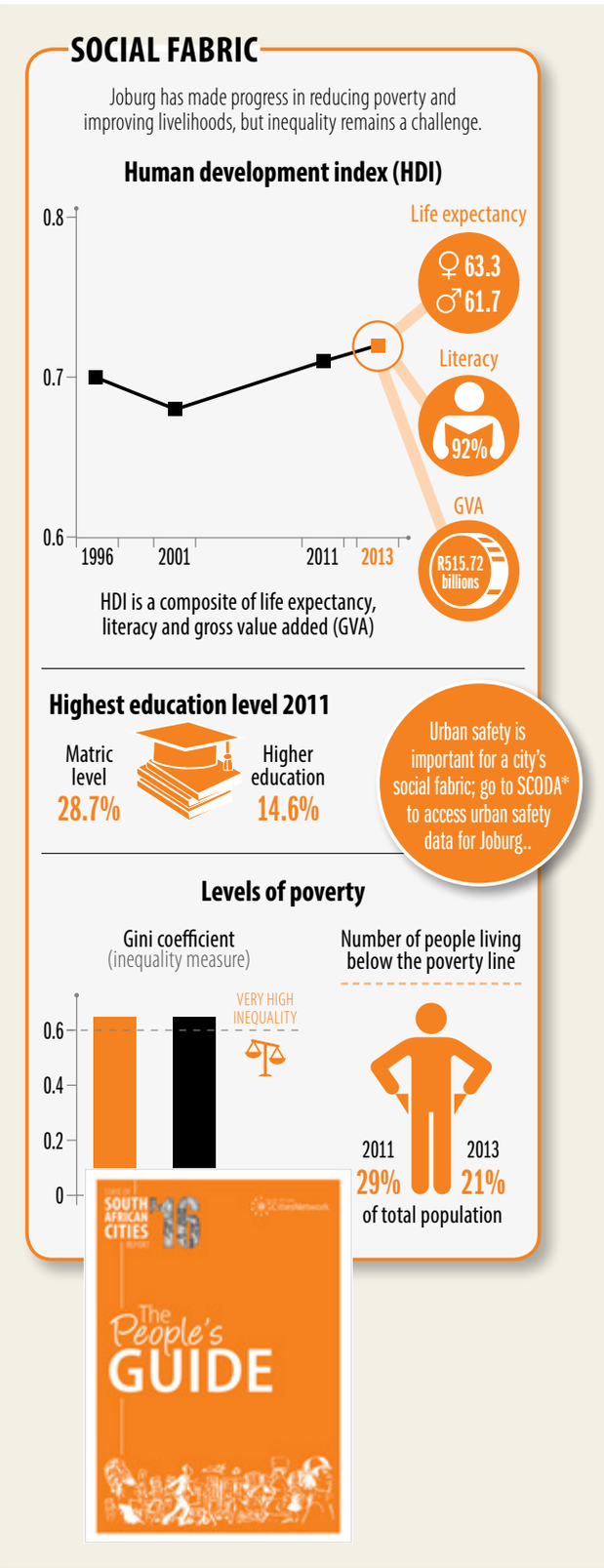
The next iteration of the People's Guide will be designed to be more visual and interactive across varied media formats to further encourage participation in the urban conversation. This is considered an innovative product and one that will hopefully take urban local governance to a community level. A key aim of the 2021 People's Guide will be to assist thinking through exactly what is required from the various actors, and especially how urban communities can hold to account both government and local, private interests and the knowledge industries for their activities in the urban sphere.

The development of the SOCR has gone through an evolution over the years, from a report produced by urban experts to a report informed by multiple authors, city engagements through the SACN's reference groups, and various consultations with urban actors working in cities. This evolution will be taken further as the 2021 State of Cities story is crafted. The 2021 project approach is one of co-creation and collaboration to encourage sense making, capacity-building and collective agenda setting. Rather than mere consumers of the SOCR as an output, it is envisaged that various urban actors will be co-producers of the narrative that represents the story of their cities.

Ultimately, all actions in the urban sphere, regardless of who is responsible for them, from the private sector to the state, have an impact on the lives of people who make the city their home. Unless communities are empowered to challenge these various interventions and investments, they will continue to bear the brunt of poorly designed, untransformed, unsustainable development that is costly for the natural and social environments. The People's Guide and its associated collateral is considered an important intervention and contribution towards a more active and engaged urban citizenry that will hold urban governance actors to account for current and future urban interventions.

The quadruple helix of cooperative space





Example of a dashboard indicator from the 2016 People's Guide, making information accessible for ordinary people in order that they actively engage with their city administrations to bring about effective change

* The South African Cities Open Data Almanac (SCODA) is a city-centric data portal that aims to support the planning, management, monitoring, and reporting needs of cities. www.scoda.co.za

A transformative approach to sustainable living in Buenos Aires

Álvaro Herrero, Under Secretary for Strategic Management and Institutional Quality; Marina Picollo; Mariana Cammisa, Buenos Aires City Government

The challenges of this century are largely urban — cities have proven to be the engines of development, but they can also be exposed to structural stresses and become more vulnerable to disruptive shocks if they do not have adequate planning. Therefore, the current international scenario demands the cities' concrete action to face global challenges. In this context, the Buenos Aires City Government (GCBA) understands the need to find local solutions to overcome these challenges. The commitment to the 2030 Agenda for Sustainable Development, and the New Urban Agenda offer ideal frameworks for working towards sustainable development.

In order to meet the standards set by the SDGs, Buenos Aires City launched its Resilience Strategy in 2018, proposing a holistic approach to sustainable and inclusive urban development, setting the path for achieving SDG 11 and contributing to the 2030 Agenda as a whole. Residents, academics, companies, non-governmental organizations, and government officials participated in the elaboration process of the strategy. Through this participatory process, the main vulnerabilities and strengths of the city were identified and structured into five pillars of action — diversity, gender, and coexistence; innovation, talent, and opportunities; environment and sustainability; social and urban integration; and security

Image: Buenos Aires City Government

Workshop on robotics to develop environmental solutions

Image: Buenos Aires City Government

Participatory work group in Barrio 20

Image: Buenos Aires City Government

Building of the alleviating tunnel for the Maldonado streams

and risk management. Through them, Buenos Aires seeks to strengthen its government planning by viewing issues in terms of resilience and by proposing innovative actions in dealing with the tensions to which the city is exposed.

The strategy incorporates the traditional resilience agenda, with the reduction of hydraulic risk, the creation of early warning systems to mitigate flooding and the urban integration of vulnerable neighbourhoods. It further focuses on palliating the chronic tensions related to the social and economic transformations that affect urban hubs. This new agenda is translated into talent-boosting policies, with the main focus on youth and the elimination of gender gaps. These projects enable the city to build a sustainable and resilient future, with opportunities for all.

As cities need to anticipate and make preparations for climate change threats, Buenos Aires has, over the last decade, developed an infrastructure capable of reducing the impact of natural threats. However, certain phenomena such as increasingly heavy and frequent rainfall, raise the risk of flooding, which is worsened by the fact that almost 70 per cent of the city's population resides along one of the 11 basins under the city. To mitigate the disruptive effects and adapt to climate change, Buenos Aires has conceived the Hydraulic Plan: a set of public works (structural measures), and programmes and actions (non-structural measures) with the goal of reducing flood risk in the city. Among the structural measures is that of flood mitigation by building two alleviating tunnels for the main outfall of the Maldonado stream that runs under ten of the city's regions. The pluvial network has also been extended, and secondary outfalls built.

Currently, Buenos Aires is carrying out mitigation works in other basins, for instance, with the construction of the second draining conduit of the Arroyo Vega, which will double its draining capacity to the benefit of more than 300,000 residents.

Regarding non-structural measures, Buenos Aires is currently implementing a Storm Early Warning System (SAT) aimed at anticipating accurately, and in real time, extreme climate phenomena. SAT consists of a meteorological satellite, a radar and 34 weather stations, together generating georeferenced information at a metropolitan level, guarding over 15 million people. The information produced by SAT is processed at a Single Coordination and Control Centre, which creates situation maps, and coordinates the action of emergency agencies. It also gives early warning to better prepare the residents in case of emergency.

Social and urban integration of Barrio 31

Barrio 31 (Neighborhood 31), with over 40,000 residents, is located near the Buenos Aires financial district. The neighbourhood is crossed by the Illia highway that has, until now, represented a physical barrier to integration. However, the highway will be transformed into an elevated park increasing the green public space per inhabitant of Barrio 31 by 343 per cent.

At the same time, the city is building 1,042 new housing units to relocate the families that are currently living beneath the highway. This process includes participative work with the families and assistance of social worker teams. In addition, the new houses are being built in steel frames and will be equipped with photovoltaic panels and solar water heaters — a milestone in the use of renewable energies for Buenos Aires City.

The integration of Barrio 31 will also turn it into a neighbourhood where people from all over the City will be able to work or study. Thus, the Ministry of Education offices are currently being moved into the area, and a new education district will be created — by the end of 2019, around 3,000 students will be studying in the five schools within the new district. Moreover, the Inter-American Development Bank has announced the construction of its new regional office in Barrio 31.

Finally, the Centre for Entrepreneurial and Labour Development has been inaugurated, a government office that offers business training, customized advice to entrepreneurs and a job search platform. Additionally, the city mayor has his own office in this building, where he regularly works and holds meetings.

Ensuring access for all to adequate, safe and affordable housing and basic services is one of the core targets of SDG 11. Moreover, the integration of slums remains one of the biggest challenges for the construction of sustainable, resilient and inclusive cities in the developing world.

In Buenos Aires, over 7 per cent of the population resides in informal settlements, formerly known as "villas". In 2016, the city engaged in one of the most ambitious plans of urban and social integration of low-income neighbourhoods in its entire history with the purpose of providing access to basic services to at least 80,000 people by 2019.

Buenos Aires' social and urban integration plan has a holistic approach that includes not only building sustainable and

resilient infrastructure, but also guaranteeing that all residents will have the same opportunities of self-development and enjoyment. The plan works on four key areas: building new housing units and improving the existing ones; improving mobility among and within the neighbourhoods; creating new educational institutions, health centres, and sports facilities; and implementing economic development programmes, with a special emphasis on boosting entrepreneurship.

Public participation is considered a fundamental and cross-cutting element of the integration programmes, with participatory management working groups proving to be an effective tool for the inclusion of residents' perspectives throughout the entire design and implementation process of the integration initiatives. In addition, participation in the design of their future housing is a decisive element to promote people's ownership and achieve their sustainability and self-development.

The city is concentrating on two of the largest low-income neighbourhoods: Barrio 31 (Neighbourhood 31) and Barrio 20 (Neighbourhood 20). Here, interventions are being carried out on an unprecedented scale. Other areas also included in this agenda are Lamadrid, Fraga, Rodrigo Bueno, Ramón Carrillo, and 1-11-14.

A sustainable, resilient and inclusive Buenos Aires will be achieved only if the same opportunities are guaranteed to all residents. Hence the reason that the city places such a strong emphasis on talent development and innovation, and its commitment towards gender equality.

Buenos Aires Gender Indicators System

The Buenos Aires City Gender Indicators System (SIGBA) was launched at the beginning of 2018. It collects data on variables concerning the situation of women and men in the demographic, economic, and political fields. The system aims at closing the statistical gender gap, based on the idea that information is essential to intervene through more and better public policies.

As part of the Gender Strategy, SIGBA follows the three gender autonomy dimensions and its design includes all major stakeholders — government, civil society, the private sector, and academia.

Image: Buenos Aires City Government

Buenos Aires City Government working with women fron Barrio 20 to conduct participatory mapping focused on gender and mobility

Image: Buenos Aires City Government

Cancha 9 is a public sports centre located in Barrio 31 that includes an open football stadium, a basketball court, a skating area and a children's playground. Since its inauguration in 2017, it has become the favoured spot for enjoyment and socializing in the neighbourhood

Image: Buenos Aires City Government

New sustainable housing units in Barrio 31

The digital revolution and automation have already started to drive changes in the labour market and further advances of these trends should be expected. In this context, Buenos Aires is moving to change the education model to anticipate these challenges and equip students with the skills demanded by the jobs of the future. In order to accomplish this, the city has developed Secondary Schools of the Future, an integral approach that includes: changes in the curricula and class dynamics, focusing on soft skills and competencies (problem resolution, collaborative work and critical thinking); the incorporation of new technologies; new training programmes for teachers; and building and redesigning schools' infrastructure.

Since Buenos Aires' main asset is its human capital, the city has developed programmes to foster entrepreneurial and innovative talent for its economic development. These include Academia BA Emprende (BA Entrepreneur Academy), a free training programme focused on the development of entrepreneurial skills, and IncuBAte, an incubator that provides customized support, financial assistance and the possibility of accessing a workspace.

Development opportunities necessarily reference one of the greater inequalities of our society — gender. More than half of Buenos Aires' inhabitants are women (54 per cent) and, although they have a higher presence and degree of education, only 50 per cent of working age women actually work.[1] Furthermore, women have fewer senior positions and leadership roles than men.

Achieving gender equality and empowering all women and girls (SDG 5) is fundamental to a sustainable and resilient city, so that women can enhance all of their talent and contribute to the city's development. To accomplish SDG 5, the BA Gender Equality Comprehensive Strategy has taken the conceptual framework of the three gender autonomy dimensions of the Economic Commission for Latin America and the Caribbean: physical, economic, and decision-making. These are interconnected since the capacity of generating their own income makes women less vulnerable to violence and more likely to share unpaid care and domestic work which will result in more participation in the public space, including the labour market.

The city is therefore committed to work for gender equity in the labour market working on public-private initiatives to close the gender pay gap and promote the access of women to decision making positions. Likewise, GCBA has amended the parental leave system for government officials to favour the distribution of care work.

Buenos Aires City has also implemented a public policy set to end gender violence, including a specialized brigade with 300 agents for the detection of gender violence, and the creation of women's police stations where victims can safely report abuses and receive counselling.

Buenos Aires is working on a series of initiatives to foster a more integrated, sustainable and resilient city for all residents, aligned to the 2030 Agenda for Sustainable Development. Through them, the city seeks to be integrated, aware of its challenges and willing to adapt — a city that, with innovation, is able to anticipate future events, and that is committed to gender equality, diversity, and sustainability.

Urban waterlog monitoring and warning — enhancing a city's resilience against climate change

Li Na; Wang Jing; Wang Yanwei; Mengyuan, China Institute of Water Resources and Hydropower Research (IWHR)

The rate of urbanization in China has increased from approximately 18 to 58 per cent over the four decades since the nation adopted its policy of economic reform and opening up, concentrating a large amount of people and assets in cities, and bringing huge pressure to bear on storm water management. Due to global climate change, there have been increasingly frequent occurrences of urban waterlogging caused by rainstorms in recent years, seriously affecting production and other routines in the cities, and causing significant financial losses. Adapting to climate change and enhancing a city's resilience therefore remains a major challenge in urban storm water management.

The conditions of the region

Foshan Municipality is located at the centre of the Pearl River Delta at the convergence of the West and North Rivers. There is reasonably heavy rainfall in the region because of its humid subtropical monsoon climate, with a multi-year average annual precipitation of 1,614.2 mm and maximum 24-hour precipitation of 279.8 mm (observed on 23 August 1999). Over 80 per cent of annual rainfall is concentrated in the flood season from April to October. In the early season, from April to June, precipitation is mostly due to frontal rainstorms that are usually lasting and extensive, while in the late flood season, from July to October, rainfall is mostly brought by typhoons, bringing the possibility of a maximum flood peak over the average volume or even a flood and waterlogging disaster.

Within the 80 km^2 of Foshan bounded by the Tanzhou, Pingzhou and Fenjiang rivers, there are over 60 inner rivers in addition to underground drainage pipelines, regulation lakes, sluice gates and pumping stations, all of which constitute the city's drainage system. At the time of writing, the drainage capacity of the newly developed urban area has an approximate five-year return period, while the old urban area could only stand up to a one-year event due to outdated drainage pipelines with their small diameter.

Although the river network could increase the city's storm water storage and regulation capacity by pre-drainage, the siltation of inner rivers coupled with insufficient pumping capacity, the clogging of the drainage pipeline network and the low-lying nature of some areas, still has the possibility of weakening the efficiency of drainage within the urban area. In case of local heavy rainfall, in particular, many places of the city will be inundated.

The monitoring and warning of rainfall and waterlogging

Real-time monitoring and forecast of rainfall and flood

In order to enhance the city's capacity to combat rainstorm waterlogging, Foshan Municipality has carried out many constructive trials on monitoring and warning systems. The Foshan Hydrological Bureau has built 10 real-time water gauges, 18 rainfall monitoring stations and 23 waterlogging monitoring stations on outer river channels, inner rivers, sluice gates, and pumping stations respectively. The local meteorological bureau has developed a quantitative rainfall forecast system based on radar monitoring that can predict the volume of rainfall over the following three hours, every six minutes, at a resolution of 1 km × 1 km. In this way, valuable information related to urban waterlogging can be fully sensed and managed with advanced monitoring and forecast technologies.

A warning system for urban waterlogging

The China Institute of Water Resources and Hydropower Research (IWHR) and Foshan Municipality have jointly developed a numerical model and warning system for waterlogging prediction, built on hydrology and hydraulics. Based on GIS and database technologies, with a simulation model as the core module, the system can make real-time analyses and calculations and predict the possible waterlog depth in low-lying areas, specifically in over- and underpasses, underground garages and malls. It does this by coupling with radar-measured quantitative rainfall prediction data and by correlating with the database of real-time automatic rainfall gauges, the real-time river regime database and the flood prevention and drainage project database.

The system comprises five modules including historical waterlog information, real-time monitoring, waterlogging warning analysis, warning information management and system management based on various functions as follows:

- **Historical waterlogging information**, which shows the location of inundation dots registered over the years in the Chancheng area of Foshan Municipality, including inundation coverage, maximum inundation depth, reason of inundation and countermeasures or planned actions
- **Real-time monitoring**, which can show information on meteorology, precipitation and the water regime along with the respective historical data
- **Analysis of waterlog warning**, which, according to the various calculation methods and rainfall data used, is categorized into four types, including analysis for auto-

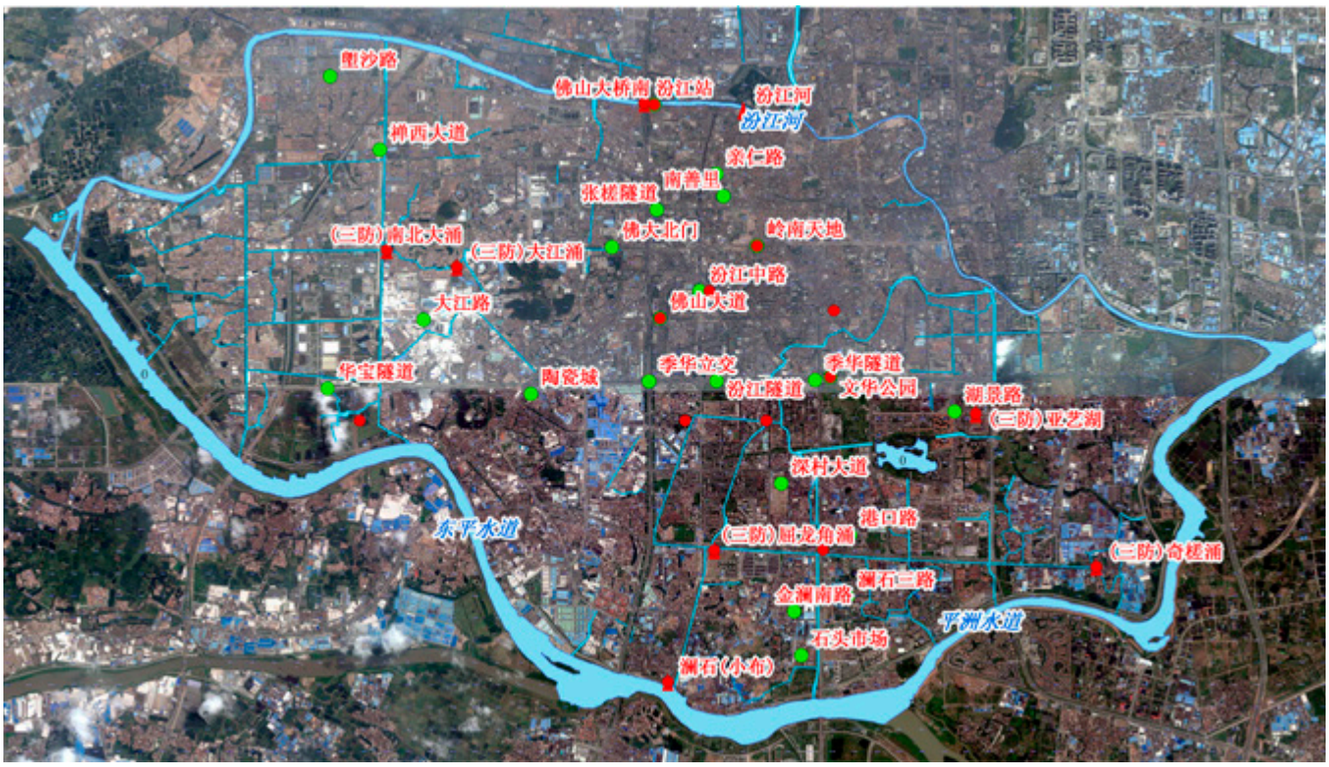


Image: IWHR

Distribution map of monitoring stations in Foshan

matic warning, real-time prediction, historical events and designed scenarios. The analysis of automatic warning is a comprehensive judgment based on both observed and radar-measured rainfall data. The conditions for judgment are:

- When the observed rainfall at all gauges over the past three hours is 0 mm and while the predicted rainfall at all radar measuring points for the first, second or third hours is also 0mm, the model will not initiate and hence no warning signals released
- When the observed rainfall at any of the gauges over the past three hours is over 5 mm or the predicted rainfall at any of the radar measuring points for the first, second or third hours is over 5 mm, the model will be initiated and operate once every other hour to demonstrate the warning result. It will stop operating until it reverts to the condition above.
- When the observed rainfall at any of the gauges over the past three hours is over 20 mm or the predicted rainfall at any of the radar measuring stations for the next first, second or third hour is over 20 mm, at which point the operation frequency of the model will be increased to once every half hour.

The above mentioned threshold rainfall values for initiating the model are defaults of the system that can be revised or reset by customers in the system management module.

The distribution result of waterlogging caused by heavy rainfall consists of information from key agencies and utilities, maximum waterlog depth distribution in the grid, dynamic display of waterlogging process in each grid, maximum waterlog distribution on roads, and dynamic display of waterlogging on roads. Using this module, the departments of hydrology and flood prevention are able to rapidly check the distribution of waterlogging under various rainstorm conditions and with different regulations of flood prevention and drainage projects, to arrive at a quantitative understanding of waterlogging in the urban area.

Warning information management

Based on the default corresponding relationship between the range of water depth and the warning grade, the warning for important utilities and road sections is decided and issued, together with an automatically formulated briefing that includes a rainfall overview, analysis results of waterlogging, a location map of rainstorm waterlogging and warning suggestions. The briefing can also be generated in a .doc format that serves as a sound reference with which flood control decision makers can quickly and comprehensively understand the scope of a rainfall-induced waterlogging event.

System applications

Based on analysis results from the waterlogging prediction model, Foshan city issues warning signals for important utilities and road sections in the urban area according to the waterlogging depth classes as follows:

- **Class Blue**: issued when main roads and low-lying areas in Chancheng district begin to witness waterlogging. The water depth in certain road sections and low-lying areas (in four or more waterlogging monitoring stations) may reach or have reached between 10 and 25 cm
- **Class Yellow**: issued when certain sections of main roads and low-lying areas in Chancheng district (in three or more waterlogging monitoring stations) may have witnessed water depth of between 25 and 50 cm

Image: IWHR

Web capture from the Foshan urban area waterlogging warning system

- **Class Orange**: issued when certain sections of main roads and low-lying areas in Chancheng district (in two or more waterlogging monitoring stations) may have witnessed water depth of between 50 cm and 100 cm
- **Class Red**: issued when certain sections of main roads and low-lying areas in Chancheng district (in one or more waterlogging monitoring stations) may have witnessed water depth of over 100 cm.

Since its operation in 2013, the Foshan urban area waterlogging warning system has been applied to the warning analysis of several large rainfall-induced waterlogging events. It has issued 65 warning signals — four orange, 19 yellow, and 42 blue. The system enables the Foshan city hydrological department to send warnings to Foshan municipal flood control department, traffic radio broadcast stations, household communities, 110 hotlines and those responsible for street block drainage through a notice platform. Also, messages are displayed on outdoor screens so that the public is cautioned against waterlogged areas, the subway management department gains lead time to set up flood control facilities, and underground garages can raise shields or stack sandbags in advance.

The early-warning messages effectively mobilize the community to adopt self-protection and self-rescue measures so as to minimize casualties and economic losses. Acknowledged for its fast response time, accurate and reliable monitoring data, and calculation accuracy of most waterlogged locations that satisfy the warning requirements, the system has improved decision making and provided technology support to bolster local flood warning and contingency regulation, and is credited for gaining critical lead time in waterlog prevention, winning high regard from local government agencies. Approximately US$ 25 million of economic losses have been avoided.

Image: IWHR

Image: IWHR

Hydrological monitoring stations in Foshan

Managing the impacts of urban development on waterbodies in New Zealand

Jonathan Moores, Urban Aquatic Scientist, National Institute of Water and Atmospheric Research Ltd, New Zealand

As with most settlements throughout the world, New Zealand's cities have been established next to streams, rivers and harbours. Urban New Zealanders have a strong economic, social and cultural connection with natural waterbodies, making extensive use of them for recreation, industry, transport, trade, fishing and tourism. Auckland's Waitematā Harbour and Christchurch's Ōtakāro Avon River, for instance, are iconic waterbodies that contribute strongly to the identity of the largest cities in New Zealand's North and South Islands, respectively.

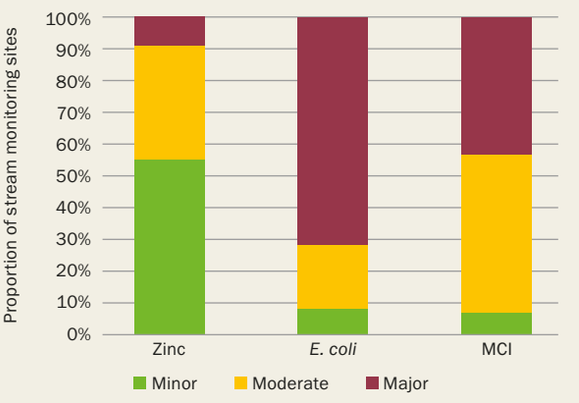
However, there is substantial evidence that historic urban development in New Zealand has resulted in the degradation of the waterbodies beside which the cities were founded. Monitoring shows that urban waterbodies tend to have the worst water quality in the country. Levels of ecotoxicants and microbial contaminants are often high: for example, in many urban streams, zinc concentrations exceed guidelines over 50 per cent of the time, while concentrations of *E. coli* bacteria routinely fall within the lowest band of the national water quality grading system. Many coastal water bodies in urban areas have suffered from increased rates of sedimentation, reduced ecological health and a growing unsuitability for recreation and the harvesting of shellfish. For Māori, New Zealand's indigenous people, the decline of urban waterbodies, in combination with a loss of access, has impacted the relationships between communities and waterways that have endured over many generations.

Te Ao Māori and urban waterways

From the perspective of *Te Ao Māori* (the Māori world view), *Te Hauora o te Wai* (the health of the water) is fundamental to *Te Hauora o te Tangata* (the health of the people). Urban development has impacted on the ability of Māori communities to exercise *kaitiakitanga* (guardianship) of many waterways, considered living entities gifted from *ngā Atua* (supreme deities). The effects of development have depleted the fundamentally important concept of the *mauri* (life force) of many urban waterways, with *wai-māori* (unrestrained water that is safe for consumption and sustains life) receiving *wai-kino* (water affected by pollution that has the potential to harm life) and consequently degraded to *wai-mate* (dead water — water that is unable to sustain life).

The practical expression of these changes is seen through impacts on a wide range of traditional practices, especially the harvesting of resources such as wild foods and plants where stocks have been depleted or lost or where discharges of wastewater and stormwater make wild food consumption and recreation unsafe and subject to *tapu* (cultural prohibition).

Indicators of urban stream water quality and ecosystem health



Source: New Zealand local government State of the Environment monitoring data (J. Gadd)

The proportion of stream monitoring sites showing minor, moderate or major difference from baseline environmental quality based on: (a) median dissolved zinc concentrations <95% species protection guideline value (minor), 80% – 95% species protection guideline value (moderate), >80% species protection guideline value (major); (b) E. coli concentrations meeting national 'A' or 'B' grade (minor), national 'C' or 'D' grade (moderate), below national bottom line (major); (c) median stream macroinvertebrate community index (MCI) scores of >100 (minor), 80 – 99 (moderate), <80 (major)

The impacts of urban development reflect the combined influences of changed land cover and hard engineering approaches to the management of stormwater and wastewater. Urban areas are typically characterized by having a high proportion of impervious land covers, such as concrete, asphalt and roofing. They also feature highly modified drainage systems, typified by piped stormwater networks discharging to channelized water ways. In combination, the modification of the land surface and the reticulation of drainage has resulted in the increased generation and rapid discharge of stormwater during rainfall events. As well as causing increased rates of stream flow and erosion, stormwater carries a range of contaminants. High traffic volumes and materials such as galvanized steel used to clad buildings generate heavy metals and hydrocarbons. The exposure of areas of bare earth during construction can result in elevated sediment generation. In some locations, especially older parts

Image: J. Moores

Waitematā Harbour, Auckland

Image: M. Flanagan

Ōtakāro Avon River, Christchurch

Image: J. Moores

Contemporary urban development in New Zealand

Image: J. Moores

Highly modified urban stream channel

of New Zealand cities that feature combined sewer systems, stormwater ingress into the wastewater network also generates overflows of untreated wastewater that carry elevated concentrations of human pathogens. Central Auckland, for instance, experiences regular wastewater overflows at over 100 locations during heavy rain, with consequent public health implications. Exacerbated by the direct modification of waterbodies, for instance the piping and channelizing of streams, the various hydrological and water quality impacts of urbanization have also resulted in a loss of biodiversity in urban water bodies. Around half of urban streams monitored for their invertebrate communities have been assessed as having poor ecosystem health.

New Zealand is currently experiencing a period of rapid urban development, primarily driven by a growing population. For instance, Auckland's population is projected to increase from its current 1.5 million to between 1.8 and 2.5 million by 2041, requiring the construction of up to 400,000 new dwellings. In Christchurch, the effects of the devastating earthquakes in 2010 and 2011 have compounded the effects of growth, resulting in a major construction programme involving both the regeneration of the central city and the expansion of peri-urban suburbs and satellite towns.

These development pressures coexist with changing societal aspirations to improve the liveability of New Zealand cities, which are home to 86 per cent of the country's population. Strong growth in the housing market in recent decades has exceeded increases in incomes, resulting in growing concerns over housing affordability and, recently, government intervention in the construction sector. At the same time, New Zealand communities have become increasingly engaged in a national debate over water quality and, especially, the decline in the swimmability of many of the nation's rivers and lakes. Aspirations to improve, or at least maintain, water quality have been recognized through the legislation of the National Policy Statement for Freshwater Management (NPS-FM). For urban authorities, addressing the legacy effects of historic development on urban waterbodies while accommodating a growing population in an affordable way represents a significant challenge. A transformational change to urban development practices is required if the further degradation of urban streams, rivers and coastal areas is to be avoided.

Water Sensitive Urban Design (WSUD) is an alternative to conventional forms of urban development. Known elsewhere by terms such as Low Impact Design (LID; North America), Sustainable Drainage Systems (SuDS; UK) and Sponge Cities (China), it has gained increasing international recognition in recent years. While, to some extent, the practical application of WSUD varies in response to regional and national drivers, it broadly involves the integration of urban land use planning

and water management in order to better manage water quality, hydrology, water supply security and amenity values of waterbodies. The application of WSUD in New Zealand has been primarily driven by requirements to manage the quantity and quality of stormwater run-off from residential development and road construction projects. This reflects international research that has shown that WSUD can reduce levels of stormwater contaminants and peak flow rates by 80 per cent or more.

WSUD projects contrast with conventional approaches to stormwater management through a combination of the following three characteristics. Firstly, WSUD aims to limit stormwater run-off and contaminant generation at source by minimizing the construction of impervious surfaces, such as roads and roofs. This can be achieved, for instance, by building clusters of multi-storey dwellings, allowing a larger area of vegetated land cover to be left undeveloped. Secondly, WSUD aims to maintain the functioning of natural drainage systems, rather than replacing stream networks with piped systems. In combination, these practices aim to maintain hydrological characteristics, including infiltration, groundwater recharge and stream flow, that more closely resemble the natural water cycle. Thirdly, WSUD uses green infrastructure to better manage stormwater in a way that complements its approach to land use planning. The use of permeable paving, for instance, helps to promote infiltration and reduce stormwater run-off from car parks and roads. Green roofs detain and evaporate rainwater that would otherwise be rapidly discharged from building roofs to the stormwater network. Bioretention systems, or raingardens, also provide for run-off control while providing treatment to improve stormwater quality via the removal of contaminants as stormwater infiltrates through an engineered soil media. Constructed wetlands also provide stormwater treatment and run-off control, as well as providing habitat and amenity services.

While the potential role of WSUD in the water supply and wastewater sectors and in relation to wider contributions to urban liveability have received little attention in New Zealand, other benefits of the approach that are recognized elsewhere are likely to become of increasing significance as the climate changes. In Australia, for instance, a key focus of WSUD has been to provide an alternative water supply to enhance drought resilience. In Denmark, WSUD has been a central feature of the response to flooding caused by extreme rainfall events. Internationally, WSUD is also recognized for a wide range of other benefits that contribute to the well-being of urban communities, for instance through contributing to urban cooling, carbon sequestration and connectedness with nature.

While there are examples of WSUD in New Zealand, recent research for the Building Better Homes Towns and Cities National Science Challenge has found that widespread adoption is hindered by a range of significant barriers. A leading concern among the development and water management sectors is the challenge in making a business case. WSUD is perceived to be more expensive than conventional development, particularly in relation to the costs associated with the maintenance of green infrastructure. On the other side of the ledger, understanding and quantifying the full benefits of adopting WSUD approaches is a challenge, partly due to a lack of precedents in New Zealand. Planning rules have been found to lack clarity and offer inadequate incentive to adopt WSUD over conventional development approaches. A lack of industry capacity and connectivity across design, construction and operational roles has led to inadequate consideration of maintenance requirements at the design stage. This has, in some places, led to the delivery of suboptimal green infrastructure that, when accompanied by a high maintenance burden, has exacerbated an institutional aversion to WSUD in some water management agencies.

Image: R. Simcock

Green roofs are one instance of green infrastructure used to manage stormwater in Water Sensitive Urban Design

Image: J. Moores

Image: J. Moores

Raingarden (top) and constructed wetland (above) — two examples of green infrastructure used to manage stormwater in Water Sensitive Urban Design

New Zealand researchers are currently investigating and publicizing examples of projects that demonstrate how WSUD can be a cost-effective, low-maintenance alternative to conventional development approaches. These include the Kirimoko Park subdivision in the town of Wanaka, an area currently experiencing rapid urban development. In addition, learning from the experience of cities overseas is playing a crucial role in understanding the factors that have contributed to the successful implementation of WSUD elsewhere. In the case of the Australian city of Melbourne, for instance, success has been founded on strong leadership and collaboration across public agencies, supported by a significant investment in providing financial incentives, capacity-building and the research and knowledge sector.

There is a growing recognition in New Zealand of the convergence between approaches to water management founded in a sustainable development ethic with long-established Māori concepts and practices that recognize communities as kaitiaki (guardians) of the earth's resources. The way forward to greater adoption of sustainable development and water management practices may therefore lie in the emergence of a uniquely Aotearoa New Zealand blend of WSUD — one that better aligns water management objectives with recognizing and providing for the values of Māori, to deliver multiple benefits for urban communities as a whole.

Water Sensitive Urban Design in practice

Kirimoko Park is a 12 ha subdivision in the town of Wanaka, an area of outstanding natural beauty located in New Zealand's Southern Alps. The subdivision was conceived as a sustainable residential development project, with property owners subject to a code governing matters such as building size, materials and energy use. The development features a reduced construction footprint and lower level of imperviousness than neighbouring subdivisions — through the building of narrower roads and footpaths — and uses grass swales and raingardens to manage stormwater.

This design approach avoided many of the costs associated with constructing a conventional piped drainage system. Additionally, the use of green infrastructure provides a superior level of stormwater treatment, making it a more cost-effective approach to land development. The green infrastructure has used plants that perform well in Wanaka's environment, including many native species that contribute to the natural character and biodiversity of the area.

Image: J. Moores

Kirimoko Park, with grass swale for managing stormwater

Towards connected sewerage in main cities — the Malaysian experience

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Ir. Syed Jaafar Idid Syed Abdyllah Idid, Director General; Noor Zarina Mohd Nazir, Principal Assistant Director, Strategic Planning Division; Jamey Ngedat, Assistant Director (Regulatory), Sewerage Services Department Sarawak.
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Malaysia is a constitutional monarchy comprising 13 states and three federal territories. Until 1994, sewerage services throughout the country were under the jurisdiction of local authorities. The Sewerage Services Act 1993 (SSA 1993) was enacted, enabling the Malaysian federal government to assume full responsibility and authority over the development, management and control of sewerage services in Peninsular Malaysia, necessitating the establishment of the Sewerage Services Department. In 1994, the Indah Water Konsortium (IWK) signed a concession agreement with the federal government to take over the operation and maintenance of public sewerage systems.

Due to the need to reform and integrate the water supply services and sewerage services industry, the Water Services Industry Act 2006 was established, repealing SSA 1993. A new entity, the National Water Services Commission was established as a regulator for both services in Peninsular Malaysia and the Federal Territories. Meanwhile, authority over sewerage services remains with the respective state governments, under the Sewerage Systems and Services Ordinance 2005 for Sabah, and the Sewerage Services Enactment 2017 for Sarawak.

During the formative years of independence, the sewerage system was predominantly primitive. However, as concern over public health grew, modern systems such as individual and communal septic tanks, Imhoff tanks, oxidation ponds and aerated lagoons were introduced by the government. Prior to the turn of the second millennium, while Malaysia continued to address environmental and sustainability issues, many mechanized plants were constructed. There are currently over 6,700 sewage treatment plants with a pipeline network covering 19,134 km, primarily in Peninsular Malaysia. IWK and other sewerage operators provide services in urban areas, but it is important to note that there is still dependency on primitive systems in some parts of Malaysia, mainly in rural and remote areas.

The Eleventh Malaysia Plan: increasing connected sewerage coverage in main cities, aims and implementation

With an increasing number of people migrating from rural to urban areas, the emphasis is on addressing significant problems related to urban services including utilities and waste management. In the Eleventh Malaysia Plan, the network of small and inefficient sewage treatment plants continued to be rationalized through the construction of regional and centralized sewage treatment plants (CSTPs) with larger capacities and efficient technologies, built in areas with sufficient demand. In areas where such plant is infeasible, existing treatment plants will be upgraded with new mechanical and electrical components to ensure effluent discharge complies with environmental standards. With investment of more than US$ 2.4 billion since 2011, the coverage of connected sewerage services is expected to reach 80 per cent by 2020, especially in main cities.

Increasing urban sewerage coverage through centralized sewage treatment facilities

To meet the target, Malaysia continues to increase the number of CSTPs in major cities nationwide. CSTPs are more compact, require a smaller footprint of land, and thereby reduce the number of small, ineffective and uneconomical sewage treatment plants. The areas targeted for CSTPs include state capitals, tourist hotspots, high density areas and water intake areas. Up until 2018, Malaysia achieved more than 80 per cent of connected sewerage coverage nationwide, a significant achievement compared to 66 per cent in 2010.

CSTPs were built with the aim of reducing operational and maintenance costs while ensuring the quality of effluent discharged to the water bodies complies with the Environmental Quality Act 1974. The rationalization of small and inefficient plants frees up land for redevelopment.

CSTPs change the landscape of Malaysian cities. These upgraded or newly built plants have transformed oxidation ponds and aerated lagoons, previously eyesores, into

Image: Indah Water Konsortium

Panoramic view of the Pantai 2 Sewage Treatment Plant

Pantai 2 sewage treatment plant: the first of its kind

Construction of the Pantai 2 Sewage Treatment Plant (P2STP) began in July 2011 and was completed in July 2015. The plant is located in a highly populated segment of Kuala Lumpur, covering the central and south-western part of the capital city. It is a landmark project featuring underground facilities with an above ground public park and recreational facilities for the public, the first of its kind in Malaysia.

This 12 ha state-of-the-art mechanical plant replaced a series of huge oxidation ponds. With this massive upgrading effort, P2STP can treat sewage more efficiently and cost-effectively using a biological treatment system, the Advanced Anaerobic Anoxic Oxic. The plant treats sewage from the Pantai catchment area and can accommodate an inflow of 1.4 million Population Equivalent.

The plant also features green technology elements including rainwater harvesting, bioeffluent and biogas reuse, a wastewater source heat pump and solar panel for electricity generation, contributing US$ 1.5 million annual savings of operating budget. The technology behind P2STP also supports Malaysia's aspiration towards a circular economy. The operator of the plant, IWK, has embarked on a journey to expand its expertise into 'waste-to-wealth' initiatives, focusing on the recovery of renewable resources and commercialization of wastewater by-products such as bioeffluent, biosolids and biogas from P2STP and other similar plants.

Since the plant's completion, the residents within its vicinity have benefitted immensely. The view of massive oxidation ponds and the regular smell are now gone. Today, these residents enjoy a view of the plant as well as the recreational area, Pantai Eco Park, which includes sports facilities and public amenities including a football pitch, badminton courts, jogging track and community hall. The effect on the local economy can be seen by the increase in property value in the area as well as job creation opportunities for residents.

attractive city landmarks, with a significant reduction in the public nuisance caused by foul odour emitted from those areas. Plant facades have been blended into the surrounding environment, and some include public amenities and sports facilities for public use. Green technologies such as solar panels and biogas reuse for electricity generation have been introduced as new features of the CSTPs, with a significant increase in the property value in surrounding areas.

Image: Indah Water Konsortium

Sports facilities, jogging track and community hall at Pantai Eco Park

Challenges and lessons learned

For Malaysia, delivering effective and efficient sewage services to support urban growth has been met with challenges:

- Choosing the right technology: Sewage treatment technology evolves rapidly, with the frequent introduction of new technology. Choosing the right technology during the planning of a new CSTPs requires thorough evaluation. It must consider the suitability of the components for local conditions, including weather and the main water pollutants. Most conventional systems use physical, chemical and biological processes, are capital and energy intensive, and require complete overhaul after 25 to 30 years in operation, at enormous cost. Choosing the best technology available, that is also economical and cost-effective in the long term, is very challenging.
- Engagement with local residents: Development of new CSTPs in highly populated and mature cities is not easy. The communications strategy during pre-construction, construction and post-construction periods needs to

Getting connected: Kuching centralized sewage treatment plant, phase 1

Located in Sarawak (the land of hornbills), the Kuching CSTP project covers a catchment area that is fully developed and densely populated. Phase 1 of the project was constructed on an 11 ha site. The plant was designed for 100,000 PE but has sufficient land for future expansion up to a maximum capacity of 400,000 PE through a total of four treatment plant modules. The collected wastewater is treated using an activated sludge system and discharged into a constructed wetland before it finally flows back into the Sarawak River, complying to environmental standard requirements.

The number of premises successfully connected under Phase 1 of the project is remarkable, with 66,253 PE recorded from 67,000 PE targeted. This figure was achieved through an effective communication strategy through which the public was informed of the benefits of centralized sewerage systems through website postings and periodic press media releases that took place before the project implementation stage. During the construction stage, a visit to each property owner was made to explain the sewerage treatment plant project as a whole, with a briefing on the scope of connection works to be carried out and the project's duration. The process involved several rounds of consultation to reach an agreement.

Image: Sewerage Services Department Sarawak

Image: Sewerage Services Department Sarawak

Top: CSTP project engagement with community representatives. Above: Door-to-door consultation with local business owners

address any public grievances. Complaints and objections to the projects need to be handled effectively through engagement with local residents, businesses, the media and other stakeholders. All stakeholders are informed of the progress of projects to minimize distress during construction periods.

- Land acquisition issues: In Malaysia, CSTPs can be built only on government land, the same as other public sewage treatment plants. Therefore, upgrading or constructing sewerage assets must first secure an area that can accommodate the scope of the project, with substantial consideration of the social impact. For projects that involve the resettlement of squatters and the procurement of private land, measures undertaken involve delicate negotiations with affected parties, with financial implications especially for land compensation and relocation works. These issues, if not properly handled, will affect project timelines.
- Ensuring connectivity to the public sewer line: The large capacity and advanced CSTPs, built to cater for the estimated Population Equivalent (PE) of catchment areas, will not be fully optimized if property owners are reluctant to connect to the main sewer lines. This aspect is always challenging, especially with the presence of on-site treatment facilities in their properties, and with financial implications for connection works and conflicts on legal requirements. Using success stories from some installations, an integrated strategy on property connection to CSTPs must be formulated prior to and during the implementation of the projects. Without connection and sufficient flow from the intended areas, the plants will be under-utilized, and delivery of sewerage services to the public will fail to be as inclusive as it should be.

Looking to the future

Relatively good progress has been made so far and, with the objective of providing more environmentally sustainable living conditions in cities and the rest of the country, the government is scaling up efforts to increase compliance with the Environmental Quality Act 1974 in terms of effluent discharged to receiving water bodies mainly from the sewage treatment facilities. Success requires a change of mindset and behaviour towards water and environmental sustainability at all levels of society. Business re-engineering in managing wastewater is also desirable to help address overdependency on expensive systems.

The potential of a bioengineering approach to treating wastewater, such as constructed wetlands, will be explored and considered in the future for its cost-effectiveness to treat pollutants and provide a variety of other typical ecosystem functions such as wildlife habitat, water storage and management, recreation, landscaping and greening the built environment.

Meeting sustainable city targets: Bunus centralized sewage treatment plant

The Bunus CSTP project is part of the Greater Kuala Lumpur initiative to rehabilitate and clean a 10 km stretch of the Klang River, known as the River of Life project. The project aims to transform an area within Kuala Lumpur city centre facing the river into a vibrant waterfront with high economic and commercial value.

Bunus CSTP has helped to reduce the amount of sewage pollution that enters the river. The facility can accommodate sewage inflow of 750,000 PE generated by the Bunus sewerage catchment. Constructed on 9 ha of land using the concept of reuse, recycle and recover, it comprises a compact Sequential Batch Reactor activated sludge treatment system. It is also complemented with sludge treatment facilities comprising anaerobic sludge digester and sludge dewatering facility, as well as a methane gas harvesting and collection system for power generation. An advanced treatment system using membrane filtration is provided to further polish the treated effluent, achieving a more stringent effluent discharge standard and improved river water quality.

Awarding scientific innovation in water research to achieve sustainable cities and communities

Abdulmalek A. Al Alshaikh, General Secretary, Prince Sultan Bin Abdulaziz International Prize for Water

The Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW) is a leading scientific award that focuses on innovation, and is offered every two years. Since its establishment in 2002 by HRH Prince Sultan Bin Abdulaziz (1930–2011), PSIPW has given recognition to scientists, researchers and inventors around the world for pioneering work that addresses the problem of water scarcity in creative and effective ways.

Even though PSIPW is a prize dedicated to water, much of the award-winning work is directly relevant to SDG 11, "making cities and human settlements inclusive, safe, resilient and sustainable." Many of the prizewinners have made substantial contributions to our understanding of urban water management and the particular needs of water users in urban environments.

PSIPW offers a suite of five prizes, covering the entire water research landscape. The Creativity Prize, worth US$ 266,000, is awarded for cutting-edge interdisciplinary work that can rightly be considered to be a breakthrough in any water-related field. There are also four specialized prizes, each worth US$ 133,000 — the Surface Water Prize, Groundwater Prize, Alternative Water Resources Prize, and the Water Management and Protection Prize.

Large-scale water management systems for massive urban needs

In 2014, Dr. William W-G. Yeh of UCLA won the Water Management and Protection Prize for pioneering the development of optimization models to plan, manage and operate large-scale water resources systems throughout the world. His methodology, and the algorithms he developed for the real-time operation of complex, multiple-purpose, multiple-reservoir systems, have been adopted in a large number of countries and their cities, including the United States, Brazil, Korea, Taiwan and the People's Republic of China.

Water needs of a desert city

In 2008, Dr. Patricia Gober won the Water Management and Protection Prize as co-director of the Decision Centre for a Desert City (DCDC) at Arizona State University, for work at the forefront of integrating physical and social science into a decision support system for enhanced water planning in an urban, desert region, with proven results. DCDC successfully engages with the daunting challenge of managing water in the face of climate change by introducing a new kind of scientific enterprise — one that includes social and policy scientists along with climate scientists, hydrologists, and engineers; one that embodies a holistic system-wide perspective and considers the dynamic interactions between energy and water use; one that facilitates collaboration between decision makers and scientists, and one that is firmly focused on the future. As a "decision centre" her organization asks the "what if" questions, it explores the kinds of decisions that must be made today to avoid future disasters, and it provides strategies that are robust enough to work over a wide range of future climate conditions.

Desert cities, such as Phoenix Arizona, pose particular challenges for urban water management

Predicting floods and protecting coastal cities

Dr. Peter J. Webster of the Georgia Institute of Technology won the Creativity Prize in 2016 for applying his extensive work on ocean-atmosphere interactions and their effects on monsoon strength to provide one-to-two-week lead time forecasts of monsoonal floods that often provoke catastrophic inundations in highly populated coastal regions. By combining weather forecasts from the European Centre for Medium Range Forecasting with a river run-off model to forecast river flow as well as the inundation following the flood "front", he was able to predict, with remarkable accuracy, the floods that have devastated Bangladesh, Pakistan, Thailand, and India over the past several years.

Winners of the Prince Sultan Bin Abdulaziz International Prize for Water, 2018

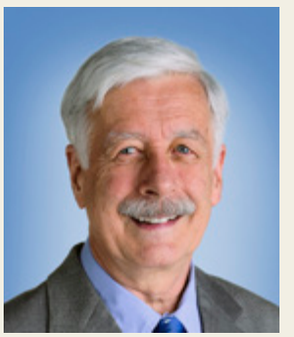
The award winners of the Prince Sultan Bin Abdulaziz International Prize for Water, 2018 were announced on 20 June 2018 at the opening ceremony of UNISPACE+50.

Creativity Prize
Dr. Andre Geim and Dr. Rahul Nair (National Graphene Institute, Manchester University) for developing novel graphene oxide membranes that promise to enable energy-efficient and high-volume water filtration and desalination.

Surface Water Prize
Dr. Wilfried Brutsaert (Cornell University) for developing, demonstrating, and validating a new theory that can generate unprecedented estimates of evaporation from the natural landscape.

Creativity Prize
Dr. Günter Blöschl (Vienna University of Technology) and **Dr. Murugesu Sivapalan** (University of Illinois at Urbana-Champaign) for developing the new field of sociohydrology, a groundbreaking paradigm for water management and a new validated approach for studying the dynamic interactions and bidirectional feedback between water systems and people.

Alternative Water Resources Prize
Dr. Omar Yaghi (University of California, Berkeley) and **Dr. Evelyn Wang** (MIT) for creating a solar-powered device that uses an innovative porous metal-organic framework (MOF) to capture water from the atmosphere.



Groundwater Prize
Dr. Martinus Theodorus van Genuchten (Federal University of Rio de Janeiro) for the development and application of key theoretical and software tools that describe water flow and contaminant transport in the subsurface.

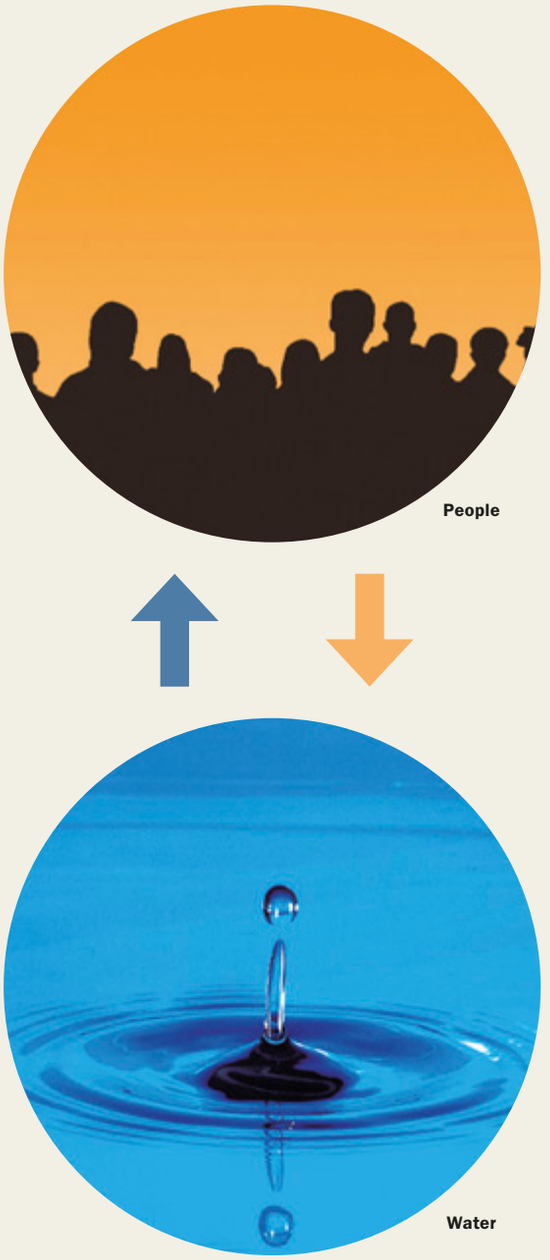
Water Management and Protection Prize
Dr. Jim W. Hall and Dr. Edoardo Borgomeo (Environmental Change Institute, University of Oxford) for developing and applying a new risk-based framework to assess water security and plan water supply infrastructure in times of climate change.

Source: PSIPW

People and water resources, and their dynamics

Dr. Günter Blöschl of the Vienna University of Technology and Dr. Murugesu Sivapalan of the University of Illinois at Urbana-Champaign were awarded the 2018 Creativity Prize for launching a ground-breaking new paradigm to understand the emergent Anthropocene. Named Sociohydrology, this new approach focuses on the dynamic interactions and bidirectional feedbacks between water systems and people by studying the effects of societal actions on hydrology and the effects of hydrological phenomena on societal development.

Sociohydrology — an interdisciplinary field studying the dynamic interactions and feedback between water and people



Source: PSIPW

Through their joint efforts, Dr. Blöschl and Dr. Sivapalan have demonstrated the power of this approach for predicting long-term human-flood dynamics and agricultural land degradation, as well as for addressing many vexing challenges posed by population growth and climate change.

Human Activity and Desertification

In 2010, Dr. Ignacio Rodriguez-Iturbe of Princeton University and Dr. Andrea Rinaldo of the École Polytechnique Fédérale de Lausan in Switzerland won the Creativity Prize for their invention and development of the new field of Ecohydrology which bridges the gap between the physical and life sciences. Ecohydrology is a multidisciplinary research field that draws from the physical sciences and life sciences to provide a unified picture of water-supported biological dispersion. In practical terms, the new research field presents itself as a comprehensive blend of theory (mathematical modelling), interpretation of past and present biological records, and field experimentation. Ecohydrology is a powerful tool in combating desertification, since human activities alter the linkages between climate, ecosystem functioning and water availability in arid lands. Dryland Ecohydrology directly tackles the crucial question of whether human beings cause deserts.

Nominations and awards

Nominations are evaluated by an international panel of distinguished scientists who serve on various committees for each of the five prizes. The nominations undergo a rigorous three-tiered evaluation process, starting with a preliminary evaluation committee, followed by a referee committee, and ending with a final selection committee.

PSIPW's 8th Award ceremony took place at the United Nations Headquarters in New York on 29 October 2018. The initial announcement of the 2018 winners was made by PSIPW Chairman HRH Prince Khaled Bin Sultan Bin Abdulaziz on 20 June 2018 at the opening ceremony of UNISPACE+50. PSIPW has a close relationship with the United Nations Office for Outer Space Affairs (UNOOSA) and a substantial number of PSIPW's prizewinners throughout the years have relied heavily on space technologies to achieve their innovative water management solutions.

PSIPW has special consultative status with the United Nations Economic and Social Council and is an observing member of the United Nations Committee for the Peaceful Uses of Outer Space.

Other PSIPW initiatives

Besides awarding its suite of prizes every two years, PSIPW is active in numerous water-related projects, some of which focus on combating desertification, community development and sustainable agriculture through the restoration and rehabilitation of degraded land. The organization also has a memorandum of understanding with UNOOSA. Among their joint initiatives is the International Conference on the Use of Space Technology for Water Management, held every three years in various countries around the world, and the United Nations Space and Water Portal, an online hub for professionals and organizations working with space technology applications for water-related activities.

Reconciling humanitarian and developmental concerns in the urban environment

Raimond Duijsens, Netherlands Red Cross

While the condition of many slum communities is generally well documented, few of those areas have names of notoriety. Barangay 101 in Tondo, a suburb of Manila, Philippines, is adjacent to an area that was used by the Manila government as a rubbish dump. The rubbish had accumulated, mixed with mud, and solidified into a mound several storeys high. The decaying waste produced methane gas that gave the area the name 'Smokey Mountains'. Sorting and selling the waste was, and is, a viable livelihood for most local residents, many of whom live at the dump site. The work is a key cause of health problems, as methane is a significant air pollutant, and the areas in and around Barangay 101 are regularly flooded, defeating the insufficient water and hygiene facilities.

Several 'garbage avalanches' in the 1980s led the government to create 27 four-storey buildings, named 'Katuparan' or 'dream fulfilment', as a housing solution. The dream did not last long for many of the residents, as rent and basic services became unaffordable. Since its inception the village deteriorated into an unhealthy and highly disaster-prone settlement.

The Philippine Red Cross, supported by the Netherlands Red Cross, has been working for several years to improve the community's health and reduce its vulnerability to disaster. This engagement comes with the realization that urbanization, climate change and the unwanted effects of economic development are reinforcing trends that keep ever more people trapped in vicious circles of poverty, vulnerability and marginalization. It is clear that, rather than being reactive to events, working to strengthen resilience and reduce the risks of disaster and health crises holds both a moral and financial imperative, as prevention is more cost effective, and relief budgets are under pressure.

Image: Philippine Red Cross

The Philippine Red Cross demonstrating the importance of hand washing to the children of Barangay 101

The urbanization of poverty and vulnerability has forced the Red Cross to expand its work to be both more preventive and more 'urban'. Also, working on the causes of risk pulls humanitarian work into the development domain, and requires a different approach. Needs are often wide-ranging and interrelated, and not necessarily all within the mandate, let alone competence, of humanitarian organizations. Also the sense of 'community', usually a given in rural settings, is less evident in an urban context. The step into the world of urban resilience is thus both inevitable and challenging for the Red Cross.

The local challenges

The 1.5 ha area of Barangay 101 officially holds 10,500 inhabitants but, due to the informal and semi-formal nature of much of the settlements, the real number is probably higher. Barangay 101 is situated on the coast, near the harbour — a major source of employment — and the waste sites. The temporary housing, built after the garbage avalanches, was meant to provide a safer habitat for the affected communities. However, plans for permanent housing have never materialized, and the Katuparan buildings, constructed with low-cost materials, are not well-maintained. Alleys between the buildings have rubbish piled several metres high and the long-term residents cannot recall the last time that septic tanks were emptied. Overcrowding makes these residential buildings potential disaster zones. The two schools that cater for Barangay 101 and the neighbouring communities — with 5,000 children admitted — are overcrowded and have, at best, unhygienic sanitary facilities.

Most residents lack access to clean water, and the inadequacy of waste disposal further adds to the health issues. Poor drainage and low-lying riverbanks turn most heavy rainfalls into floods, with climate change a further aggravating factor. Where parts of this barangay, and indeed of Tondo, are sinking, the streets and paths are elevated, contributing to the risk of flooding and clogged drainage. Many diseases are rampant, with children most at risk. Diarrhoea is prevalent, but cholera and tuberculosis also emerge from time to time. Rising average temperatures, another effect of climate change, impact on vector-borne diseases such as dengue.

Image: Philippine Red Cross

Improvised housing in Barangay 101, a suburb of Manila, Philippines, is sited adjacent to an area that was used as an urban rubbish dump

The make-up of the population is rather diverse, with groups of families sharing similar backgrounds. Many of them come from rural areas, in search of job opportunities which they mostly find in the informal sector. Usually both parents are working, and caregivers for their children are often found in the extended family. Undernutrition and food insecurity impact health and livelihood opportunities substantially. Although both primary health care and hospital care are, in essence, free, and insurance should extend to all residents, the reality is that many informal settlers are left uncovered and without access. Additionally, out-of-pocket costs make health care largely unaffordable for many residents. The double burden of disease, affecting many poor people, is particularly visible.

Finally, disasters regularly affect the communities. Many of the poorly built houses cannot withstand extreme weather events. Investment in stronger materials is not often made because of lack of finances, and there is a risk of eviction as many settlements are illegally constructed. Flooding regularly damages houses and affects livelihoods. Drainage is poor, and the already limited capacity of canals is further reduced due to dumped rubbish — a combined effect of irresponsible behaviour and waste collection systems that are both insufficient and uncoordinated. The resulting stagnant water exacerbates health risks. Another major risk is fire, as much of the makeshift housing consists of wood, and the use of fire for cooking and lighting is common practice. Because the dense structures prevent access to emergency teams, any external response is severely restricted.

The Red Cross intervention programme

Although the sheer survival of the community amidst these dire conditions can be seen as a manifestation of its resilience, the reality is that mortality rates are high, diseases keep children out of school and adults out of work, and disasters further prevent prospects for development. Instead, this resilience represents a status quo with high humanitarian needs. While it is recognized that the improvement of these conditions is tied directly to many SDGs, the Red Cross operates from a humanitarian and needs-driven perspective. Its interventions strengthen survival and are, in that sense, only the first step in the community's development.

Either way, the ambitions of the Red Cross intervention programme are high. In considering working within the overlapping fields of water, health, hygiene and disaster, the Red Cross has set out to improve household water and sanitation facilities and practices, provide home-based care for diarrhoea, and initiate systems and structures that anticipate and respond to disasters and public health emergencies and prevent water and sanitation-related diseases. That approach combines hardware (physical construction and commodities) with software (training and awareness). Having been underserviced and largely neglected for many years, the community has welcomed this external interest in and improvement of its living conditions.

To complement its work in the communities, the Red Cross has also reached out to the local government. Despite the informal nature of many settlements, it was acknowledged that eviction would not be feasible, and might even harm the economic functioning of the harbour. Providing services to improve health and nutritional status, and to reduce disaster risks, would therefore not only help Barangay 101 but also benefit the city of Manila, putting less pressure on systems and potentially increasing cost recovery for services such as water and electricity that had thus far been informally and sometimes illegally accessed. The Red Cross also advocated the improvement of disaster services, and urged stockpiling of appropriate non-food items such as oral rehydration solutions, household water treatment chemicals and hygiene kits.

One of the city's water providers has extended its service by installing a communal water supply system that serves the informal settlers. The issue of land ownership remains unsolved, preventing the proposed construction of latrines. Physical space, flood proneness and related health risks have been further complicating factors.

The interventions are accompanied by intensive health, hygiene, nutrition and waste management campaigns, and are complemented by improved services and health centres to address health emergencies. Most campaigns have been designed by community members and include wall painting and songwriting as part of the improvement process. Water storage practices have also been improved to prevent mosquito breeding. Health surveillance has been boosted in order to give timely and effective treatment and to prevent diarrhoea and other diseases. Finally, the Red Cross has worked on improving disaster risk awareness, organized response drills and provided first aid training. School-based committees have been established comprising staff, students and parents, and supported by the Red Cross and local authorities.

Making it work, and learning from the experience

Engagement at Barangay 101 exposed and challenged the Red Cross in its humanitarian methods. The determining nature of in-depth needs assessments and stakeholder mapping appeared stronger here than in post-disaster relief practice. Also, the difference between urban and rural contexts was considerable: the notion of 'community' appeared less uniform, with dissimilar needs for water, sanitation and hygiene in different pockets, depending on status (formal or informal); living conditions (permanent, semi-permanent or temporary); income range; and existing infrastructure (such as water supply, or open spaces for construction). Therefore, a further subdivision of the barangay's needs appeared to be a useful strategy. While the Red Cross' main motivation for engaging were the identified health and water, sanitation and hygiene needs, many community members instead expressed livelihood (income) and food security as their major concern, and therefore extra emphasis on the latter was ensured.

Image: Philippine Red Cross

Since its inception in the 2000s, this village has deteriorated into an unhealthy, disaster-prone settlement

While the densely built areas were already technically challenging, the unresolved issues of land ownership eventually prohibited the provision of the latrines. The most needy places were in the barangay's informal sections, and the government's efforts to clear river banks in order to improve flood management made construction there impossible. Temporary structures were considered as an alternative but were unsustainable as they would carry the risk of decay and would come with high costs for maintenance and desludging.

The resilience approach confirmed the importance of behavioural change to address drivers of risk. Tools have been successfully adapted to the urban context and, as community engagement was not always easy to organize, presented simple and practical solutions that could be easily applied, like for disease prevention. At the same time, tangible results were crucial to retain community motivation — more so because prior engagements with external organizations failed to move beyond the planning stage. The results also stimulated a sense of cohesion that was important for other aspects such as organizing clean-up drives for waste management. Compared to rural contexts, the recruitment and retention of volunteers appeared challenging. However, while some dropped out, the remaining Red Cross' Community Health Volunteers appeared very dedicated and enthusiastic. The success of the programme is largely due to their actions and initiatives.

A Memorandum of Understanding-based engagement with local government enabled access to the various authorities. Some were successful, such as those for waste collection, while others turned into a journey through mandates, interests and responsibilities that are not always clearly marked and aligned, such as those for latrine construction. The active participation of, for example, the Barangay Captain (chairman) in the clean-up drive stimulated community participation. It is believed that local enthusiasm and commitment grew as the programme became established and began to show results. For many Red Cross staff and volunteers, this 'humanitarian diplomacy' with key stakeholders, carried out on the basis of expressed needs by the community, appeared challenging but eventually was applied successfully.

Although only recently concluded, the programme has shown positive results in terms of improved attitudes to sanitation and hygiene, the availability, use and maintenance of water and hygiene facilities, and more adequate treatment of diarrhoea. Health volunteers are now called to assist in neighbouring barangays, and have responded to combat a measles outbreak in early 2019.

Also, risk awareness has improved. The project is a local expression of the opportunities and challenges of the combined global agendas of the SDGs, the Sendai Framework for Disaster Risk Reduction, the Paris Climate Agreement, and the New Urban Agenda. While considered as a pilot programme (data to demonstrate the humanitarian impact are not yet available) it has strengthened the Philippine Red Cross' determination to continue and increase work on urban community resilience as a key future orientation.

Image: Philippine Red Cross

Campaigns for imrpvement have been designed by community members to include, among others, wall painting and songwriting

Rio de Janeiro — modelling the metropolitan area

Luis Firmino Martins Pereira, Architect and Ubarnist; Amanda Ithala Paschoa, Communication, Metropolitan Chamber of Rio de Janeiro

The metropolitan area of Rio de Janeiro has peculiar characteristics, partly because of its historical status as Brazil's capital city up until 1960. The city has had two masterplans — the Agache Plan created in the 1930s, and the Doxiadis Plan in the 1960s. Both of those initiatives were restricted to the Rio de Janeiro municipality, while the wider metropolitan area never had a plan, which is the chief reason for the subsequent unpredictable growth.

After the transfer of the capital to Brasilia in 1960 and the fusion of the states of Rio de Janeiro and Guanabara in 1975, Rio's metropolitan area was finally recognized as such. Until then, as capital city, Rio de Janeiro built a great infrastructure of railways and urban amenities that were all directed towards the city centre, intensifying activities within the central area where 75 per cent of the city's employment and 85 per cent of hospital facilities are concentrated. But that arrangement worked against the interests of the peripheral area where most of the city's population lives but without adequate infrastructure. In the 1980s, the state of Rio created its own Metropolitan Foundation for Development, but that agency terminated its activities after 1989. Since then the city has had no plan or governance programme for the metropolitan area.

The governance process

In 2014, the state government established the Metropolitan Chamber, with the objective of devising the Strategic Urban Development Plan for the Metropolitan Area (PEDUI), and preparing a law to regulate the metropolitan governance process. Despite those intentions, since the initiative was created by an act of the state government, it lacked obligation from the municipalities to participate in decision making. But, in 2015, and according to PEDUI objectives, a legal project was instigated to create an effective governance process, where decisions are to be made through a voting process between the 22 mayors and the city governor. The law was approved in December 2018[1], establishing four significant rules, to:

- Define the extent of the metropolitan region, including the 22 municipalities
- Establish common public concerns, such as sanitation and mobility
- Define a structure with an executive council, a social council and an institutional structure to take care of the necessary processes
- Create a metropolitan fund.

The new law also guarantees social representation in both the executive and social councils. The first intersectoral committees are now being implemented to prepare the policies and projects for the voting decision process in issues such as water supply, sewage collection and treatment, mobility, housing and infrastructure projects.

In terms of sustainable processes, the initiative represents great progress that should see increased efficiency in policy implementation and project prioritization, enacted with transparency and full consent from the population.

The metropolitan plan

The metropolitan plan began in 2016 and was concluded in 2018 with the support of the World Bank. The work of the consultants, Jaime Lerner Architects and Consulting Quanta, was developed together with the Metropolitan Chamber, and structured into four phases: diagnostic; future vision; scenarios; and action programmes.

The process benefited from the involvement of a large number of stakeholders, initially divided into thematic groups such as sanitation and resilience, mobility, economical development, natural and cultural environment; and also by segments such as non-governmental organizations, private sector, university, class organization, government organization and legislation representatives.

The project progressed, holding over 100 workshops with the participation of more than 5,000 people. The principal concerns through those participatory events focused on management and governance of public interests, mobility, sanitation, safety and environment.

Post-project research shows that the metropolitan capital became the centre of economic activities, with the urban areas around the capital working as dormer cities, creating an imbalance in the region. Currently, the metropolitan area — with a total area of 6,700 km^2, and home to 12.3 million people — comprises 22 municipalities which, together, are responsible for 75 per cent of state's GDP, supporting 75 per cent of jobs.

As the Metropolitan Region of Rio de Janeiro has lost its economic strength over recent years, there are marked inequalities both in the relationship between the centre and periphery and in the intra-urban spaces of the more dynamic areas. A case of extreme concentration can be found in the central region of the metropolis, where the main transport hub and the best services are located. Lack of sanitation, environmental degradation, frequent flooding, concentration of transport links, and a housing deficit are some of the effects generated by this model of urban expansion and

socioeconomic development that has widened territorial, economic and social inequalities, creating some of the main obstacles to metropolitan management and planning.

The biggest challenge is the uncontrolled sprawl of urban growth, recorded at 32 km^2 per year over the past 10 years, and mostly making informal use of land.

The vision for the future is one of creating a socially balanced and metropolitan structure, where the inhabitants have a good quality of life, living near to their place of work and having access to urban amenities. In realizing that vision, one of the obstacles to be overcome is the population's lack of self-esteem.

Because of the economic downturn in the state of Rio de Janeiro, the plan is now to focus on improving management in the short term and seeing economic reversal as a long-term challenge. Proposals have been organized into short-, medium- and long-term objectives and actions, with six programmes established to combine 131 separate actions:

- Smart metropolis programme
- Sustainable metropolis programme
- Balanced metropolis programme
- Metropolis programme to inhabit
- Reinventing the bay programme
- Governing metropolis programme.

The proposals have been conceived as territorial rather than sector programmes. For instance, mobility cannot be considered without recognizing how it affects housing or sanitation issues. However, the emphasis on territory creates difficulty for those who want to focus on a specific action for sanitation, mobility, or housing.

The importance of transportation as an instrument of planning is well documented, and it is clear that transport must be used to assist the desired reconfiguration of the metropolis. The slogan "integrating the metropolis from end to end" is useful in understanding the importance of connections between the main metropolitan centres of Rio de Janeiro and Barra da Tijuca, where there is a concentration of activities, in counterpoint to the largely precarious housing spatialization in the metropolitan environment.

To lend more balance to the metropolitan area, the plan suggests an increase in connections between central and subur-

Image: Executive PEDUI Resume. Photo Erika Poleto

View of Guanabara Bay from Rio de Janeiro with Niterói and São Gonçalo in the background

Image: Executive PEDUI Resume – Jaime Lerner's Architecture Office

Plan for a new railway station, creating fresh thinking for the areas around the station in terms of access, pleasure, and comfortable walkability

ban regions, including multifunctional projects in Baixada Fluminense and the eastern metropolitan areas, as well as investments in collective and active transportation instead of in major road works and individual motorized transport.

The promotion of connectivity also includes a friendlier approach to the design of the railway station, in which the concept of transport oriented for development is applied, creating fresh thinking for the areas around the station in terms of access, pleasure, and comfortable walkability.

The new urban territory modelling proposed by the plan introduces three important frameworks:

- A Metropolitan Macrozone
- A Metropolitan Interest Zone
- Metropolitan Assets.

Metropolitan Macrozone

Metropolitan Macrozoning (MZM) is a significant new urban development instrument guaranteed by the metropolitan statute, and seeking to establish the guiding elements of metropolitan territorial planning, considering the principles that underpin proposals for spatial reconfiguration. The MZM initiative identifies the macrozones and outlines general guidelines for land use and occupation, as well as the main metropolitan axes, which receive special treatment. The MZM proposes the planning of large portions of territory that are to be debated and agreed upon with the municipalities that make up the The Rio de Janeiro Metropolitan Region, with the support of the metropolitan government, in order to ensure that the revisions of the municipal masterplans accord to the common interest. It should be emphasized that municipalities should adapt their planning instruments to align with common metropolitan interests and functions as dictated by the metropolis statute.

Metropolitan Interest Zone

In order to implement its initiatives, programmes and actions, Metropolitan Interest Zones (ZIMs) have been established under the Metropolitan Plan, which are aimed at emphasizing, for the benefit of all agents and institutions, the importance of these areas in supporting the public functions of common interest of the metropolis; which must surpass local interests. It is estimated that, in order to achieve the intended results of the plan, the support of all metropolitan actors is essential, especially that of the municipality representatives. The creation of the ZIMs enables an opportunity for joint action of public and private agents to achieve a state of real metropolitan citizenship.

The ZIMs are organized into Environmental Interest Zones (ZIM-A), Economic Interest Zones (ZIM-E) and Metropolitan Urban Interest Zones (ZIM-U), according to their most relevant features.

Metropolitan Assets

The metropolitan assets are the structures that have prime economic importance in the metropolis and its territorial development, such as ports, airports, highways, railways and the systems that complement logistics and collective transport. The management of these assets, regardless of the person in charge, must occur in a manner integrated with metropolitan priorities.

There is no shortage of challenges to building a cohesive, prosperous, and environmentally healthy metropolis, and yet these are the aspirations that permeate the devising of the plan. The main determinants and potentialities of the metropolis were analysed in detail in regards to spatial reconfiguration and urban centralities, economic expansion, appreciation of natural and cultural heritage, mobility, housing and social facilities, sanitation and environmental resilience and public management.

Conclusion

The new law overseeing the governance process is designed to connect the mayors of the Metropolitan Region cities, the governor of the state of Rio de Janeiro, and representatives of non-governmental organizations in order to facilitate collective decisions on urban planning. It is envisaged that this arrangement will create the basis for sustainable development in the region.

The PEDUI has a range of actions scheduled up until 2040, designed to achieve the results proposed by the latest participatory process and this will be important in procuring guidelines for the governance of the metropolitan area. This step is considered the first and most important of the process to ensure that the plan is implemented.

For the first time it will be possible to define a common purpose in establishing steps for improvement in infrastructure projects, such as sanitation, mobility and housing, all of which should be according to a masterplan that offers directives for a more compact, efficient metropolis where the opportunity for achieving a good quality of life is available throughout the region.

Image: Metropolitan Chamber Database

Stakeholders establishing steps for improvement in infrastructure projects within the masterplan

Image: Metropolitan Chamber Database

Unpredictable urban growth on the periphery of the Rio metropolitan region

Inclusive urban development for Thailand's street vendors

Poonsap Suanmuang Tulaphan, HomeNet Thailand

Nok, a female street vendor on Ladpraw Road, Bangkok, came from a farming family in the north-eastern part of Thailand. After finishing elementary school, she was unable to further her studies because her family was poor. However, with the ambition to study, she moved to live with relatives in Bangkok. At the age of 13, while studying in non-formal education, she found work as, among others, a babysitter, household worker, and an employee for a street vendor. Working in the street vending sector, she realized that this kind of job does not require high investment but offers sufficient return for living in a city such as Bangkok. At age 17, she began to sell flowers and seasonal fruits from a footpath. She is currently 40 years old, has finished secondary school, and has a family with two children. Nok (pictured below) and her husband are still vending from the roadside, but she has been determined to use that employment to accumulate as much money as possible in order to support her children through opportunities for higher education. Nok's life is a familiar story of migration and a search for an improved livelihood in a large city. Street vending is a secure way of life that enables people to feed themselves and their families and to support their children in further education.

Image: HomeNet Thailand

Street vending offers sufficient return for living in a city such as Bangkok

A 2016 survey of 400 Bangkok vendors found that 70 per cent were women of over 40 years of age, and that over 40 per cent had completed only primary education.[1] This finding confirms the significance of street vending in creating urban jobs for disadvantaged workers. Despite their level of education, the workers are able to own micro-businesses, with minimal investment. The job also helps some families to change their social status. Street vending provides a major source of food and goods to low-to-moderate income consumers. Street food also reduces the burden of cooking and provides convenience for city residents, especially women who work outside the home. The availability of cheap food choices contributes to food security for the public in general.

Additionally, street vending has become a tourist attraction, adding vitality to a streetscape as well as contributing to an area's economy. Moreover, other workers who have links to street vending activities have the opportunity to earn their living as, for instance, street vendors' employees, local producers in the supply chain and transport workers such as tuk-tuk or motorbike taxi drivers. These are all honest jobs created by street vendors, maintaining self-reliance in the urban and rural working poor and lessening the burden on the government. It can therefore be said that street vending plays an important part in driving a local economy.

Street vending also has social and environmental consequences for the city — it has been found that people prefer to walk on the street among hawker stalls.[2] Also, street vendors have their eyes on the street, contributing to a general feeling of security and safety.

Regulations for street vendors to ensure sustainable and inclusive urban development

It is estimated that there are more than 1.7 million street vendors in Thailand, trading in food, clothing, souvenirs and consumer goods for city residents and tourists alike. Bangkok has approximately 240,000 street vendors, acting as a magnet for tourists, and providing authentic local foods, souvenirs, and a natural sense of street theatre. CNN has honoured Bangkok's street food as the best in the world for three consecutive years (2016–2018).[3] In short, street vending creates the economic, social and cultural identities of Bangkok and of Thailand.

Although Thai street vendors are large in numbers and have been a feature of the cities for more than 100 years, their role within urban development is still invisible to the

Image: HomeNet Thailand

Street vending has become a tourist attraction, adding vitality to a streetscape as well as contributing to an area's economy

government and city administrators. Thailand has no law to directly protect street vendors' right to work, but there are overwhelming rights and powers for local authorities to regulate vendors through considerations of cleanliness and traffic. Local authorities are able to designate vending areas as well as limiting trading hours and fees. Authorities also have the power to ban trading.

As a city grows and develops, the number of street vendors increases, even though there are fewer public spaces left to exploit. City administrators have varied views on regulating street vending — some recognize the important role played by vendors in local economic development, while others argue that street vending is illegal because goods are sold in public spaces. Also that the vendors hinder pedestrians' mobility, create dirt and traffic jams, are old fashioned and obscure the beautiful landscape of the city. There are also allegations that some stalls sell pirated goods or unhygienic food. Most street vendors are not registered in the city, are not part of the city's population, and have no voting rights. They migrate only to take advantage of a city's prosperity.

A new initiative — the project on Inclusive Urban Development for Informal Workers in Thailand — has received support from the European Union to work with eight cities in Thailand from 2016 to 2020. It aims to promote inclusive urban planning and local economic development that integrates informal economy workers such as home-based workers, street vendors, domestic workers and beauticians. Under the initiative, support is given to these worker groups in order that they access social protection and services provided by the state. HomeNet Thailand also works to group informal workers into membership-based organizations. Thus the ideal of building a city for all becomes the experience of city administrators. In addition, training in communication and collective negotiation is given to informal workers' leaders to enable them to clearly articulate issues and needs to local authorities. Street vendor case histories have so far been gained from the three cities of Chiangrai, Songkla and Bangkok.

Chiangrai city

Chiangrai city is a major tourist destination in northern Thailand. The mayor and administration team believe that street vending helps promote tourism and local economic development. In 2008, Chiangrai municipality initiated the Walking Street project, allowing people in Chiang Rai and nearby areas to sell their products under a minimal trading fee, with both local and non-municipal hawkers enjoying equal treatment from the administration.

In 2017, after working closely with HomeNet Thailand, Chiangrai Walking Street Club was able to increase its membership to 271. Members pay fees and elect representatives to coordinate activities with the municipality, while the club educates its members on the rules and regulations of the municipality as well as on cleanliness, checking and prohibiting the selling of illegal items, detecting counterfeit banknotes, social insurance for informal workers, the campaign against using foam in the market, and product development to increase sales.

Image: HomeNet Thailand

Vendors add a sense of safety and security to the street, especially at night

The club has collaborated with the state-owned bank to reduce the use of cash by using mobile banking, and it has made a proposal to the municipality to create another food street to promote traditional food, increase the vending period and enhance members' economic well-being. The municipality has also supported the organizing of a Restaurant Owners and Vendors Club, attracting a membership of around 30. In 2017, after working with HomeNet Thailand, the club was able to expand its membership to 237 market traders in the night bazaar market as well as street vendors trading in front of eight municipality schools. Club representatives in each area help educate members on municipality rules and regulations. The club also developed a plan to promote a social insurance scheme for informal workers as well as money saving activities for its members. In addition, members are encouraged to attend various festivals organized by the municipality.

Songkhla city

Songkhla is a major city located in the south of Thailand. The mayor and administration team wanted to create employment opportunities for informal workers and, after working closely with HomeNet Thailand, the municipality registered 1,300 street vendors trading in the area, promoting street vendor's organizations and facilitating the election of representatives in each autonomous area. A money saving activity has also been promoted among vendor organizations.

Street vending within the municipal area has been agreed as a tourist attraction, and standard food centres have been built where hawkers are able to rent stalls at a fair price. The municipality provides parking space for customers who come to the food court, as well as providing cooking hygiene training to vendors selling food.

Bangkok Metropolis

Between 2016 and 2018, the Bangkok Metropolis Administration (BMA) adopted a policy to strictly regulate street vending and to remove vendors on the grounds of violating pedestrian rights and trading in public areas. The BMA has cancelled 488 out of 683 designated vending areas, with approximately 12,000 vendors affected. There is a plan to remove all of the remaining vendors by the end of 2019, creating trouble for the street vendors, consumers and other workers connected to street trading. HomeNet Thailand has organized a network of street vendors who have been affected by the policy. The network of Thai Street Vendors for Sustainable Development now has approximately 7,500 members and advocates a review of the existing policy by the government and BMA. The Network has demanded the establishment of a committee with the participation of affected vendors to find an urgent solution to the problem. Likewise, long-term legislation has been proposed in order to regulate street vending and address important issues such as promoting the creation of street vendor organizations, cleanliness, traffic obstruction, fees for the use of public space, and taxation to attract income into the state and local government.

Summary

Supporting the livelihoods and development of street vendors in the municipalities of Chiangrai and Songkhla has facilitated both their protection and access to government services, leading to the reduction of poverty and social inequality, and ensuring inclusive and sustainable urban development. Promoting opportunities for everyone to benefit from urban development and prosperity is the route to sustainability.

While the experience of the recent street vending policy in Bangkok has been a challenge to the government and to the city administrators' vision, it nevertheless embodies a commitment towards achieving the Sustainable Development Goals by 2030, and SDG 11 in particular. In order to make cities and human settlements inclusive, safe, resilient and sustainable, the government and city administrators must recognize that informal workers, such as street vendors, contribute to local economy development. The support of employment and social protection for these workers by considering amendments to laws, policies and other measures, will help the working poor gradually transition to the formal economy.

Image: HomeNet Thailand

An elderly street vendor in Bangkok

Towards urban resilience in Tel Aviv — cracking the innovation code

Hila Oren, CEO, The Tel Aviv Foundation

The city of Tel Aviv has been characterized in many ways. Now branded the Non-Stop City, it also became the White City and a UNESCO World Heritage Site in 2003 for the largest collection of Bauhaus-style buildings in the world, named Best Smart City in the World in 2014 for its utilization of technology for the benefit of residents, and most recently, the vegan capital of the world.

The mayor of Tel Aviv-Yafo, Ron Huldai, recently elected for his fifth term, has transformed the city and helped to cement it as the commercial and cultural capital of Israel. Though not officially a 'global city' — Prof. Saskia Sassen's definition of a leading city with an international business centre and a direct influence on global affairs — Tel Aviv's innovative and pluralistic character, and its participation in global programmes and partnerships, justify its description as a lighthouse to Israel and the world. Two of these global programmes and partnerships that help drive innovation and diversity in the city— Urban95 and 100 Resilient Cities — are instrumental in Tel Aviv's advances in reaching Sustainable Development Goal (SDG) 11: making the city inclusive, safe, resilient and sustainable.

Image: Sivan Ozen

The responsibility to provide for, and the power to impact people's daily lives and environments rests increasingly with cities and local governments. The relationships between the old and new, café culture and commerce, are significant considerations of urban planning responsibility

The Tel Aviv Foundation has been an effective enabler of the participation by the municipality of Tel Aviv-Yafo in many of these global programmes and partnerships. The Foundation is one of the external faces of Tel Aviv through its global philanthropic work and engagement with other urban funds around the world. It generates additional resources to help the city develop smart solutions to urban challenges, and implement game-changing urban and social development projects to support those in need and to create opportunity. In enabling the municipality to access alternative and additional sources of financial and human capital, the Foundation also plays an important role in advancing SDG 11.

This is increasingly important in Tel Aviv and around the world as urbanization trends upwards. Currently, 55 per cent of the world's population lives in urban areas and this is expected to increase to 68 per cent by 2050.[1] Consequently, the responsibility to provide for, and the power to impact people's daily lives and environments rests increasingly with cities and local governments. This presents new challenges as municipalities seek to expand their budgets and resources to meet the needs of their growing populations. Given these trends, the criticality of SDG 11, globally, is increasing.

City foundations (also known as mayoral funds) have been established in a number of locations around the world, from New York to London to Christchurch. As new urban challenges and needs emerge, the foundations seek to attract funding and knowledge to help address them. Many of these organizations, such as the Tel Aviv Foundation, are chaired by the mayor, which ensures alignment between the operations of the foundation and the strategy of the municipality. In the case of Tel Aviv, this also enables municipal matching, a unique mechanism whereby the city matches donations to double their financial impact.

The Tel Aviv Foundation adds increasing value through its ability to facilitate public-private partnerships and connections with international organizations offering best-practice programmes and methodologies. A recent example of a successful public-private partnership is the Temuna theatre, which is being rebuilt as part of a commercial development. For international organizations, partnering with the Foundation is a win-win, as it offers a gateway to sharing best-practice programmes and methodologies with the city, contributing positively to strategy and policy.

Since 2016, the Tel Aviv Foundation has forged meaningful partnerships with 'Urban95' of the Bernard Van Leer

Image: Shani Halevi

Urban95 has transformed existing physical spaces into places for young children to play and explore nature, and for their caregivers to meet and rest. The municipality's implementation features these blue modules that are characteristic of the Urban95 project rollout

(BvL) Foundation and '100 Resilient Cities', powered by the Rockefeller Foundation. These initiatives have undoubtedly had a positive impact on the municipality of Tel Aviv-Yafo and its residents; helping to make the city more inclusive, safe, resilient and sustainable. Specifically, they address universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children.

Urban95

Urban95 has a simple and compelling premise: If you could experience a city from 95 cm — the average height of a three-year-old — what would you change? The BvL Foundation posits that urban spaces that cater to pregnant women, babies, toddlers and young children also nurture strong communities and economic development. To effect positive change in this sphere, BvL supports a number of cities around the world to re-shape their landscapes and facilities to enable children in their first five years, and their families, to thrive.

Through its partnership with the BvL Foundation, the Tel Aviv Foundation helped Urban95 to embed its project manager in the day-to-day operations of the municipality of Tel Aviv-Yafo in order to become a real strategic partner. Consequently, the Urban95 team has been able to build the organizational capacity, mechanisms and political support to influence the municipality's strategic thinking, urban agenda and resource allocation, as well as create cross-departmental collaboration. This is particularly important as a significant demographic shift takes place in the city — the growth of young families.

Urban95 focuses on three main areas, which are outlined below along with some of the ways that Tel Aviv has implemented them:

- **Public spaces**. Transforming existing physical spaces into places for young children to play and explore nature, and for their caregivers to meet and rest. The municipality has added 150 toddler-focused facilities, equipment and activities to many of its 500 playgrounds and has undergone a complete shift in the way it plans public spaces for this age group.
- **Young parenthood**. Surrounding parents with ideas for ways to incorporate play and storytelling into daily routines, and nurture their children's fast-developing brains. The municipality has developed a new basket of early childhood-related services in 10 community centres; facilities which previously did not serve early childhood at all. It also engages parents digitally through its Digitaf platform, connecting over 25,000 parents in the city to relevant facilities and services, including parenting videos that have been translated for the city's asylum-seeker community.
- **Municipal infrastructure**. Making it possible for caregivers and young children to walk or cycle to health care, childcare, a safe place to play, and a source of healthy food. The municipality has created a cross-departmental mobility roundtable with the city architect, the construction and infrastructure division, the urban renewal and traffic divisions, and the department for strategic planning to map barriers to young children and families in the city and pilot projects to make services walkable for parents.

Image: Inna Felker

Tel Aviv's urban lifestyle draws an increasing number of young people, who choose to remain in, or return to the city, many of whom previously moved further afield to begin their families

As a result of Urban95, the positioning of early childhood as a strategic priority in Tel Aviv's urban agenda, together with the increased budgets and new policies that follow, is improving the quality of life for young families when they need it most. Importantly, residents notice and appreciate the expansion of child-friendly spaces and services. Within the Urban95 network, Tel Aviv is recognized as a global leader, and this is instrumental in advancing SDG 11.

100 Resilient Cities

100 Resilient Cities, pioneered by the Rockefeller Foundation, has a bold promise: to help cities around the world become more resilient to the physical, social, and economic challenges that are a growing part of the twenty-first century. This means identifying areas that cities can develop in order to better withstand, respond to, and adapt more readily to shocks such as floods, earthquakes, cyberattacks, and stresses such as social gaps, rising temperatures, and public transport requirements.

Tel Aviv was accepted to the 100 Resilient Cities network following a rigorous selection process by a panel of expert judges who recognized the competence of the city's mayor and staff as well as the city's capacity for change, history of building partnerships, and ability to work with a wide range of stakeholders. The Tel Aviv Foundation played an important role here too.

In each of the 100 Resilient Cities, a Chief Resilience Officer (CRO) is appointed to lead the process of building a resilience strategy and implementing the projects. In Tel Aviv, the CRO is situated in the heart of the municipality and works alongside the general manager in a unique horizontal role, working together with key departments to shape the city's strategic plan.

Following two years of extensive research using unique methodologies and involving local residents, municipal departments, the national government, non-governmental organizations and the private sector, the Tel Aviv resilience team is about to launch the city's strategic resilience plan. The plan focuses on five discovery areas that will leverage the city's resilience and help it advance SDG 11. Importantly, many of the projects within these areas have already been approved for implementation in the short-term, while others are moving towards implementation in the long-term.

The five discovery areas are:

- **Southern coastline**. As a signature coastal city, Tel Aviv has undertaken, over the past three decades, to connect the city to its precious natural resource. Yet the southern coastline represents a valuable but untapped public space and environmental resource. A range of projects have been developed to increase access to, and utilization of this piece of natural heritage through community, ecological and economic development opportunities.
- **Building trust between the Arab community and the municipality**. Yafo is one of the only places in Israel where Jews and Arabs live in coexistence, but national sensitivities and recent significant investment in the city has stoked distrust within the Arab community towards the municipality. Now, through deep strategic thinking and dialogue, the city is developing projects to engage and empower the Arab community through participatory decision making processes, youth leadership programmes, and more.

Image: Avi Levy

Projects have been implemented to connect Tel Aviv to its precious natural resource — the coastline. In parallel, the city is developing projects to solve its multicultural challenges through deep strategic thinking and dialogue

Image: Kfir Bolotin

Projects have been designed to help communities sustain their quality of life, reduce the cost of living and become more environmentally aware and resource efficient, especially with energy, food and public spaces

- **Sustainable communities**. Tel Aviv is growing exponentially, with resident, infrastructure and transport demands causing great stress on the city. Projects have been designed to help communities sustain their quality of life, reduce the cost of living and become more environmentally aware and resource efficient, especially with energy, food and public spaces.
- **Social cohesion through participation and volunteerism**. Digitalization, privatization and the nature of modern city life have made Tel Avivians more individualistic. Though Israel has a comparatively low rate of regular volunteerism, it remains an important part of the national culture — demonstrated powerfully during security crises. Leveraging this to promote good citizenship behaviour, a new mechanism has been developed to increase volunteering; for example, using big data to match opportunities with prospective volunteers.
- **Complementary economy and urban financial tools**. The traditional municipal toolbox is not sufficient to cope with growing social and economic gaps. A variety of complementary economy and urban financial tools will be developed or leveraged to stimulate local economic development, including crowdfunding, social bonds, and local currencies (city coin).

In addition to working with the resilience team through the research and planning phases, the Tel Aviv Foundation will support the implementation of these projects. It seeks traditional philanthropy to help fund projects in Discovery Areas 1 to 4. It can also leverage its unique financial position — independent but with strong ties to the municipality — to support projects in Discovery Area 5: urban financial tools. To this end, in 2018 it signed a Memorandum of Understanding with UN-Habitat to cooperate in matters of innovative financing for the sustainable provision of urban services, and to share the learnings with the world, representing an innovative and important financial dimension to SDG 11.

In the past few years, Tel Aviv's urban agenda has demonstrated increasing commitment to the SDGs. It has made important strides in advancing SDG 11 specifically by embracing two strategic and sweeping processes: Urban95 and 100 Resilient Cities. Tel Aviv is known as the First Hebrew City of Israel and, today, mixes Jewish culture with fierce secularism. The ancient Jewish mantra from the Ethics of the Fathers — "You are not obligated to complete the work, but neither are you free to desist from it" — continues to bear scrutiny, as the Tel Aviv Foundation and the municipality of Tel Aviv-Yafo continue to work towards a more sustainable city and a better world.

Making cities and human settlements inclusive, safe, resilient and sustainable

Centre for Liveable Cities, Ministry of National Development Singapore

Singapore is a city-state with limited land and a high urban density. These unique circumstances demand the prudent and strategic use of space to ensure sustainable development, given an increasing population and the necessity of economic growth. This requires sound and dynamic urban governance combined with integrated long-term planning to ensure sufficient land for sustainable growth as well as a convenient and high-quality living environment for Singaporeans. Singapore therefore works with various stakeholders on policies such as those geared towards public housing and an integrated transport network, while ensuring the incorporation of green spaces throughout the urban landscape. Ultimately, the goal is to create a pleasant environment in which all Singaporeans can work, live, and play.

Integrated land use planning

Singapore takes a long-term approach to urban planning. This is implemented through the Urban Redevelopment Authority (URA)'s Concept Plan, a long-term strategic land use and transportation plan that outlines broad strategies to guide development for the next 40 to 50 years. These strategies are translated into a Master Plan that details upcoming developments over the next 10 to 15 years.

The Concept Plan is reviewed at least once every 10 years and the Master Plan once every five years. These reviews are necessary to take into account various factors such as changing land use needs; socioeconomic and technological trends; demographic changes; the economic, social, and environmental needs of current and future generations; as well as regional and global economic developments.

The Concept and Master plans map out the directions for Singapore's growth and introduce new and innovative approaches to planning and development. For example, in Master Plan 2014, URA identified future growth areas to meet a wider range of economic needs such as business expansion and diversifying employment areas. As part of the plan, the Jurong Lake District in the western part of Singapore was identified as a new mixed-use business district.

New approaches to district planning include integrating utilities, facilities and services — such as district cooling systems and common services tunnels — at district level instead of at a building level. This will allow the achievement of economies of scale as well as cost savings and the convenience of tapping on shared services. Another example is hawker centres[1] (or cooked food centres) that are co-located with community amenities and offer a variety of high quality and affordable food.

Housing a nation

Over 80 per cent of Singapore's resident population lives in public housing built by the Housing and Development Board (HDB). More than nine in ten of these public housing resident households own their flats. Public housing is heavily subsidized to ensure that it is highly affordable. A progressive system of housing grants has been put in place, on top of subsidized purchase prices for new HDB flats. As a result, most first-time home buyers today use less than a quarter of their monthly income to pay their housing loans. This is well below the international benchmark of 30 to 35 per cent of monthly income allocated to housing.

Beyond shelter, public housing provides an environment in which to live, work, play, and learn. HDB towns have a full range of facilities to meet the various needs of residents, such as commercial spaces, schools, transport nodes, and parks. New towns today are centred on the fundamental philosophy of sustainability, so as to provide residents with a high quality of life and reduce commuting times. Most HDB towns are developed based on the "Neighbourhood Principle", where several neighbourhoods are grouped around a town centre that provides essential services within close reach of residents. Punggol, HDB's youngest town in the northeast of Singapore, is based on a newer planning concept where smaller residential estates share a common green and a variety of well-integrated facilities to enhance accessibility and encourage clean commuting. The green network of nature reserves, parks, park connectors, tree-lined roads and other natural areas built within and around HDB estates has made living in public housing more desirable.

Building safety

The Building and Construction Authority (BCA) champions a strong culture of safety awareness and regulation in the built environment sector. Through regular reviews, BCA upholds high safety standards while ensuring that the regulatory regime remains relevant even as projects grow in size and engineering complexity.

The design and construction of buildings in Singapore is regulated under the Building Control Act and Regulations. This includes a rigorous system of checks and controls throughout

Image: Singapore Tourism Board

The distinctive Marina Bay Central Business District skyline demonstrates Singapore's commitment to building a *City in a Garden*

the entire building lifecycle of design, construction, commissioning before occupation, and maintenance after completion.

Under the Periodic Structural Inspection regime, regular inspections must be conducted on completed buildings by professional engineers to assess the condition of a building and recommend rectification measures if necessary. BCA's regulatory control also extends to lifts and escalators. Owners must obtain a permit from BCA for each lift and escalator, carry out monthly maintenance, and test them annually. Contractors have to maintain the lifts and escalators in accordance with manufacturers' recommendations and relevant standards.

Transit-oriented development and planning

Singapore employs a transit-oriented approach to development and planning in order to ensure that transport capacity is able to support the variety of land uses, and that limited land is utilized productively. In this respect, land transport strategies and measures are guided by the Land Transport Master Plan, which is reviewed every five years. The long-term goal is to make public transport the preferred mode of transit, through improved connectivity and better services. Active mobility — walking, cycling, and the use of personal mobility devices — is also promoted. Together with new business models and technologies, such as car sharing and self-driving vehicles, Singapore aims to advance a mobility paradigm that is centred away from private transport. The following are some examples of Singapore's transit-oriented initiatives:

Promoting public transport

The aim is that 75 per cent of morning and evening peak journeys should be made using public transport by 2030, and at least 85 per cent by 2050. To achieve this, Singapore's rail network will be expanded from 230 km today to 360 km by 2030, enabling eight in ten households to be within a 10-minute walk of a train station, and 85 per cent of public transport journeys of less than 20 km to be completed within 60 minutes. In addition, bus networks will be extended and their service levels enhanced. In 2012, the Bus Service Enhancement Programme was introduced to provide commuters with better connectivity, more comfortable journeys, and shorter waiting times. Between 2012 and 2017, 1,000 Government-funded buses were added, with 80 new bus services rolled out to improve connectivity to major transport nodes and key community and commercial facilities.

Walking and cycling plan

Walk Cycle Ride SG is a vision to make walking, cycling and riding public transport a way of life for Singaporeans. To help realize this vision a Walking and Cycling Plan (WCP) was introduced for developments with high pedestrian and cyclist traffic. The WCP requires developers to ensure that designs meet the needs of pedestrians and cyclists instead of catering mainly to vehicular traffic. It also provides for the building of ramps for barrier-free access. Further, developers are incentivized to provide bicycle lots and supporting facilities through exemption of these spaces from the gross floor area calculation. In addition, more covered walkways are being constructed so that people can walk to train stations, bus interchanges, and neighbourhood amenities comfortably, regardless of the weather. To date, 120 km of sheltered walkways have been constructed, with another 200 km completed at the end of 2018.

Future challenges

Limited land
As Singapore's population and economy grow, the use of limited land will need to be continually optimized, whether through redevelopment, planning, or building underground in order to keep up with demand.

Changing demographics
The population is expected to age rapidly, with the number of Singaporeans over 65 years of age doubling to 900,000 by 2030. The dependency ratio is also expected to decrease, with only two working adults supporting each elderly person by 2030.

Increasingly diverse population
Singapore's open economy and immigration policies have resulted in a more cosmopolitan society. A "one-size-fits-all" approach to urban planning will no longer be able to cater for a more diverse resident mix.

Ageing infrastructure
As Singapore develops and the population density increases, the government will have to ensure that buildings are safe and well-maintained so as to sustain growth.

Future opportunities

New growth districts
Singapore is optimising space by transforming existing areas into new growth districts. This includes redeveloping the Greater Southern Waterfront region after the relocation of existing maritime ports to the western part of the country, and the redevelopment of the Paya Lebar region in the northeast, after the relocation of the existing military airbase.

Spatial strategies
Spatial strategies are being applied to avoid overcrowding. This includes setting up economic centres outside the traditional business and financial district in the central region, such as Changi Business Park in the East and one-north[2] in the west. In tandem, more residential spaces are being planned in central Singapore to enable more people to work nearer their homes.

Underground infrastructure
Options are being explored to shift more of the transport and utilities infrastructure and storage facilities underground. Some examples under study include an underground goods mover system to reduce freight transport on roads, underground electrical substations, and rock caverns for storm water drainage and storage to increase water resilience.

An enabling city
The aim is to transform the country into an enabling place for seniors to live independently and comfortably while remaining integrated in the community. For example, barrier-free accessibility, and more seating and community spaces in housing estates have been introduced. There is also a programme to equip flats with senior-friendly fittings such as grab bars and slip-resistant floor tiles.

To better engage senior citizens, spaces have been integrated with facilities such as day care, and health and community programmes in the estates. Parks are being enhanced with senior-friendly amenities. A network of 10 therapeutic pocket gardens based on horticulture therapy will be piloted to support seniors with dementia as well as post-stroke patients through the provision of contemplative spaces and activity zones.

Seniors can live close to their families and communities through priority schemes for new HDB flats, a Proximity Housing Grant[3] for resale flats, and purpose-built housing options such as three-generation "3-Gen" flats and short lease two-room "Flexi" flats. The country is also exploring integrating senior-friendly housing and senior care services, such as assisted living developments.

Varied housing options
Singapore's public housing environment offers a range of options to meet varying needs and demands, such as different budgets, designs, and locations. This caters for home buyers with different aspirations and income levels, as well as changing family structures.

Design for maintainability
Instead of approaching maintenance as a downstream issue, consultants and developers are encouraged to consider maintainability outcomes further upstream, i.e. to design buildings that are easier to maintain. Singapore has worked with industry stakeholders to develop the Design for Maintainability Checklist in 2016 and a Façade Access Design Guide in 2017 to motivate designers and developers to integrate suitable solutions at the design stage for safer, more labour-efficient and cost-effective maintenance regimes.

Maintenance of exterior features
Owners of buildings are required to ensure that any exterior features such as windows, claddings and plaster are maintained and securely fixed.

A Periodic Façade Inspection regime will be introduced, focusing on buildings older than 20 years. Inspections will be required once every seven years to allow for the early detection of façade deterioration and to facilitate timely repair.

Launched in 2010, the National Cycling Plan (NCP) envisions cycling as an integral part of Singapore's transport system. Intra-town off-road cycling paths connected to major transport nodes and key amenities were constructed and bicycle parking facilities enhanced in seven HDB towns. The NCP was revised in 2013 with the more ambitious targets of providing every HDB town with a cycling path network, and building an island-wide off-road cycling path network of over 700 km by 2030. This will be implemented by giving greater priority to cycling in the transport system, enhancing cycling infrastructure, encouraging clear and consistent cycling rules and etiquette, and increasing community support for cycling.

Inclusive transport

Singapore continues to place measures to guarantee the accessibility of public transport to all, including the elderly, disabled, visually handicapped, and families with young children. Since 2006, all train stations have been equipped with at least one barrier-free entrance with a lift, a tactile guidance system, and wheelchair-accessible toilets. More than 85 per cent of train stations now have barrier-free access routes from the station entrance to the platforms. Priority queue zones for passengers with special needs for boarding trains, public buses and lifts were introduced in 2015, and have been implemented in 20 train stations and nine bus interchanges to date. Since 2017, public buses have also been equipped to allow parents to board with children in open strollers. By 2020, all public buses will be wheelchair-accessible.

Safer streets

To make streets safer for the elderly and for those with disabilities, 50 "Silver Zones" will be implemented by 2023 in areas with high senior resident populations, in amenities frequented by seniors, and in areas with high rates of accidents involving senior pedestrians. Silver Zones include road safety features, such as lower speed limits, centre dividers, and humps and chicanes that slow down motorists and

remind them to look out for pedestrians. To date, 15 Silver Zones have been completed.

Green buildings

Singapore is working to ensure that at least 80 per cent of total building gross floor area will be green by 2030. To this end, the BCA Green Mark Scheme was launched in 2005 to promote resource efficiency and reduce any potential environmental impacts on the built environment. The Green Mark Scheme paved the way for the formulation of Singapore's first Green Building Masterplan in 2006, focusing on new buildings. Following consultations with industry stakeholders, the Masterplan was revised in 2009 and 2014 to cover existing buildings and tenanted space, and drive the built environment sector to meet the 80 per cent green buildings target. To date, Singapore has more than 3,200 green buildings with a total gross floor area of more than 94 million m^2, equivalent to more than 34 per cent of total floor area of all buildings in Singapore.

Green transport

In addition to promoting public transport and encouraging active mobility, Singapore is encouraging a shift to cleaner vehicles. To help vehicle purchasers make more informed decisions, the Fuel Economy Labelling Scheme was introduced, providing information on the fuel efficiency of each vehicle model. Another scheme provides rebates for low-emission vehicles and levies surcharges for high-emission ones. In December 2017, an electric car-sharing programme, *BlueSG*, was rolled out to introduce 1,000 shared electric cars and 2,000 charging kiosks island-wide by 2020. In addition, 50 hybrid buses were deployed by the first quarter of 2019, and 60 electric buses are slated for trials by mid-2020.

Green spaces

Despite the constraints, close to 10 per cent of land in Singapore is set aside for parks and nature conservation. Today, more than 80 per cent of households live within 400 m, or a 10-minute walk, of a park. The aim is to expand this to more than 90 per cent of households by 2030, by creating more neighbourhood and regional parks. One of the most iconic regional parks is the Singapore Botanic Gardens (SBG). With over 150 years of history, the SBG is a premier tropical botanical garden and is Singapore's first UNESCO World Heritage Site. Located just outside the main shopping district, the SBG is also a prime example of green spaces coexisting within a broader urban landscape.

As Singapore continues its transformation into a *City in a Garden*, the National Parks Board (NParks) has identified six key areas to fulfil this vision:

- Establish world-class gardens
- Rejuvenate urban parks and enliven the streetscape
- Optimize urban spaces for greenery and recreation
- Enrich biodiversity in the urban environment
- Enhance competencies of the landscape and horticultural industry
- Engage and inspire communities to co-create a greener Singapore.

Image: Singapore Tourism Board

The green network of parks interwoven throughout public housing estates has contributed to a high quality of life for many Singaporeans

Image: Singapore Tourism Board

Singapore aims to achieve 200 ha of skyrise and vertical greenery by 2030. The Park Royal Pickering Hotel was one of the early recipients of the Skyrise Greenery Awards in 2013, which recognized the integration of greenery in its architecture

World Cities Summit

The biennial World Cities Summit (WCS) is an exclusive platform for government leaders and industry experts to address liveable and sustainable city challenges, share integrated urban solutions, and forge new partnerships. Jointly organized by Singapore's Centre for Liveable Cities and the Urban Redevelopment Authority, key highlights of the Summit include the WCS Mayor's Forum, the Lee Kuan Yew World City Prize and the WCS Young Leaders' Symposium. The Summit is held in conjunction with the Singapore International Water Week and the CleanEnviro Summit Singapore.

In 2018, the three events were attended by a record number of over 24,000 participants, with 43 Ministers, and 133 senior officials including mayors, city leaders, government officials, industry leaders, city experts, academics, and representatives from the business community across 110 countries and regions. A total of 1,100 companies participated at the event, with US$ 26 billion worth of new business announced.

In 2020, the three events will come under the umbrella of "Singapore Sustainability Week" and take place in Singapore at the Sands Expo & Convention Centre from 5–9 July 2020.

International collaborations

An extensive network of collaborations with international partners and governments has been established over the years to exchange knowledge and best practices on building sustainable cities.

BCA and UN Environment collaborations

The BCA has collaborated with UN Environment on several initiatives related to sustainable buildings. For instance, the Centre for Sustainable Buildings, established through the signing of the 2nd BCA-UNEP Memorandum of Understanding (MOU) in 2011, provides technical support, tools and solutions for the building sector in Asia. In 2013, the BCA and UN Environment established a five-year partnership project, the "Nationally Appropriate Mitigation Action (NAMA) Development for the Building Sector in Asia", which supports four participating Asian countries — Indonesia, the Philippines, Thailand, and Viet Nam — in developing national plans to reduce greenhouse gas emissions in their building sectors.

Image: National Parks Board

Launched in 2010, the National Cycling Plan envisions cycling as an integral part of Singapore's transport system. Since 2013, the country has been working towards building an island-wide off-road cycling path network

The project is part of the International Climate Initiative supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

Global Alliance for Buildings and Construction (Global ABC) Regional Roundtable for Asia-Pacific

The Global ABC is an initiative launched at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), as part of the Lima-Paris Action Agenda. It aims to scale up actions within the buildings and construction sector to reduce emissions. Singapore hosted the Global ABC's inaugural Regional Roundtable for Asia Pacific in conjunction with the International Green Building Conference in September 2016. The two-day event involved a series of activities to meet the global sustainable buildings and climate change agenda. This included a presentation of UN Environment's Finance Initiative publication "Sustainable Real Estate Investment — Implementing the Paris Climate Agreement: An Action Framework", and the Working Session of the Sustainable Energy for All Building Efficiency Accelerator. It was attended by more than 85 participants from national governments, local authorities, non-governmental organizations, international financial institutions and research institutions from 14 countries in the region.

Centre for Liveable Cities' International Capacity Development Programmes

Since 2015, the Centre for Liveable Cities (CLC) has organized international capacity development programmes for 1,472 international city leaders, offcials, and practitioners from 42 countries. CLC's international programmes are guided by the Singapore Livability Framework, which identifies the outcomes and systems of a liveable and sustainable city. The Framework is also a means to assess sustainable urban development as outlined in SDG 11 and the New Urban Agenda.

In 2016, Singapore signed a three-year MOU with the United Nations Human Settlements Programmes (UN-Habitat) to jointly develop international capacity development programmes. The inaugural SG UN-Habitat International Leaders in Urban Governance Programme was held in 2017. To date, nearly 80 participants from 32 cities representing 20 African countries have attended the programme, which shared Singapore's strategies in urban transformation contextualized to African cities' needs.

URA Academy

The URA Academy conducts training sessions to share Singapore's planning experience and expertise with overseas government officials and professionals. Each year, it hosts more than 2,500 delegates from over 45 countries. The URA Academy has also been organizing a four-day Integrated Land Use Planning course since 2009 to provide a comprehensive overview of URA's core work.

Sino-Singapore Tianjin Eco-City

In 2007, Singapore and China embarked on a flagship bilateral project to jointly develop the Sino-Singapore Tianjin Eco-city (SSTEC). The 30 km^2 SSTEC provides a platform for both countries to collaborate on environmental protection, resources and energy conservation, and build a harmonious society. Prior to the development of the SSTEC, the site comprised mainly uninhabitable saltpans, barren saline land and polluted water bodies. As of 2018, the 8 km^2 Start-Up Area is largely completed. The SSTEC is now home to approximately 80,000 residents and 5,000 registered companies.

SSTEC's development is guided by a key performance indicator framework. The Framework comprises 26 KPIs spanning environmental, economic and social aspects, including 100 per cent green buildings, 100 per cent water potability at tap, more than 20 per cent renewable energy usage, 100 per cent services network coverage, and 100 per cent provision of free recreational and sports facilities within 500 m of residential areas.

SSTEC has been actively pursuing eco-developments. These include rehabilitating its 2.6 km^2 wastewater pond; conducting research in green development; developing green building standards and constructing green buildings; tapping renewable energy sources such as wind, solar, and geothermal energies; encouraging residents to lead environmentally-conscious lifestyles; and promoting green transport.

In line with SSTEC's vision to serve as a model of sustainable development for other cities, Singapore and China have been working together to document lessons and experiences gained over the last 10 years to share with other cities in China and beyond. The documentation was launched at SSTEC's tenth year milestone in 2018.

Ghent Port Area — successful stakeholder involvement in spatial development processes

Dr. Joris Scheers, ECTP Secretary-General and KULeuven Visiting Professor

The Ghent Port Area is an important logistic, industrial and residential zone, located in the highly urbanized northern part of Belgium. Many residential areas and small villages are scattered around the port area, sometimes close to, or even surrounded by, industrial sites and docklands. There is significant infrastructure including roads, railways and harbour, the sites of more than 300 companies offering over 65,000 jobs, and 30,000 local inhabitants all claiming their part of the available space of approximately 10,000 ha.

In the early 1990s, local residents were faced with increasing negative effects of the surrounding industrial sites, including car and steel manufacturing, coal terminals and warehouses. Economic actors wanted to expand their activities, and nature conservation organizations requested clear policy measures for the neighbouring vulnerable bird breeding areas of international and European importance. In addition, the region called for more efficient transport infrastructure, such as a new lock to allow easier entrance to the port, the (re-)construction of an urban ring motorway, new rail infrastructure and a new dock.

Since World War II, the uncoordinated development of these various human activities gradually degraded the spatial structure of the area into a chaotic mixture and generated large environmental problems. In 1993, a number of leading policy officials of the regional government of Oost-Vlaanderen (East Flanders Province) took the initiative to address these issues, initiating the integrated Ghent Port Area Project with the main objective of turning different government levels and sectorial policies towards an integrated spatial, environmental and economic development of the area.

Process and solutions

During the beginning of the project (1993–1996), a small group of spatial planners and officials was convened by the regional government to explore the issues at stake, screen for relevant actors, listen to their main concerns and interests, and develop a strategic spatial concept — a coherent spatial vision of the future development of the Ghent Port Area, including a balance between economic, social and environmental issues, aiming for general approval by the various actors and institutions involved.

During the second phase (1997–2007), the primary strategic spatial concept was gradually developed into a coherent vision, fuelled by research and stakeholder involvement. A steering committee was put in place, comprising leading politicians and civil servants of the different governments (local, regional, national) and the Ghent Port authority.

At the same time, several small and medium-sized — private as well as public — projects were implemented that addressed the environmental and living quality in the residential areas. A number of strategically chosen mobility problems were solved by the regional mobility authorities, through interventions such as adjusting bus services and remodelling unsafe crossroads.

In 2007, the project organization reached a higher level of impetus. Driven by a multi-stakeholder platform, a sub regional network was set up under auspices of the regional authority. Based on the initial strategic spatial concept and best-in-field experiences of the various projects, an overall strategic development plan for the Ghent Port Area (2007–2015) was developed. The plan includes a long-term vision for the sustainable development of the area up to 2030, a number of key decisions and an action programme. Implementation of the action programme has continued since 2007.

The entire project was evaluated in 2013, on the occasion of its twentieth anniversary. As a result, new objectives were defined and the range and number of actors involved was enlarged, making the project ready for its fourth phase, which is running up until 2020.

Unique integration of local residents

Six of the canal villages have set up residents' groups that organize regular local meetings, during which an interactive exchange between the inhabitants takes place to give updates on the progress of the various initiatives and implementation projects. The leaders of the residents' groups are always invited as 'privileged witnesses' to coordination as well as topical meetings within the project. Consequently, the residents' meetings are very often attended by representatives of the various authorities and private companies involved in the area.

All of the partners in the Project Ghent Canal Zone support the working of the residents' group activities in terms of content, logistics, and insurance.

In addition to the residents' groups having an official seat on the steering committee, high participation rates show the large scale of residents' support of the project, which has evolved from the status of 'action committee' to that of 'actor'.

Image: Kanaalzone Gent, Carl Dejonghe

Collaboration between residents' groups and other stakeholders facilitating discussion on project progress

One of the residents' groups, 'Sint-Kruis-Winkel-Mendonk', even took on the legal status of a non-profit organization, launched its own website[1] and published a 'Guide for the Ghent canal resident', which explained the often difficult port jargon in terms understandable to readers. All of these activities contribute strongly to the success of the development project, especially in terms of social integration.

24/7 environmental help desk

The close proximity of the living function to the industrial and port activities in the Ghent Canal Zone very often leads to complaints concerning smell, dust and noise, and this is one of the main complaints from residents' groups, which had been unsure as to what authority or institution to contact, especially outside of office hours. A single contact point was therefore established and an efficient complaint registration and follow-up system developed, with direct forwarding to both the possible perpetrator and the responsible authority.

After office hours, during weekends and on holidays, the system automatically connects to Ghent Port Company that registers the complaint and organizes an on-the-spot search.

A regional development coalition

A regional development coalition has now been instated. In general terms, this network endeavours to arrive at a region-wide agreement between all local partners, so that they can lobby other actors that have key competencies and resources needed for the realization of the strategic plan objectives. The network includes officials and planners but also private bodies such as companies, citizens' groups, environmental organizations, trade unions and employers' organizations.

For the last two decades the spatial development process has been based on a three-tier methodology: a coherent and sustainable long-term spatial vision supported by local residents and actors; the development and application of particular instruments such as development plans, environmental subsidies, and the creation of funds; and an effective, in-the-field implementation based on budgeted projects.

Results and impacts

- **Transparency, stability and legal certainty for all stakeholders and their activities.** A strategic spatial development plan for the Ghent Port Area was officially approved by the steering committee, the stakeholders and all local governments involved — East Flanders Province, City of Ghent, Evergem and Zelzate local authorities, and the Port Authority. Based on this strategic plan, three existing land use plans were adapted, establishing quality standards, precise delineation of residential territories in villages, preservation of nature reserves, exact locations and conditions of industrial and port area development, buffer zones, and mixed use functional zones. As a result, the spatial structure of the entire area became more robust and was able to combine different functions in a more qualitative way.
- **An organically grown and continuously developing project management structure with short and informal communication lines leading to formal results.** After many years of working together in a dynamic structure and

applying a grounded methodology, the stakeholders in the Ghent Port Area have built a relationship of trust, passing information between one another directly. By establishing this regional development coalition based on a common spatial vision, problems are solved and results achieved.

- **Made-to-measure solutions are developed for specific problems.** Examples are the establishment of a public company, PROVAG, funded by the five public authorities cited above, with the ability to relocate houses in the Ghent Port Area; and the engagement of the Flanders regional government to effectively landscape specific buffer areas.
- **Fair and just management of difficult policy options and potential conflict situations.** The planning process has proved its ability to quickly detect and handle (potential) conflicts. In one case, little or no tension escalated into rigid intransigence between action groups and authorities, companies and even judicial procedures, when 110 families were expropriated for the construction of a new dock. Those families were able to continue living in the area in adequate new housing facilities.
- **An inclusive and broad-based steering committee to ensure widely supported decisions.** Throughout the development process, satisfactory cooperation and consultation structures have been devised. The steering committee has evolved from approximately 20 members in the beginning to the present number of 90. In this very widely composed body, non-governmental organizations, interest groups and citizens have an equal line of communication to economic and political stakeholders. As a result, proposals can be tested, and decisions of the steering committee are widely supported.
- **Sturdy initiatives and the implementation of projects contribute directly to enlarging social support for public works with an environmental impact.** The initiatives taken within the development framework of the Ghent Port Area are well defined and contribute to the improvement of the relationship between the various actors on the ground. Examples are a significant and tangible reduction of noise, dust and air pollution in the area due to an adapted infrastructure design, and mitigation measures for the new ring road, R4. The latter was acquired via a robust participation process that included all local and regional actors. To date, the area is doing very well, with a better environment, growing shipping volumes and stable employment rates.

Today, the Ghent Port Area Project is generally acknowledged as a fine example of integrated regional development and has been nationally and internationally recognized with the 2009 European award for the social integration of ports, among others.

Image: Kanaalzone Gent, Carl Dejonghe

Consultation includes officials and planners as well as private companies, citizens' groups and environmental organizations

Image: Kanaalzone Gent, Carl Dejonghe

Neighbours participating in a field trip in aid of the Doornzele project, Ghent Canal Area, Belgium

Balikpapan — maintaining a sustainable city

Association of Indonesian Municiplaties (APEKSI), Jakarta

Located on the east coast of Kalimantan, Indonesia, Balikpapan is the second largest city of East Kalimantan Province after the capital, Samarinda. Between 2016 and 2017 the population growth in Balikpapan reached 2.26 per cent. With its 104 ethnic groups, the city has the largest economy in Kalimantan, with economic growth increasing from 3.6 per cent in 2013 to 4.28 per cent in 2015, and a decline in inflation from 8.56 per cent in 2013 to 6.26 per cent in 2015. GDP per capita also increased steadily from approximately US$ 9 million in 2016 to US$ 10 million in 2018. The percentage of poor people saw a marginal decrease between 2015 and 2018 while the Human Development Index marginally increased between 2017 and 2018, and the Liveable Index increased from 80.81 in 2017 to 81.3 in 2018.

Balikpapan's long-term vision, 2000–2025, is to realize its potential as a city of service, industry, trade, tourism, education and culture, built within the framework of a city of faith. The medium-term vision, 2016–2021, is to understand itself as a leading city that is comfortably inhabited, and sustainable for people of faith. To achieve this vision there needed to be improvements in human resources in terms of quality and competitiveness, sound environmental credentials, improvements to infrastructure, the development of a flexible and popular economy, and the implementation of good governance.

As in other cities, Balikpapan has a number of challenges such as high urbanization, and the high population growth gives rise to problems such as the availability of clean water, a reliable electricity supply, and good sanitation.

Image: Balikpapan City Goverment (APEKSI)

Cycle lane, built to encourage cycling as a viable alternative to motor transport

Strategy applications

It was decided that, in realizing Balikpapan's vision as a liveable city, physical and non-physical aspects needed to be taken into account. Physical aspects include urban facilities, infrastructure and spatial planning, while non-physical aspects include social relations, economic activities, culture and security.

The aspiration to be an advanced, modern, prosperous and happy civilization as well as a city of faith is being implemented through maintaining a community of believers and devotees that are charitable, pious, cultured, law-abiding, and moral; building a society of achievement that values hardworking, creative, innovative and independent people; and creating environmental conditions that are clean, beautiful, safe and comfortable.

In addition, several programmes have been developed in an effort to ensure sustainability, including:

- Foresting, with two protected forests and 20 urban forests
- The development of industrial estates with zero waste and zero sediment systems
- Reducing the volume of waste to landfill through the 3R programme — reuse, reduce, recycle
- Strengthening resilience to the impacts of climate change by developing a greenhouse gas baseline.

In 2012, Balikpapan City committed to establish 52 per cent of its area as protected, and 48 per cent as an area of cultivation. The city also has a large potential in mineral resources, with 60 per cent of the area sited over coal deposits. But, based on its determination to become a service economy and with the aim of sustainable development, Balikpapan City has committed not to offer mining permits in the city area, including this decision in its regional spatial planning policy.

The Blue Sky Programme for improving air quality

Monitoring is carried out through 24 spot checks from stable emission sources to determine the city's air quality, with the result that suspended particulate matter is 100 per cent controlled. Motor vehicle emission testing is also carried out through spots checks, with air quality monitoring system locations designated for the transportation, residential and trading areas. The ambient air quality is also monitored through six spot checks in urban areas and three at the local landfill site.

The mass public transport facilities organization (SAUM) operates six bus corridors and 14 shelters. Along with this, the city operates the Public Transport Information System, providing comprehensive information on public transport including roadworthiness of vehicles.

To increase public awareness in reducing motor vehicle emissions, a special cycle lane has been built, encouraging cycling as a viable alternative to motor transport. Also, a car-free day programme is carried out every Sunday between 6 am and 9 am along 2 km of main road, encouraging pedestrians. To date, 60 per cent of proposed pedestrian walkways have been built, expected for completion in 2021.

As one of Indonesia's pilot cities of clean energy, Balikpapan has built three stations to serve gas as a fuel for motorized vehicles. In addition, gas is distributed through pipelines in six city wards, with the proposal to carry out nearly 4,000 connections to private residencies.

Balikpapan has also implemented a non-smoking policy in public spaces, including places of prayer, offices, children's playgrounds, schools, public transport, reading parks, health centres and sports facilities. In addition to reducing carbon emissions, the non-smoking areas are important for increasing public health awareness — the number of sick patients is still dominated by acute respiratory infections.

Water quality

Due to the high population growth, the supply of raw and clean water is a challenge for the city. The Manggar dam is a source of raw water, but is only able to supply to 60 per cent of the population. A new dam, the Tritit, has therefore been built, along with a groundwater wells monitoring information system, which can monitor the water depth and soil status and is accessed remotely. The system can help to control groundwater availability as an alternative source of raw and clean water.

Another problem with high population is sanitation. Balikpapan has a wastewater management installation which has a capacity of 800 m^3/day, with 10 pumping station units, 118 internal control units, and serving 1,380 households.

Reducing the use of plastic

Balikpapan's plastic waste is approximately 40 tons per day, or about 7.2 of the total volume of waste per day. Since 2016, requests have been made to the public to reduce the use of plastic bags for shopping and for people to use their own bags. This was made into official policy in 2018 along with the recommendation to recycle drinking bottles, reduce plastic bags in a number of malls and modern markets, implement eco-offices and commit to waste management. Private sector organizations have been asked to provide alternative, environmentally-friendly bags.

Solid waste management

The disposal of solid waste, especially that from households, is also a challenge. In 2017 the city produced approximately 460 tons of solid waste per day, with 79 per cent treated by government-run systems, 19 per cent treated by the community, and 2 per cent left untreated. Balikpapan has therefore built a solid waste data management system through which the community can check the status of the city's waste management.

Balikpapan has collaborated with Pupuk Indonesia for composting, and compost is now used for fertilization in green open nurseries. In 2016, a temporary landfill site was developed with a capacity of 10 tons. To date, 117 waste banks have been formed, with a total of 5,236 customers.

Image: Balikpapan City Goverment (APEKSI)

Participants in the campaign to reduce the use of plastic bags — an official policy since 2018

A waste bank administration automation system has also been built. Solid waste at the landfill site has been used for energy in the form of methane, biomethane green, and traditional market waste biogas. The production of methane gas from waste has been able to supply 150 households around the landfill. Waste-to-energy conversion was developed in 2017 at one of the markets, Pandansari, which has been replicated in all of the city's markets.

In 2016, a material recovery facility was built for separating inorganic waste as a follow-up of sorting from the source. The facility has a capacity of 10 tons per day.

The Resilient City Programme

As a result of a hilly topography, one of the threats to the city is that of landslides, especially during high rainfall. For this reason, Balikpapan has built the landslide information system[1], which aims to provide clear information about landslide areas for use by the community and government handling programmes.

With the support of Local Governments for Sustainability (ICLEI), Balikpapan has included the reduction of greenhouse gas emissions into its local middle-term development planning years 2016–2021 through which a climate resilience strategy is being developed as an effort to overcome the impact of climate change in the city. Several adaptation and mitigation programmes have been initiated, including:

- Since 2007, in an effort to increase public awareness to protect the environment, and in collaboration with local media, the city government has conducted the Balikpapan green, clean and healthy initiative, which was a competition attended by every household.
- As a city surrounded by areas of peat, Balikpapan endeavours to anticipate frequently occurring land fires by using regular patrols, constructing firebreaks and creating simulations with environmentally-friendly materials.
- As a number of large companies are sited at Balikpapan, the city operates corporate social responsibility programmes to support sustainable development.

Adiwyata school

With its name derived from the school that founded it, the Adiwyata School Programme was created to build an ideal forum for sustainable development, based on both science and ethics. Established to provide guidance for schools in Balikpapan, the forum comprises elements from the environment agency, education agency, non-governmental organizations, and an environmental observer.

Public service application system

The Beauty Integrated Services Information System for the Public (SICANTIK) was launched in 2015 for the convenience of licensing public services, with applicants able to monitor the processing online. The system makes the licensing process transparent and integrates it with other service unit applications. In addition, the Information System and Public Complaint service was built in order to handle complaints, questions, criticism, and suggestions. Access channels include a call centre, social media platforms, website and email.

Image: Balikpapan City Goverment (APEKSI)

The Manggar landfill site

Image: Balikpapan City Goverment (APEKSI)

Fuelling point for gas-driven vehicles

Results

The 3R programme resulted in:

- Closure of seven polling stations due to smells and rubbish
- Waste collection efficiency
- Reduction of inorganic waste generation to 42.6 per cent at the pilot project, Gunung Bahagia Ward
- A 50 per cent reduction in the number of plastic bags used.

The construction of the city's eco-building airport received a number of awards, including:

- 2014 Healthy Airport, Indonesian Ministry of Health award
- 2014 Best of the Best Airport of the Year
- Ranked sixteenth in the world's Airport Service Quality and Airport Council International assessments
- 2014 Prime Excellent Service.

A number of awards have been received by Balikpapan City for:

- Best Spatial Planning
- Livable City (IAP)
- Eligible City of Children
- Adipura (Environment), awarded 18 times
- Winner of Wahan Tata Nugraha (Transportation), awarded 18 times
- 151 awards for Adiwyata School
- Environmental Sustainable Cities award given in the clean land, clean water, and clean air categories
- The planting of 1 million trees
- Ranked second in the Smart City Award
- The Most Liveable Cities (WWF)
- Ranked second in the Sustainable City Index, Indonesia
- Ranked third in the Happiness Index, Indonesia.

My City X — citizens' collaboration tools for urban management

Yoshihide Sekimoto, Institute of Industrial Science; Toshikazu Seto, Center for Spatial Information Science, University of Tokyo, Japan

Smart City is a designation that can be used for describing cities that use cutting-edge technologies and surveillance cameras to control such practicalities as zero scratch autonomous driving or cash-free environments. However, it is important to remember that any city, to be of true benefit to its citizens, must be sustainable; and that the collaboration of citizens with local government using self-controllable data, and without interference by a single corporate stakeholder, is central to sustainability. It is for this reason that a collaborative urban planning project, *My City X,* has been created using open data and machine learning techniques, and designed for use by ordinary citizens. Two tools have been developed within the project: an urban simulation system, *My City Forecast*[1], and a civil infrastructure monitoring tool *My City Report*.

My City Forecast

In urban management, the importance of citizen participation is being emphasized more than ever before. This is especially true in countries where depopulation has become a major concern for urban managers, and many local authorities are working on revising city master plans, often incorporating the concept of the "compact city." In Japan, for example, the implementation of compact city plans means that each local government decides on how to designate residential areas, and promotes citizens moving to these areas in order to improve budget effectiveness and the city's vitality.

However, implementing a compact city is possible in various ways. Given that there can be some designated withdrawal areas to satisfy budget savings, some compact city policies can be unfavourable for some citizens. At this critical point in the design of urban infrastructure, it is necessary to include citizen–government collaboration as well as mutual understanding and cooperation in every step of urban management, especially in the planning process.

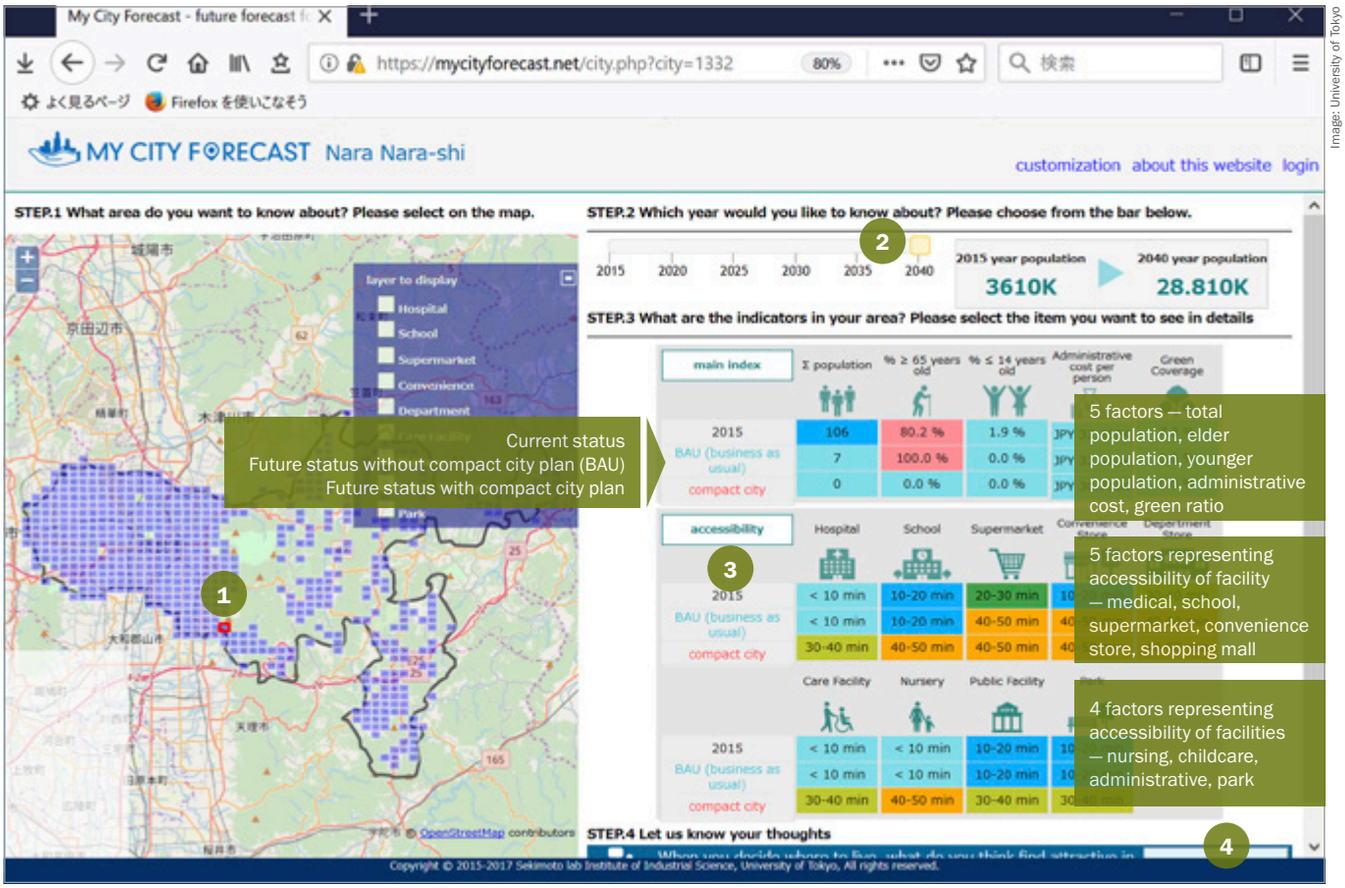
Along with the recent rapid growth of big data utilization and computer technologies, a new conception of cooperation between citizens and government has developed. With emerging technologies based on civic knowledge, citizens have begun to attain the power to engage directly in urban management by obtaining information, thinking about the problems within the city, and taking action to help shape the city's future. This development is also supported by the open government data movement, which promotes the availability of government information online. CityDashboard is one well-known example of real-time visualization and distribution of urban information. CityDashboard, a web tool launched in 2012 by University College London, aggregates spatial data for cities around the UK and displays the data on a dashboard and a map. These new technologies are expected to enable both citizens and government to view their urban situation through an interface presenting an overhead view, based on statistical information.

However, usage of statistics and governmental data is as yet limited within the process of urban planning. In research conducted by University of Tokyo, it was revealed that most of the data sets gathered through basic surveys for urban planning and national censuses and stored by local officials in Japan, are not efficiently utilized or fully shared with citizens. Further, lack of appropriately skilled personnel and technological know-how discourages discussion based on data analysis and/or urban simulations. As a result, the urban management process mainly yields to government initiatives, neglecting to take advantage of citizen participation opportunities.

To help improve this situation and increase citizen participation in urban management, University of Tokyo has developed a web-based urban planning communication tool using open government data for enhanced citizen–government cooperation. The main aim of the present research is to evaluate the effect of the system on users' awareness of, and attitude towards, the urban condition. An urban simulation system, *My City Forecast,* has been designed and developed, that enables citizens to understand how their environment and region are likely to change by urban management in the future — up to 2040.

The simulation model includes an estimation of the population, the location of urban facilities, and administrative costs. The data used to summarize the simulation results are mainly common household indicators, which users can compare directly with their actual living data. Moreover, the simulation results are provided at a spatial resolution of 500m by 500m, enabling users to recognize their personalized environmental information on their neighbourhood.

It is expected that, as more people use the web tool online and utilize it in the actual planning process, citizen–government communication will be enhanced. To achieve this effectively, there needs to be continuous evaluation and development based on feedback gathered through user tests. This article shows the result of the psychological evaluation



My City Forecast main page interface, showing the four steps to registering opinion — step 1: select the area (500m square grid); step 2: select the year; step 3: compare three types of results simulated through 14 factors; step 4: register opinions

of users' attitudes toward the future image of their urban region constructed through the provision of personalized environmental information.

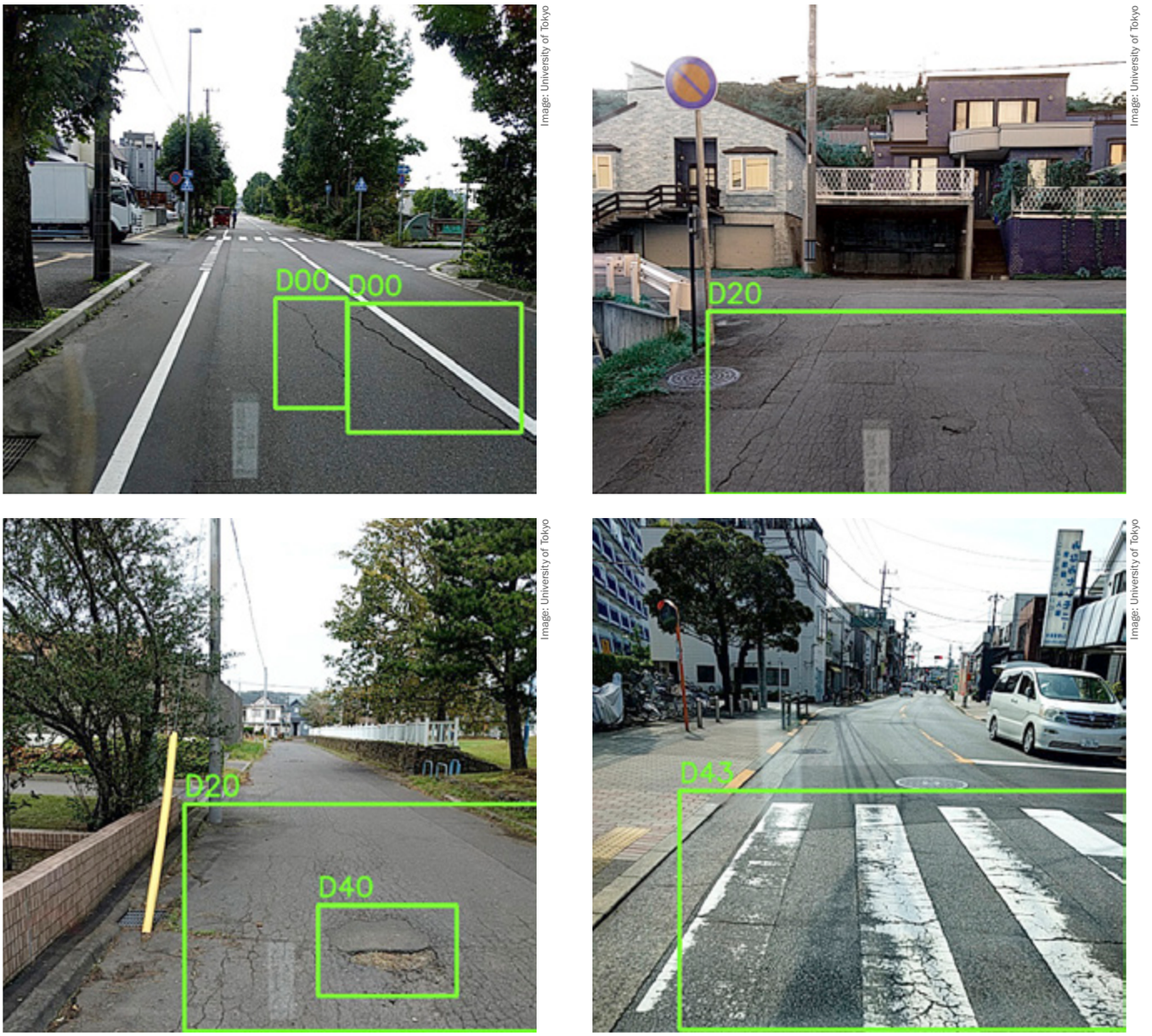
At the top of the *My City Forecast* web page, users can choose which city to view. The page for the city of Nara is shown as an example above. On the left, there is a map of the city divided into 500m by 500m cells. Users can choose a particular area with a click (step 1). Next, by sliding the time axis, users can set the estimation time stamp for a year (step 2). The results for the future simulation of the area, encompassing 14 urban structure indicators, will appear simultaneously on the right of the page. For each indicator, these urban transition simulation results will be shown both with and without the concept of the compact city applied. Here, the 'without' version is referred to as 'Business as usual' (BAU) (step 3). By clicking a given indicator, the map will visualize values spatially for that indicator. By clicking the link at the bottom of the page, users move on to the questionnaire, where they can submit their profiles and offer opinions on their present and future living environment (step 4).

My City Report

During the period of high economic growth in Japan, from 1954 to 1973, infrastructure such as roads, bridges, and tunnels were built extensively. However, because many of these were constructed more than 50 years ago[2], they are now old, and the number of structures that are to be inspected is expected to increase rapidly in the next few decades. Also, the discovery of the aged and affected parts of infrastructure has thus far depended solely on the expertise of veteran field engineers, and, because of the increasing demand for inspections, there has been a shortage of expert field technicians and financial resources in many areas. In particular, the number of municipalities that have neglected conducting appropriate inspections owing to the lack of resources or experts has been increasing. The US also has similar infrastructure ageing problems. Indeed, the prevailing problems in infrastructure maintenance and management are likely to be experienced by countries all over the world. Considering this negative trend in infrastructure maintenance and management, it is evident that efficient and sophisticated infrastructure maintenance methods are urgently required.

In response to this problem, many methods of efficiently inspecting infrastructure, especially roads, have been studied, such as those using laser technology or image processing. There have also been several studies using neural networks for civil engineering problems between 1989 and 2000, and computer vision and machine learning techniques have recently been successfully applied to automate road surface inspection. However, thus far, with respect to methods of inspection using image processing, it is believed that these methods suffer from three major disadvantages:

- There is no common data set for a comparison of results; in each research, the proposed method is evaluated using



Road damage detected by smart phone using deep learning. Clockwise from top left: D00: linear crack; D20: alligator crack; D43: white line blur; D40: pothole

its own data set of road damage images. Given the field of general object recognition, wherein large common data sets such as ImageNet and PASCAL VOC exist, there is a need for a common data set on road scratches.

- Although current state-of-the-art object detection methods use end-to-end deep learning techniques, no such method exists for road damage detection.
- Although road surface damage is classified into several categories[3], many studies have been limited to the detection or classification of damage in only longitudinal and lateral directions.

It is therefore difficult for road managers to apply research results directly in practical scenarios. Considering these disadvantages, in this study, University of Tokyo has developed a new, large-scale road damage data set in order to train and evaluate a damage detection model that is based on the state-of-the-art convolutional neural network method. The contributions of this study are as follows.

- 9,053 road damage images containing 15,435 instances of damage have been created and released. The data set contains the bounding box of each class for the eight types of road damage. Each image is extracted from an image set created by capturing pictures of a large number of roads obtained using a vehicle-mounted smartphone. The 9,053 images of the data set contain a wide variety of weather and luminance conditions. In assessing the types of damage, the expertise of a professional road administrator was employed, rendering the data set reliable.
- Using the developed data set, the state-of-the-art object detection method was evaluated based on deep learning and generated benchmark results.[4]
- It was shown that the type of damage from among the eight types can be identified with a high degree of accuracy.

The state of mobility in Accra

Alex Johnson, Director, Metro Transport, Accra Metropolitan Assembly (AMA)

Accra is a city of about 2.4 million inhabitants who have to face various types of daily challenges in meeting their mobility needs. A typical journey in Accra for average distances beyond 1km can be characterized by long travel time, long waiting time for public transport and long walking distances to bus stops. These indicators grow worse towards the urban periphery. The sphere of influence of services in the central parts of Accra attracts an additional daytime population of about 1 million to the city on a daily basis. This results in congestion with many implications for productivity and healthy city living that needs to be managed.

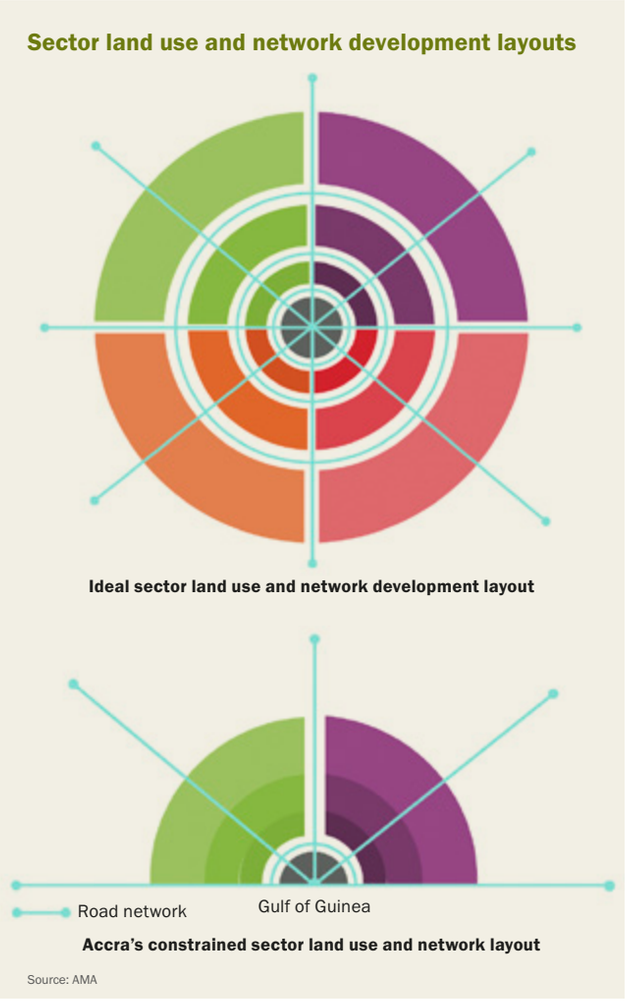
The current state of Accra's mobility infrastructure has been shaped by a long history of limited conventional planning of sector land uses; first influenced during the colonial era by a road network pattern designed to transport goods from the hinterlands to the city's port. With the road network in Accra having been conditioned by this type of functional outlook and other geophysical constraints, formal planning schemes by public institutions such as the Land Use and Spatial Planning Authority (formerly Town and Country Planning Department) have also been negatively influenced by informal land use decisions and developments.

Under these conditions, it is difficult to identify a functional hierarchy of access for planning schemes in Accra. As a result, physical developments are low on provisions for mobility infrastructure, for example it is still possible for some major artery roads to be completed without adequate provision for pedestrians and cyclists because of a lack of adequate planning and resources. Some of these dynamics are attributable to uncontrolled growth and a rapid change in land-use activities.

It is almost impossible to develop the city using the concentric circle model of land use, given the physical constraint posed by the Gulf of Guinea, assuming that land resources were totally under government control. The most viable mobility strategies include the development of mass transit systems to compensate for the limited accessibility options to and from the city centre, if the current administrative, business and civic land uses are going to stay relevant for the country's capital city in the long term.

The limiting nature of the road network in affording east-west orbital movements means that there is a need to foster judicious use of the existing radial network for mass transportation options in order to reduce congestion.

On the macro level, spatial analysis shows Accra as a dual sprawl settlement structure, with development evolving on both sides of the N1 Kwame Nkrumah motorway and the George Bush Highway. This type of development has deepened



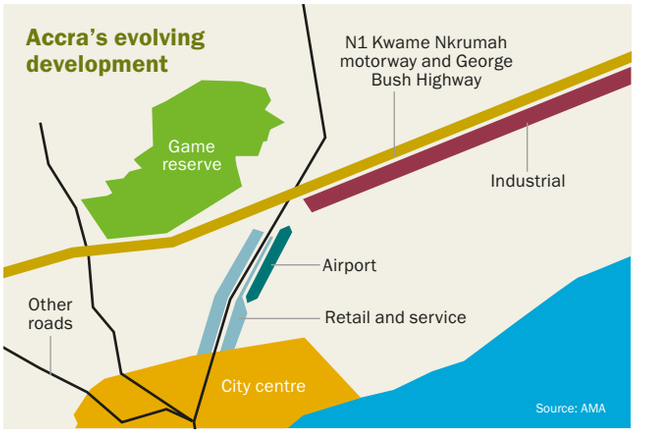



Image: AMA

Unpaved local street in Osu, Accra


Image: AMA

Paved local street in Osu, Accra


Image: AMA

Section of the N1 Highway in Accra with pedestrian pavements encroached on by traders


Image: AMA

Section of the N1 Highway in Accra with pedestrian walkways

the spatial disintegration of land uses that are mostly residential to the north of the N1, and industrial to the south side of the motorway. The radial nature of Accra's road network in the face of this land-use pattern places workplaces and homes far apart, resulting in unidirectional traffic flows during the morning and evening peak travel periods.

Network development and quality of access

Another important issue is the limiting choice of available alternatives of access routes for specific mobility needs, influenced by the conditions of road infrastructure. Bad roads prolong travel times unnecessarily. A lack of alternatives means captive use and, in the case of Accra, overstretched capacities that reduce the level of service for users in terms of travel speeds on sections of some road corridors. In comparing quality of access, local roads have the worst surface conditions and the least pedestrian and cycle lane pavement facilities per kilometre length compared to highway sections in the urban space. The non-connectedness of mobility infrastructure becomes more obvious when assessed with gender considerations, especially for disabled persons. Most projects in Accra that set out to solve mobility problems may not have been informed by comprehensive user data. Additionally, there are instances of pedestrian pavements on major arterial roads having been appropriated by commercial activities, forcing pedestrians to walk in the vehicular traffic right of way, making such environments unsafe, especially for children.

Accra's national sphere of economic influence

With the prospects of a cosmopolitan Accra being reinforced by increased migration from other parts of the country, this has resulted in widespread engagement of open spaces, including pedestrian and vehicular rights of way, for economic activities. Under normal circumstances, open spaces provide viable prospects for urban redesign. However, in Accra, these spaces are under constant pressure from rising housing needs, resulting in rampant unplanned urban-infilling and in some cases, encroachment of road reservations.

As a result, the urban form in Accra has no predictive structure as the majority of land use decisions run ahead of regulatory planning decisions. The challenges for mobility in Accra are further compounded by institutional silos of activities that continue to threaten a robust local government decentralization concept that aims to provide an integrated land use planning capacity at the local level. The most visible manifestation of the urban form problem, evidencing poor integration of land use, is traffic congestion at peak periods moving in the direction of the central business district during the morning period and away from it in the evening.

The economic attractiveness of Accra to migrants from other parts of the country means that the administrative structures and resources made available for city management must be considered on merit and not agreed routinely.

Mobility services and institutional capacity at the local government level for transportation management

Given the history of a public transport subsector that has long been regulated largely by informal provider groups, it was problematic to quickly change that system when the Ghana Urban Transport Project (GUTP) was introduced in 2008. The challenge remains that the majority of economic actors are in the private, informal sector, necessitating much investment in institutional capacity to build data systems for effective surveillance as well as a results-based monitoring system for effective regulation at the local government level.

There are few staff with technical expertise working from the local government office to facilitate a newly introduced regulatory regime. Meanwhile the city has an onerous task in streamlining public transport route services covering an area of over 170 km^2 when approximately 30 per cent of the 315 routes registered at Accra Metropolitan Assembly (AMA) alone go beyond its administrative jurisdiction. The coordination challenges are clear, as the institutional capacity of each local government institution in the Greater Accra Region is critically imbalanced. From a regional perspective, this does not augur well for harmony in enforcing standards. The ideal scenario would be a coordinating transport executive that would also serve as a cross-jurisdictional body to harmonize transport and mobility needs at the regional level to reinforce local needs.

Even though a Greater Accra Passenger Transport Executive has been formed, there are capacity issues for planning and service regulation that need to be addressed immediately. That is because Accra's mobility needs have limited complementarity given the existing infrastructure and so require optimal use of road space under strong policy directions that emphasize mass transit. In the absence of any practical action, the traffic congestion problem will continue to grow.

Network layout comparison

Accra network layout showing the major connecting corridors

Connectivity in Paris

Comparison of the concentric circles of an orbital network with consistent grids in Paris with Accra's north–south orientation with only the semi-circle (ring road) providing limited east–west movement

Transport projects and the activities of the Department of Transport in AMA

Since the GUTP ended technically in 2014, few transportation initiatives are running in Accra for solving, in a comprehensive way, the urban mobility issues. One of the few projects that has begun in the Greater Acccra Metropolitan Area is the Ghana Urban Mobility and Accessibility Project (GUMAP), funded by the Swiss Development Cooperation, SECO. The objectives of GUMAP are to reinforce the gains of the GUTP and foster a more comprehensive approach in dealing with mobility problems through institutional capacity-building.

Major deliverables under the GUTP that are still visible are the current, improved bus services running on the Accra–Amasaman road corridor, covering a distance of about 26 km. On the institutional side, four key district assemblies including the AMA now have departments of transport activated by a recent change in local government law of Ghana which mandates that local administrations of metropolitan and municipal status should have a Department of Transport.

The argument from the above is that it is important for all assemblies within the Greater Accra Region to be adequately resourced and supported by the Ministry of Local Government in order to carry out their transportation management mandate through institutional collaboration for infrastructure development and mobility services design and delivery.

The way forward

In line with the Sustainable Development Goals, Accra's transport action plans throughout the road agencies in the public sector emphasize sustainable mobility options. This is engendering advocacy from professional circles to see more pedestrian-friendly infrastructure in the central parts of the city as well as satellite business areas such as Osu (Oxford Street). Local interaction with international programmes such as the Bloomberg Initiative on Global Road Safety, C40 Cities Climate Leadership, and 100 Resilient Cities, is changing professional orientation towards sustainable mobility considerations for the design and use of access infrastructure.

Meanwhile, there is a spatial development policy programme for local plans in Ghana known as the Spatial Development Framework (SDF), seeking to redefine the roles of local government authorities and encouraging them to take charge of settlement planning activities at their level. It is expected that these types of initiative will also come with the necessary capital resources to plan for infrastructure at the local level, including mobility infrastructure. If the institutional arrangements for the implementation of the SDF plans become a reality, this will represent a shift in the financing model for mobility infrastructure, thus making more capital resources available at the local government level to cater for infrastructural needs including those for mobility and accessibility.

Towards localizing Sustainable Development Goals in Mongolia

Tuvshinbagana Munkhjargal, Director of Project Research and Planning; Tsend-Ayush Baasanjav, Head of Administration Unit; Khaliunaa Gantulga, Project Research Specialist, Project Research and Planning Department; Sod-Erdene Servuud, Chief Executive Officer, Ulaanbaatar Development Corporation JSC

By parliamentary resolution, in February 2016 Mongolia adopted its Sustainable Development Vision 2030 (MSDV-2030), welcoming the approval of the Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development. The state has since been taking measures to identify its responsibilities for medium- and short-term policies at both national and local levels.

With financing from the United Nations Development Programme (UNDP), the National Development Agency of Mongolia has implemented a project for adopting MSDV-2030 in line with the SDGs, and framing the voluntary national report for the second half of 2018.

The fulfilment of this project will result in implementing MSDV-2030 in the medium-term, disseminating the ideology of the SDGs and MSDV-2030, assessing the SDGs' implementation in Mongolia and submitting the report to the United Nations high-level political forum 2019.

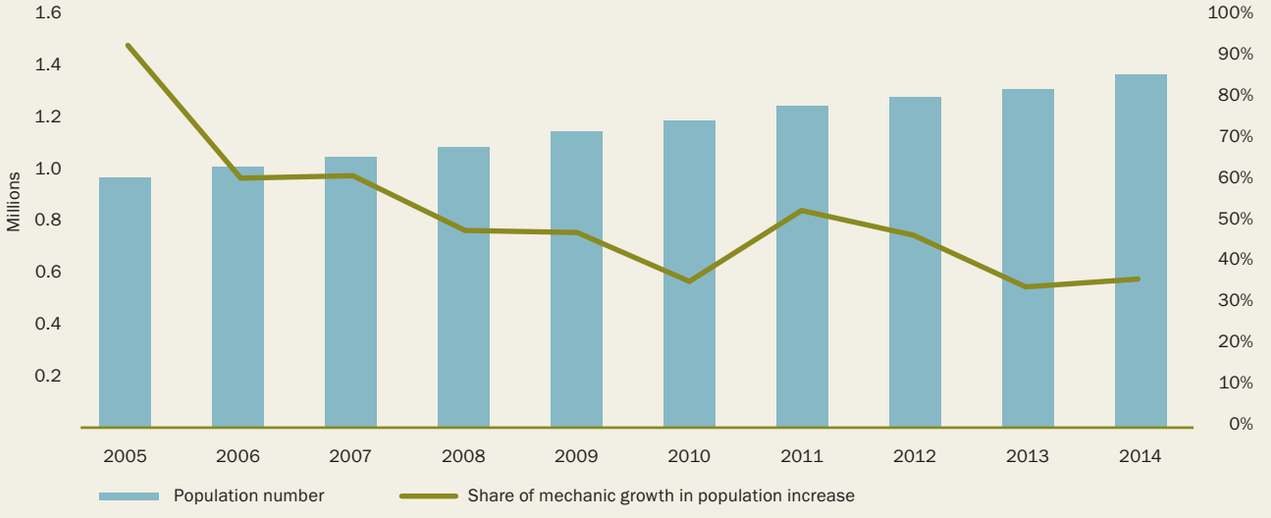
Localizing the SDGs is being carried out at both government and local levels, with the Ulaanbaatar mayor's office organizing the project in cooperation with UNDP. Three main works have been undertaken, and the following measures have therefore been proposed to improve the current state of Ulaanbaatar's development financing:

- Improving the legal environment
- Creating a project prioritization tool for development projects, and improving project management
- Ensuring public participation in the development financing system
- Creating the conditions for private investment
- Attracting external sources
- Creating new sources of revenue for Ulaanbaatar
- Establishing a community-based financing system.

In addition, a group of national advisors has developed a mapping system for implementing the SDGs and MSDV-2030 of Ulaanbaatar through assessing and analysing the appropriate correlation between policies and budgeting, monitoring, and reporting.

The 2016–2020 Action Plan of the Capital City's Mayor (APCCM) — is targeted on ensuring that Ulaanbaatar is citizen-oriented, and has been set out to create an East-Asian

Mechanic growth of population 2005–2014



Source: National statistics office

financial, business and tourism hub that is business-friendly and built on green development concepts.

The APCCM is concerned with five main sectors — economy, urban development and infrastructure, green development, social development, and governance — all of which align with the MSDV-2030 priorities, demonstrating that Ulaanbaatar is well prepared for localizing the SDGs.

The amendment to the masterplan to develop Ulaanbaatar up to 2020, and identifying development trends up to 2030

Since 1954, the shape of Ulaanbaatar has been formed through the implementation of five development master plans. In recent years, and especially since Mongolia transitioned into a market economy in 1990, rapid urbanization has occurred due to socioeconomic change and economic growth. This, in turn has caused the expansion of unplanned slum districts with a lack of infrastructure and an inaccessibility to schools, nurseries, health care and public transport. This has created such challenges as road congestion and environmental pollution.

As of 2017, 1,462 million — just over 46 per cent of the country's population, or 386,200 households — are living in Ulaanbaatar. Over the last two decades, the population has been growing rapidly, with more than half of the increase in mechanic growth, which is directly related to rural-to-urban migration.

In 2013, with the aim of resolving these urgent challenges, the Mongolian Parliament approved an amendment to the masterplan to develop Ulaanbaatar up to 2020, and agreed further to identify development trends up to 2030.

In accordance with the masterplan 2016–2020, a detailed action plan, with 90 development investment projects under six priorities and 14 objectives, was approved as a medium-term investment planning initiative. The six development priorities are to create a:

- Safe, healthy and green city
- Liveable environment
- City with good governance based on the participation of both citizens and the private sector
- City with a multi-centred urban settlement system
- Tourism hub
- Developed and internationally competitive city.

The development vision

Ulaanbaatar's development vision sees the city becoming the smart capital of Mongolia, with a traditional style and unique appearance; a city that is internationally competitive with an economy stimulated by high-technology-based industries; and an eco-friendly city that respects its traditional, centuries-old, nomadic heritage.

Highlights of projects implemented under the masterplan

According to the masterplan, the city will develop 29 sub-centres, two of which are being built at Bayankhoshuu — during the coldest period of winter, the air pollution index of this area reaches 2,800 while it is around 200–300 units in other areas of the city — and Selbe where air pollution is at its highest and where the next two sub-centres are being planned for construction.

The Bayankhoshuu sub-centre will provide 3,526 households in the 7th, 8th, 10th, and 28th subdistricts of the Songihokhairkhan area with safe drinking water and safe, liveable conditions. Moreover, a 240-bed nursery will be built, increasing its enrolment by up to 63 per cent. One feature of this project is the establishment of a business incubator centre that will train local residents for new skills and support micro-businesses. On completion of the project, affordable apartments will be constructed to accommodate 10,000 households based on the sub-centre's capacity to provide heat, drinking water, and a sewerage system.

On establishment of these two sub-centres, the number of stovepipes will be reduced by 7,220, eliminating 2.6 per cent of total air pollution in the city. Provided that all 29 sub-centres are established, 50 per cent of slum district households will be provided with the infrastructure to alleviate annual greenhouse gas emissions.

Economic development strategy

With the need to create and implement detailed economic development policies under the masterplan, the Economic Development Agency designed long-, medium-, and short-term strategies for the development of Ulaanbaatar's economy. These strategies are essential components of the masterplan, and address complex issues of development, progress, finance, taxation, infrastructure, transport, education, health, culture, tourism, administration, and the current and future development trends of those sectors.

Ulaanbaatar Development Corporation JSC, established under the masterplan for sustainable development

Approximately US$ 16 billion (as of 2012) was required to implement the projects reflected in the masterplan, while funding of US$ 683 million was required to implement the short-term measures stated in the Economic Development Strategy. Since there has been a shortage of financing for these works from the capital city budget an alternative optimal solution had to be found, as bank loan financing interest rates are high, maturity is short, the State's budget is under a high burden and the private sector is not able to provide solely for these measures.

In addition, since legal and other barriers and constraints threatened to halt implementation of these projects and programmes if they were to proceed by conventional methods, a capital city funded, closed joint stock company, the Ulaanbaatar Development Corporation JSC, was formed in April, 2015 to work more effectively with the private sector. The company is now implementing strategic and development projects and programmes through public-private partnership agreements that have been reflected in the APCCM and the masterplan.

The introduction of natural gas to Ulaanbaatar

220,000 households exist in the unplanned slum districts on the outskirts of the city, with no connected utilities. They mostly use coal burning stoves that produce 80 per cent of the city's annual greenhouse gas emissions. Moreover, the transportation sector emits around 20 per cent of total emissions, 11.2 per cent of which is produced by public buses.

Image: National Development Agency of Mongolia

Inspection of public bus emissions in Ulaanbaatar

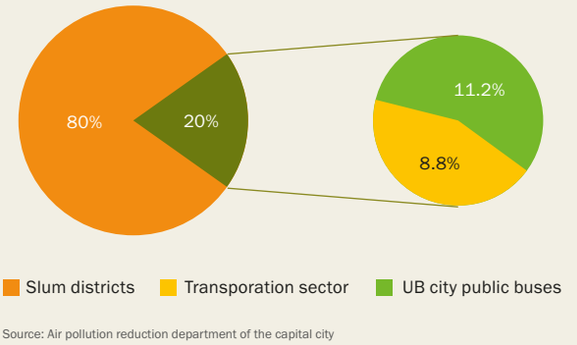
Thus, following the masterplan and the 2016–2020 action plans of the city and the government, the Ulaanbaatar Natural Gas LLC was established to introduce natural gas as a fuel for the city's public bus fleets. It was decided that, if all the buses in service were refurbished with natural gas engines, the lead, sulphur dioxide and nitrogen dioxide emissions would fall by 90 per cent and air pollution reduced by 11.2 per cent, virtually eliminating a major source of air pollution.

The project to introduce natural gas to Ulaanbaatar for green energy will be implemented in three stages. Firstly, natural gas will be imported from Russia as a liquid and supplied to city's public buses. Secondly, when a natural gas distributing infrastructure has been built in the city, taxis, intercity buses and heavy machinery will be converted. In the final phase the low pressure stoves in the slum districts will be supplied with natural gas. A natural gas processing plant will then be built at the end of the project.

Public utility service centre

According to research by Mongolia's Ministry of Nature, Environment, and Tourism, 88 per cent of soil in the city is contaminated. The main polluters have been open defecation in slum districts, sewerage disposal, and general waste dumped into the soil. Bacterial pollution of the soil has been found at a depth of 47 m, evidence of decades of contamination. Since there is a lack of utility service centres that meet hygiene standards in the slum districts, the Ulaanbaatar Development Corporation has committed to building public utility service centres in 80 subdistricts to improve the living environment for the residents living on the outskirts. On establishment of these service centres, over 380,000 city residents currently unconnected to the infrastructure will receive comprehensive utility services for their homes.

Composition of greenhouse gas, by source



Source: Air pollution reduction department of the capital city

Image: National Development Agency of Mongolia

A teen living in the slum district carries water for household consumption from a water distribution centre

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Secretariat's General Direction of Resilience:
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Coordinator: Tai Cardel
Coordinator: Cesar Abarca
Alejandro guerra
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Mariana Olvera
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The SACN's membership includes the following cities:
Buffalo City Municipality
City of Ekurhuleni
City of Johannesburg
City of Tshwane
Ethekwini
Mangaung Metro Municipality
Msunduzi Local Municipality
Nelson Mandela Bay Metro Municipality

For more information, visit the SACN website www.sacities.net

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