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FOR A BETTER URBAN FUTURE

Innovative Experiences of Cities:
Environmental Sustainability and Climate Action through South-South and Triangular Cooperation

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List of Abbreviations

CCCS	Colombian Council for Sustainable Construction (Consejo Colombiano de Construcción Sostenible)
CO2 CO2eq	Carbon dioxide Carbon dioxide equivalent
CPYCS	Paraguayan Council for Sustainable Construction (Consejo Paraguayo de Construcción Sostenible)
CUF	Cities Alliance's Community Upgrading Fund
C40	C40 Cities Climate Leadership Group
GHG	Greenhouse gas emissions
ha	Hectare
ICCT	International Council on Clean Transportation
INSHP	International Network on Small Hydro Power
IUOs	Integrated Urban Operations
kWh	Kilowatt hour
LED	Light-emitting diode
MERCOCIUDADES	Mercosur Cities Network
MOCUPP-Urbano	Monitoring Land Use and Land Cover Change in Productive Landscapes

P4G	Partnering for Green Growth and the Global Goals 2030
SDGs	Sustainable Development Goals
SSTC	South-South and triangular cooperation
TWh	Terawatt hour
UN	United Nations
UNDP	United Nations Development Programme
UN-Habitat	United Nations Human Settlements Programme
UNIDO	United Nations Industrial Development Organization
UNDRR	United Nations Office for Disaster Risk Reduction (formerly UNISDR)
UNOSSC	United Nations Office for South-South Cooperation
USD	United States dollar
ZEBRA	Zero Emission Bus Rapid-deployment Accelerator

Foreword by UNOSSC

Cities around the world hold the key to an urgently required paradigm shift towards low-emission and climate-resilient development pathways. As stated by United Nations Secretary-General António Guterres at the C40 Mayors Climate Alliance in April 2021, "Cities and urban centres are on the frontlines of the climate crisis…but cities can also boost climate action, clean energy and sustainable development, through more effective strategies and policies, especially as they recover from the impacts of the coronavirus pandemic."

As they are among the most impacted by the adverse effects of climate change, cities in developing countries are increasingly devising innovative approaches to adaptation. At the same time, sustainable development solutions now often originate in the Global South, including for clean and low-emission energy generation, transportation, buildings and waste management.

In 2019, United Nations Member States for the first time highlighted in the Buenos Aires outcome document of the second High-level United Nations Conference on South-South Cooperation (commonly known as "BAPA+40") the importance of establishing or strengthening coordination mechanisms at the sub-national level to leverage expertise and other resources through South-South and triangular cooperation towards the attainment of the 2030 Agenda for Sustainable Development. The UNOSSC South-South and Triangular Cooperation among Maritime-Continental Silk Road Cities for Sustainable iDevelopment Project (Cities Project) is designed to provide streamlined services and support sub-national level efforts on this.

By highlighting the importance of sharing knowledge, technologies, practices and experience through 12 case studies of cities from around the world, this publication aims to provide useful insights into practical and effective solutions to inspire, replicate and scale-up South-South and triangular cooperation at the city level for addressing climate change and fostering environmental sustainability in different urban contexts.

I would like to express my appreciation to the local governments and municipal authorities that have enthusiastically contributed to this publication and to UN-Habitat for the continuous collaboration in the spirit of promoting the tremendous potential of South-South and triangular cooperation for the implementation of the Paris Agreement and the achievement of the Sustainable Development Goals. I greatly look forward to continuing these partnerships in the future.

Adel Abdellatif

Adel Abdellatif
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Foreword by UN Habitat

Cities have borne the brunt of the Covid 19 pandemic and are on the front line of the climate crisis. These challenges to humanity and life on the planet highlight the need for greater international cooperation. To build back better we must build back together.

Urbanisation, if well- planned and managed, holds the promise of "bending the curve" both in terms of reducing global warning and in tackling the current and future epidemics. With sustainable urbanisation, cities hold the key to achieving the Sustainable Development Goals (SDGs). The New Urban Agenda, adopted in 2016, provided us with a blueprint for achieving both the Paris Agreement and the SDGs. The current pandemic has further highlighted its importance.

We have learnt over the years that while every city is unique, they face some common challenges, and experiences from one can benefit another. This publication profiles some selected initiatives from cities with this objective. While each case is different, they all bring out the need for strong local leadership and coordination between all stakeholders including local and national governments, businesses, communities and civil society organisations. They also highlight the need to focus on the inclusion of all, particularly vulnerable groups, in devising and implementing solutions.

Knowledge sharing and innovation are key pillars of UN-Habitat's work. They play an important role in spreading good practices, sharing expertise and scaling up innovative solutions, thus inspiring transformative change. UN-Habitat has developed a dynamic, integrated approach to innovation that incorporates both digital and non-digital technologies. It is based on horizontal and collaborative working practices that consider a diverse range of views and considers the context in which the innovation is taking place. In recent years, South-South and triangular cooperation has become key to transferring expertise and technologies for scaling up climate action.

As part of our ongoing strategic collaboration with UNOSSC, to promote such cooperation in accelerating progress towards the SDGs and the Paris Agreement, we have jointly produced this publication with the aim of raising awareness on our common urban challenges and mainstreaming standards of sound urban development through South-South cooperation. We hope it will be interesting for city planners and managers and NGOs as well as citizen groups and students across the global South. It should also encourage cities everywhere to replicate promising and innovative solutions in their pursuit of a sustainable, inclusive, green and resilient urban future for all.

Rafael Tuts
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United Nations Human Settlements Programme

Acknowledgments

1. Introduction

Home to the majority of humankind, cities are at the forefront of tackling climate change and promoting environmental sustainability. Rising sea levels and extreme weather events such as floods, droughts, and storms are impacting heavily on infrastructure, livelihoods and human health in cities. At the same time, urban activities are a major contributor to climate change and environmental degradation producing about 70% of global greenhouse gas (GHG) emissions, 70% of global waste and more than 60% of global energy consumption.[1]

In 2016, United Nations (UN) Member States adopted the New Urban Agenda, reaffirming their global commitment to sustainable urban development as a critical step for realizing sustainable development in an integrated and coordinated manner at the global, regional, national, subnational and local levels. The New Urban Agenda also serves to support and localize the achievement of the Sustainable Development Goals (SDGs). [2]

Growing recognition of South-South and triangular cooperation at the city level

There is a growing recognition of the importance of South-South and triangular cooperation[3] at the city level. In 2017, the UN General Assembly urged[4] the UN to continue to support South-South cooperation projects that contribute to the implementation of the New Urban Agenda. In 2018, a report issued by the UN Secretary-General titled "Role of South-South cooperation and the implementation of the 2030 Agenda for Sustainable Development: Challenges and opportunities"[5] pointed out that the number of actors in South-South and triangular cooperation has expanded and increasingly include subnational entities such as municipal and provincial governments as important stakeholders. With the adoption of the Buenos Aires outcome document of the second High-level United Nations Conference on South-South Cooperation (commonly known as "BAPA+40"), Member States highlighted the importance of promoting South-South cooperation at the sub-national level. More specifically, Member States encouraged the establishment or strengthening of coordination mechanisms at the sub-national level to leverage expertise and other resources through South-South and triangular cooperation towards the attainment of the 2030 Agenda for Sustainable Development.[6]

Further, BAPA+40 recognized alarming "trends towards rapid urbanization in developing countries" and called "for greater South-South and triangular cooperation initiatives aimed at eradication of poverty in all its forms and dimensions in urban and rural areas through more coordinated policies and sharing of knowledge, solutions and experience, by raising the productivity, resilience and sustainability at the local level, including of urban centres where 68 per cent of the world's population is projected to live by 2050. An important means to this end is sharing of good practices in participatory urban planning and management. We stress the importance of scaling up South-South and triangular cooperation towards decent work for all,

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[1] See "The Global Context" of the New Urban Agenda. Available at: https://habitat3.org/the-new-urban-agenda.

[2] United Nations General Assembly. Resolution adopted by the General Assembly on 23 December 2016. New Urban Agenda. A/RES/71/256*. 2016. Available at: https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_71_256.pdf.

[3] Triangular cooperation involves two or more developing countries in collaboration with a third party, typically a developed-country government or multilateral organization, contributing to the exchanges with its own knowledge and resources.

[4] United Nations General Assembly. Resolution adopted by the General Assembly on 20 December 2017. South-South Cooperation. A/RES/72/237. 2018. Available at: https://undocs.org/en/A/RES/72/237.

[5] United Nations General Assembly. Role of South-South cooperation and the implementation of the 2030 Agenda for Sustainable Development: Challenges and opportunities. Report of the Secretary-General. A/73/383. 2018. Available at: https://undocs.org/en/A/73/383.

[6] United Nations General Assembly. Resolution adopted by the General Assembly on 15 April 2019. Buenos Aires outcome document of the second High-level United Nations Conference on South-South Cooperation.

local community development and service delivery in rural areas to address the drivers of rural-to-urban migration and related challenges"[7].

Cities around the world are already spearheading innovative solutions for a low-emission climate-resilient development and environmental sustainability in many areas, including energy, mobility, water, waste management and disaster risk reduction. Cities are also increasingly joining forces and learning from each other to collectively strengthen environmental protection. The United Nations Office for South-South Cooperation (UNOSSC) is supporting these efforts by fostering city-to-city partnerships, the exchange of innovative approaches, and the development of urban pilot projects in developing countries.

South-South and Triangular Cooperation among Maritime-Continental Silk Road Cities for Sustainable Development Project (Cities Project)

UNOSSC launched the Cities Project in 2017, with funding support from the Government of China, to promote South-South and triangular cooperation at the city level, leveraging UN specialized agencies' expertise and the strategic opportunities offered by the Belt and Road Initiative (BRI) in advancing the Sustainable Development Goals (SDGs). In 2020, over 200 cities and institutions globally had actively participated in activities under the Cities Project. Over 40 online knowledge exchanges and capacity development trainings were organized, connecting over 1,000 cities from more than 140 countries.

In 2021 the South-South Cities Clusters, an online community hosted on the South-South Galaxy platform, was developed to bring cities together to interact and exchange with UN specialized agencies, experts and partners, in order to facilitate city-to-city horizontal cooperation and exchange.

UN-Habitat Waste Wise Cities Programme

Similarly, the United Nations Human Settlements Programme (UN-Habitat), is the United Nations programme working towards a better urban future. Its mission is to promote socially and environmentally sustainable human settlements development and the achievement of adequate shelter for all. Through its Waste Wise Cities programme, launched on World Habitat Day 2018, UN-Habitat inspires, catalyzes, guides, monitors, enables, and mobilizes support for local governments to work towards improved waste management, resource efficiency and sustainable cities and communities. To support the achievement of the SDGs at the city level, Waste Wise Cities and its affiliates share knowledge and good practices, build capacity for waste data collection and monitoring, advocate and educate, and assist in the preparation of bankable waste management and circular economy projects. Furthermore, UN-Habitat also supports cities in developing low-carbon solutions to meet their transport needs and improving the energy efficiency of buildings.

This publication is produced by UNOSSC in cooperation with UN-Habitat under the Cities Project framework. The solutions in this publication will also be available on the digital platform for global knowledge sharing and partnership brokering – South-South Galaxy and its new section for cities – South-South Cities Clusters.

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[7] See footnote 6, paragraph 32.

2. Objectives

The main objective of this publication is to showcase innovative solutions that foster environmental sustainability and low-emission climate-resilient development in cities in developing countries and how South-South and triangular cooperation is contributing to the delivery, replication, and upscaling of those solutions.

The publication also aims to engage more partners in the exchange of experiences and knowledge-sharing as well as pilot project opportunities. Similarly, UN-Habitat's Waste Wise Cities programme welcomes additional member cities, affiliates, and partners.

3. Methodology

This publication was developed based on submissions received in response to a global call for submissions published on the UNOSSC website from 4 May to 20 June 2021 and shared by UN-Habitat among its network. Submissions were screened and pre-selected based on the published eligibility criteria of presenting innovative experiences that include South-South or triangular cooperation approaches, being scalable and replicable, and involving a local government or municipal authority.[8]

The final selection of innovative experiences as presented in Chapter 4 below was also guided by ensuring a diversity of examples in terms of geographic regions, countries, cities, mitigation and adaptation actions, and thematic areas of action.

4. Innovative Experiences

This chapter offers 12 case studies of innovative experiences on advancing environmental sustainability and climate action in small and large cities in Africa, Asia, and Latin America. The cases cover a broad range of thematic areas, including disaster risk reduction, sustainable buildings, solid waste management, renewable energy, food security, low-emission mobility, and sustainable urban planning. The chapter therefore showcases a variety of effective ways to achieve GHG emission reductions and to address the adverse effects of climate change in urban environments.

Most of the actions presented in these case studies have been enabled by or benefited from South-South or triangular cooperation (SSTC) approaches. These SSCT actions include, for example, turning waste into energy in Viet Nam through technology transfer from China, increasing climate resilience through the exchange of experiences between cities in Argentina and Brazil, or introducing Colombia's successful sustainable construction certification system in Paraguay with support from Germany. A common denominator of all cases is that the proposed solutions are replicable, in line with local needs and circumstances, have a potential for scale-up, and as such can serve as meaningful references for other cities to inspire urgent action on climate change and environmental sustainability.

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[8] Further information available at: https://www.southsouth-galaxy.org/news/call-for-submissions-innovative-experiences-of-cities-on-environmental-sustainability-and-climate-action.

Table 1: Overview of case studies

No	Short Title	Focus Area	Location	Climate Action	SDGs
4.1.	Advancing organic waste composting	Waste Management	Sao Paulo, Brazil	Mitigation & Adaptation	3, 11, 12, 13 and 17
4.2.	Increasing climate resilience in informal coastal communities through infrastructure development	Urban Resilience	Monrovia, Liberia	Adaptation & Mitigation	1-11, 13 and 17
4.3.	Turning waste into energy	Waste Management	Can Tho, Viet Nam	Mitigation	3, 6, 7, 8, 9, 11 and 17
4.4.	Shifting to zero-emission buses	Sustainable Transport	Latin American cities	Mitigation	11, 13 and 17
4.5.	Fostering sustainable urban construction	Sustainable Construction	Asuncion, Paraguay	Mitigation & Adaptation	11, 12 and 17
4.6.	Demonstrating green hydropower solutions	Renewable Energy	Lishui, China	Mitigation & Adaptation	1, 5, 7, 8, 13 and 17
4.7.	Increasing resilience through experience sharing	Urban Resilience	Esteban Echeverria, Argentina	Adaptation	1, 3, 5, 6, 11, 13 and 17
4.8.	Pioneering integrated urban solutions	Urban Planning	Santa Marta, Colombia	Mitigation & Adaptation	1, 5, 6-11, 13, 15-17
4.9.	Utilizing artificial intelligence for improved solid waste management	Waste Management	Kiambu, Kenya	Mitigation	5-12 and 17
4.10.	Promoting agroecology for sustainable food systems	Urban Resilience	Tandil, Argentina	Adaptation & Mitigation	2-4, 8, 12 and 17
4.11.	Spearheading community-driven waste management	Waste Management	Dehradun, India	Mitigation	6, 8, 10-13 and 17
4.12.	Improved urban planning through monitoring of land use and land cover change	Urban Planning	San Jose, Costa Rica	Mitigation & Adaptation	3, 5, 11, 13 15 and 17

4.1. Advancing organic waste composting in São Paulo, Brazil

Source: Prefeitura de São Paulo

- ➤ **Where?** São Paulo, Brazil·
- ➤ **Who?** City of São Paulo Waste Management and Cleaning Authority
- ➤ **What?** Waste management
- ➤ **When?** Since 2015
- ➤ **Climate benefits?** Reducing GHG emissions and increasing climate resilience
- ➤ **Which SDGs?** SDG 3, SDG 11, SDG 12, SDG 13 and SDG 17

Summary: The city of São Paulo has significantly improved its waste management through the introduction of a local low-cost composting technology. Instead of sending organic waste to distant landfills, up to 100 tons per day of market organic waste and tree pruning are now composted in five facilities within the city. The compost is used for public green spaces and urban gardens, increasing plant health and crop yields, and is also donated to citizens, farmers, schools, and non-governmental organizations.[9]

Innovative Experience: Every day, São Paulo, Brazil's most populous city, produces over 20,000 tons of municipal solid waste. Organic waste constitutes the highest share (47%).[10] In 2015, São Paulo started a pilot project for the treatment of organic waste from street markets and tree pruning. With a small investment and a relatively simple composting technology, the municipality set up de-centralized composting plants, serviced by an efficient waste segregation at source and collection system. São Paulo has about 1,000 street markets that generate a total of almost 100,000 tons of nitrogen-rich organic waste per year, mainly from fruits and vegetables. Furthermore, São Paulo also generates almost 100,000 tons of carbon-rich organic waste from city pruning per year, both necessary for the composting process.

The project started with one composting plant in the city district of Lapa, which initially composted 170

tons of organic waste per year from 26 street markets. Environmental education has been an important component of the project from the start. The city works with local private street cleaning companies. Those companies have formed environmental education teams, who teach the street market vendors how to adequately separate their waste. They also provide the vendors with special compostable bags to dispose of their organic waste, which are then collected by the cleaning company when the market closes. This helps the vendors to keep their stands and the surrounding area clean. Adapted trucks collect the organic waste and take it to the composting plants together with organic waste from city pruning. At the composting plant, the waste is checked and sorted again to ensure that only suitable organic waste is used and no contaminants are present.

Source: Prefeitura de São Paulo

The composting plants apply a thermophilic composting method that uses natural-aeration static composting piles. The composting process is carried out using 20 meters long x 2.2 meters wide composting piles. Each pile has an underground composting leachate collection system, which goes into a larger 10,000 litre box for storage. To feed the composting windrows, three raw materials are used, in the following approximate mass proportions: Fruit, legume and vegetable waste from street markets (75%), municipal chopped pruning waste (20%) and straw (5%). The composting piles are formed by alternating layers of organic waste and straw/green waste from the pruning of urban green spaces. This creates a suitable environment for microorganisms to decompose the organic matter, transforming it into organic fertilizer within about 120 days. The organic fertilizer is then used by the city for its parks, green spaces and its urban gardening project to increase plant health and crop yields. It is also given back to the market vendors and donated to citizens, farmers, schools and non-governmental organizations.

The composting plants are open to the public and visitors are informed about composting and its benefits. This has not only led to local learning, but also to South-South learning through visits from other developing countries, including Angola, Mexico and Peru.

Impacts and Results: Today, the municipality of São Paulo is successfully running five composting plants and treats the organic waste from 300 of its almost 1,000 street markets. By 2024, the city aims to compost 100% of organic waste from street markets by adding three new composting plants and further improving the composting technology to increase the outputs of each plant. Under this project, 10,000 tons of waste have already been composted in 2020 while a total of 20,000 tons has been composted since the beginning of the project in 2015. This has led to the reduction of 14,176 tons CO2eq. Compared to disposal

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[9] Further information available at: https://www.prefeitura.sp.gov.br/cidade/secretarias/subprefeituras/amlurb/index.php?p=283430.

[10] The city has three main organic waste streams: 1. Organic waste from households: This is by far the largest waste stream and it is under full control of the city government; 2. Large waste generators: These are companies that generate more than 200 litres of waste per day. The companies are legally required to hire companies that provide an environmentally appropriate destination for their waste; and 3. Waste from street markets and municipal pruning.

or dumping of organic waste into a landfill (emitting about 819.1 kg CO2eq/t), using this composting technology results in GHG emission reductions of 87% (emitting ca. 110.3 kg CO2 eq/t). Air pollution has also been reduced in the city as less organic waste needs to be transported to distant landfills. In addition, the project has created awareness among citizens about composting. Furthermore, the fertilizer produced in the composting plants supports crop yields within the city's urban gardening project and increased plant health in public green spaces.

Under UN-Habitat's Waste Wise Cities programme, São Paulo has signed an agreement with the city of Praia, the capital of Cabo Verde, to undertake South-South cooperation on the improvement of waste management practices. Insights from its composting project will be part of São Paulo's contribution.

Challenges and Lessons Learned: São Paulo's citizens were opposed to composting plants due to an unsuccessful project in the past where the installation of urban composting plants had led to strong odours and the spread of diseases in the city. The new composting technology used in this project addresses this challenge, as it controls any significant odours[11] and avoids the problem of possible diseases through the high temperature generated within the composting piles. Another lesson learned was the importance of engaging all stakeholders, including public authorities, cleaning companies, and citizens.

Most importantly, the city realized that there are effective and scalable waste management solutions that do not require major investments or the lengthy construction of large waste management facilities. The flexibly-sized composting plants were able to be set up quickly, using only organic materials, are aesthetically pleasing, and coexist well with the urban landscape.

Long-term Sustainability, Replicability, and Potential for Upscaling: The project is economically sustainable over the long term because its operating costs are either equal or lower than the cost incurred for sending organic waste to landfills. There is also a possibility for income generation through the sales of organic fertilizer. In addition, the project is environmentally sustainable as it reduces waste going to landfills and associated GHG emissions and air pollution. Furthermore, it is socially sustainable as the citizens have embraced this circular economy approach and benefit from free organic fertilizer directly or indirectly through the urban gardening project.

This approach can be easily replicated under different circumstances as it is based on a modular system that can be applied flexibly based on the availability of space and volume of organic waste. The composting plant operation can be either completely manual or semi-mechanized in line with the available workforce and budget.

UN Habitat Highlight ☼

Waste Wise Cities Tool
Since its launch in February 2021, UN-Habitat's Waste Wise Cities Tool (WaCT) has been applied in Mombasa, Nairobi, Kiambu (Kenya); Mahe Island (Seychelle), Bukavu (DRC), Addis Ababa and Bahir Dar (Ethiopia) Mangalore (India), Dar es Salaam (Tanzania), Lagos (Nigeria), Karachi (Pakistan) and Khulna (Bangladesh). The surveys generally reveal inequalities in access to waste collection services, especially in low-income areas of the city and the lack of reliable data on solid waste for strategic and action plan development. Nairobi has developed a detailed circular economy action plan based on WaCT application results. Similarly, the other cities will start the development of strategic and action plans based on WaCT data.

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[11] The minimization of odours is achieved through using only raw fruits, legumes and vegetable waste; composting waste within three hours of arrival; keeping composting piles in place; and enabling the passage of air through the use of straw. Further information available at: https://www.waste.ccacoalition.org/sites/default/files/files/assessment_lapa_composting_plant-_sao_paulo.pdfr

4.2. Increasing climate resilience in informal coastal communities through infrastructure development in Greater Monrovia, Liberia

Source: Cities Alliance

> ➤ **Where?** Greater Monrovia, Liberia
> ➤ **Who?** Cities Alliance, Ministry of Internal Affairs of Liberia, Paynesville City Corporation, Monrovia City Corporation, Slum Dwellers International, Young Men's Christian Association, Federation of Liberia Urban Poor Savers
> ➤ **What?** Urban resilience
> ➤ **When?** Since 2016
> ➤ **Climate benefits?** Increasing climate resilience and reducing GHG emissions
> ➤ **Which SDGs?** SDG 1-11, SDG 13 and SDG 17

Summary: TThe Cities Alliance's Community Upgrading Fund (CUF)[12] enables informal communities to work together with local and national authorities in Liberia to address basic infrastructure and service needs in often neglected urban areas. As of today, the CUF has benefited over 350,000 people in Greater Monrovia, including through improving the climate resilience of coastal communities.[13]

Innovative Experience: The CUF works in densely populated neighbourhoods in two cities and twelve townships in Greater Monrovia, which are characterized by socially fragmented communities and enormous backlogs of basic infrastructure, including an absence of road access, drainage, toilets, and drinking water. Only 4% of households use toilets connected to the main, partially dysfunctional, sewer system. Only

35% of households have access to piped water, which is non-potable. In addition, only 8% live in areas with public lighting. The built environment is substandard with 80% of social infrastructure requiring major renovations.

This lack of basic infrastructure has a severe impact on people's lives, undermining cohesion, productivity and health, which is worsened by exposure to adverse impacts of climate change with, for example, heavy rains turning into disastrous floods and devastating mudslides. With the aim of enhancing climate resilience, the CUF supports two of Monrovia's most at-risk coastal settlements to identify vulnerabilities and craft community-driven responses that improve their adaptive capacity. CUF is a bottom-up mechanism that enhances community engagement and ownership of the design and implementation of small infrastructure projects, including through the following innovative approaches:

- Creation of an **institutionalized platform** for the engagement and cooperation of, and the mediation between, stakeholders at different levels and the facilitation and leverage of resources for community-led projects through the establishment of pool funds;

- Focus on **localizing SDGs** in most neglected areas of a city and involving vulnerable groups in the design process of infrastructure systems;

- **Long-term engagement** to enable a self-preserving platform through ownership.

Impacts and Results: The CUF has already reached at least 100 communities through community-based small infrastructure projects to improve public services in the Greater Monrovia area with an estimated number of up to 350,000 beneficiaries. Projects include 110 community water kiosks, six toilet and shower facilities, two kindergarten school blocks, and

fencing for three schools to enhance a safe learning environment. In addition, 100 water points and four community water storage tanks were restored or improved. Activities also include capacity-building in water management, sanitation and hygiene for local government officials and communities.

An important component of these activities is the exchange of knowledge and lessons learned through South-South cooperation, for example with counterparts from Ghana. An exchange trip to Accra and its surrounding areas was organized by the Cities Alliance for selected officials of the Liberian national and local governments as well as partner organizations, including water operators, among others. The delegation from Liberia included representatives of all key institutions whose mandates and roles within the government structure are directly related to water, sanitation and hygiene. The exchange helped inform and train Liberian officials on Ghanaian sanitation solutions such as bio-digesting toilets for potential replication and adaptation to the Liberian context. The selection of participants was led by Liberia's Deputy Minister of Internal Affairs, which fostered ownership and led to an effective selection of key decision-making and technical experts. The trip resulted in continuing exchanges between the Liberian and Ghanaian counterparts regarding the development of pilot projects in Monrovia's informal settlements, and the possible scaling up of the initiative in other areas. In general, the learning exchange enabled the local utility company to expand its water supply services and sewage system into informal settlements. Following this success, more South-South exchanges on technical issues related to water management are planned.

Challenges and Lessons Learned: Key challenges include the coordination between Ministries, local government entities, utility companies and service providers; land tenure rights; low participation levels of citizens due to their extreme hardship; heavy and long rainfalls slowing down construction for half of

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[12] Cities Alliance is a global partnership fighting urban poverty and supporting cities to deliver sustainable development. To manage its activities, the Cities Alliance operates a multi-donor fund with the United Nations Office for Project Services as host and Trustee.

[13] Further information available at: https://www.citiesalliance.org/newsroom/news/spotlight/empowering-urban-poor-improve-their-communities.

the year; and logistical aspects due to very poor public infrastructure conditions. Some of the lessons learned based on the challenges for the CUF initiative have been the necessity of carrying out feasibility studies that address both programmatic and operational risks; the importance of facilitating the active coordination between community, municipal and national governments, and, at the same time, maintaining an active governance structure including the CUF Board and the Technical Working Groups. Other lessons learned are the necessity to plan the implementation modalities upfront and the allocation of adequate resources for communication and visibility activities, as well as for the employment of human resources for technical and operational support. Finally, the CUF model has proven that participatory decision-making and consensus-building processes that bring together city authorities and community leaders, result in the implementation of projects with no objection or rejection from community residents, and can be an effective way to create a community-based sustainable process for managing community services that address the most immediate needs in informal settlements. However, it is important to highlight that such inclusive processes require time and several rounds of negotiations. The key aspect for the project implementer to consider is to set up the participatory process as soon as possible in order to build consensus at a project's early stage.

Long-term Sustainability, Replicability, and Potential for Upscaling: The long-term sustainability of the infrastructure improvements is ensured through a bottom-up approach that fosters strong local ownership of the community-led identification and

implementation of infrastructure projects. For each project, land owners sign a land waiver that gives the right-of-use to the community. Operations and maintenance costs are covered through the collection of fees and from secondary income streams, for example, the water kiosks sell water for a small fee and host a small shop, which also generates income. CUF's multi-year commitment is also central for its sustainability as it allows time to identify the right stakeholders, understand their needs and priorities, gain their trust and engage them successfully.

Source: Cities Alliance

The approach taken by CUF in Greater Monrovia is replicable and has huge potential for upscaling as it follows a clear structure and process that can be easily adjusted to other local circumstances or thematic focus areas. Showcasing economically, environmentally, and socially feasible solutions to urban infrastructure challenges of informal and neglected communities can make a significant contribution to leveraging additional funding in this area.

UN Habitat Highlight ☀

Planning for Climate Change: A strategic, values-based approach for urban planners Volume 1 (Guide) & Volume 2 (Toolkit)

Published in 2014 by UN-Habitat, the Planning for Climate Change guide and toolkit is created for city planners to better understand, assess and take action on climate change at the local level. It is specifically targeted to the needs of planners and allied professionals in cities in low and middle-income countries where the challenges of planning for climate change are particularly high. It provides an approach that allows local decision-makers to develop climate action plans that reflect local values. The tool has been applied in more than 50 cities, primarily in Asia and the Pacific region. It has also been used as local government training tool and in tertiary education. Check out the video here

4.3. Turning waste into energy in Cần Thơ, Viet Nam

Source: Foreign Economic Cooperation Office, Ministry of Environmental Protection of China

▶ **Where?** Cần Thơ, Viet Nam
▶ **Who?** City of Cần Thơ, China Everbright International Ltd.
▶ **What?** Waste management
▶ **When?** Since 2016
▶ **Climate benefits?** Mitigation
▶ **Which SDGs?** SDG 3, SDG 6, SDG 7, SDG 8, SDG 9, SDG 11 and SDG 17

"In the past, the domestic waste stacking outside the houses would simply be incinerated or buried. But now, garbage trucks coming to our houses to collect the waste, which makes our living environment much cleaner"
 (Resident of the city of Cần Thơ)

Summary: Municipal solid waste management has been one of the main environmental challenges in Viet Nam. Improper management of waste has caused adverse impacts on the environment, community health, and social-economic development. The waste-to-energy plant in Cần Thơ, financed, constructed, and operated by China Everbright Environment Group Ltd. (Everbright Environment) since 2018 as a public-private partnership, has contributed significantly to improving domestic waste management through recovery of resources. As an excellent example of South-South cooperation and investment, the plant was awarded the "2018 Award of Orders of Merit to Enterprises in Cần Thơ" by the Cần Thơ Investment Promotion Conference. It is the first modern waste-to-energy project in Viet Nam and now serves as an important demonstration site.[14]

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[14] Further information available at: https://www.cebenvironment.com/en/media/news_content-p181209.html.

Innovative Experience: Located in southern Viet Nam, Cần Thơ is the largest city in the Mekong Delta with a population of 1.23 million, located approximately 160km south-west of Hồ Chí Minh City. With the rapid economic development and continuous urban expansion of recent years, there has been a constant increase in municipal solid waste, threatening residents' well-being as well as the environment. Waste clearance in Cần Thơ reaches about 650 tons per day. In the past, the city had two waste incineration plants, incapable of generating electricity, which were treating 150 to 200 tons per day. They were shut down in 2021 as the Cần Thơ waste-to-energy plant has effectively enhanced the local waste treatment capacity.

Since the characteristics of domestic waste in Viet Nam are similar to that of cities in southern China, the technologies adopted by Everbright Environment are highly suitable for the local context. Everbright Environment undertook the design, procurement, construction, and trial operation of the plant, including flue gas treatment and leachate disposal technology. These technologies have been widely used by Everbright Environment in southern China and have become reliable and mature technologies. According to a qualified third-party inspection, the plant meets the national standards of Viet Nam and the daily average value of online monitoring indicators for flue gas complies also with the EU 2010 standards.

Source: Foreign Economic Cooperation Office, Ministry of Environmental Protection of China

Tours to the plant have also been carried out to increase engagement with the public. The plant has a garden-style, odourless and noise-free environment, where the waste is disposed of with strict inspection

and controlled emissions. The plant facilitates waste disposal and contributes to improving the local urban ecological environment. Therefore, Everbright Environment has been recognized by the Vietnamese government, the public and the media. In June 2020, the Cần Thơ project was approved by the Cần Thơ local government as the first industrial tourism-based spot in Viet Nam's waste-to-energy industry.

Impacts and Results: The project received a total investment of around USD 47 million with an operation period of 22 years, including two years for construction. The plant is equipped with an incinerator disposing of 400 tons of municipal solid waste per day and a 7.5 MW steam turbine generator set. Currently, the waste treatment capacity of the plant takes up about 75 per cent of the total daily waste treated in the city. By the end of August 2021, the amount of domestic waste disposed of added up to 492 tons and 166 GWh of electricity was generated. A small portion of the electricity generated is for the plant's own use, while the rest is transmitted to local electricity grids. In 2020, for example, altogether 59.6 GWh of electricity was generated by the plant, of which 51.8 GWh is supplied to local grids.

Challenges and Lessons Learned: The construction of the waste disposal facility needed to be embraced by the public as well. The Cần Thơ project is completely open to the public and subject to the supervision of the government and society. The flue gas data are made public on the LED screens outside the plant's gate and shared with local environmental protection departments via the internet on a real-time basis. The project not only maintains a high level of environmental management standards, but ensures that operations are safe, uninterrupted, stable and high quality. Since April 2019, the project has made the first Friday of each month the Open Plant Day for visitors. As of September 2021, it has received over 2,200 visitors in more than 100 rounds of tours, including government representatives, residents, journalists, industry experts, employees' families, and students from elementary and middle schools.

The local community has been engaged in the Cần Thơ project from the outset. In the early stage of the project, local community representatives were

invited to conduct a study tour to visit Everbright Environment's waste-to-energy projects in operation in China. In addition, community surveys were carried out during the project's environmental impact assessment study so as to ensure that the project was constructed in accordance with local expectations. After the completion of the project, residents were invited to visit the plant.

Long-term Sustainability, Replicability, and Potential for Upscaling: Since the waste-to-energy technology in Viet Nam is still in its infancy, the relevant regulations and standards are not yet fully in place, but the Cần Thơ project's construction, technology, and operation standards have provided the Vietnamese government with references for improving the waste-to-energy industry standards. The project also helped to enhance Cần Thơ city's technical capability through the hiring and training of local staff. The plant has employed around 140 people from local universities, vocational training schools and the surrounding communities.

4.4. Shifting to zero-emission buses in Latin American cities

Source: Prefeitura de São Paulo

> ▶ **Where?** Medellín (Colombia), Mexico City (Mexico), Santiago (Chile), São Paulo (Brazil)
> ▶ **Who?** City of São Paulo, C40 Cities (C40), International Council on Clean Transportation (ICCT), P4G, Centro Mario Molina Chile, Clean Energy Works, Global Green Growth Institute, World Resources Institute
> ▶ **What?** Sustainable transport
> ▶ **When?** Since 2019
> ▶ **Climate benefits?** Mitigation
> ▶ **Which SDGs?** SDG 11, SDG 13 and SDG 17

"It's clean energy. It is this type of transport, clean and without noise, that we want to see more and more in the city of São Paulo" Mayor Bruno Covas (City of São Paulo)

Summary: The international Zero Emission Bus Rapid-deployment Accelerator (ZEBRA) initiative supports major Latin American cities to accelerate the implementation of zero-emission buses. It does so by translating political commitments into fleet-wide deployment strategies and innovative business models, securing commitments from bus manufactures to make zero-emission bus technologies adapted to local circumstances available, facilitating financing and sharing good practices among cities within the region.[15]

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[15] Further information available at: https://linktr.ee/zebrapartnership.

Innovative Experience: The ZEBRA initiative was launched by C40 and ICCT in 2019 with funding from P4G to accelerate the deployment of zero-emission buses in major cities in Latin America. An estimated 25,000 buses may be purchased over the next decade in ZEBRA's core cities of Medellín, Mexico City, Santiago, and São Paulo, providing a critical opportunity for shifting to zero-emission bus fleets.

The ZEBRA initiative's approach is innovative as it develops localized solutions for cities based on a holistic view of the bus market in Latin America and the engagement of all key stakeholders with a focus on manufacturers and investors. ZEBRA facilitates the development, refinement and adoption of innovative business models, which radically transform the way in which buses are procured and operated. ZEBRA is helping to mainstream business models that can help municipalities to overcome the high up-front costs associated with e-buses, allow for better risk distribution and facilitate larger volumes of procurement.

Source: Prefeitura de São Paulo

The ZEBRA initiative embodies South-South and triangular cooperation as a partnership between global organizations and municipal authorities across Latin America, working towards the common goal of transitioning to zero-emission buses. ZEBRA has fostered knowledge sharing between Latin American cities on various occasions. Through ZEBRA, São Paulo has gained insights into successful examples of electric bus deployments across the region. As well, the São Paulo pilot programme was showcased to over 20 cities in the region. In this context, Chile's Centro Mario Molina played a crucial role in collecting and disseminating key information from Santiago's electric bus fleet, which is currently the world's largest electric bus fleet outside China. This information led to the development of case studies and provided useful inputs in response to specific requests from other cities. ZEBRA also hosted a virtual zero-emission bus workshop and other knowledge-sharing activities, gathering its network of cities, as well as manufacturers and investors mostly from the region, to discuss barriers and share solutions towards bus fleet electrification.

The city of São Paulo is working with the ZEBRA initiative to meet its ambitious target of decarbonizing its fleet of over 14,000 buses by 2038, reducing not only GHG emissions but also drastically improving the city's air quality. ZEBRA is helping transform São Paulo's zero-emission bus policy into fleet-wide electrification strategies that include the implementation of innovative business models and the development of local electric bus technology. To achieve this, the city is working with ZEBRA partners to secure commitments from major bus and engine manufacturers as well as from regional financial institutions and investors.

Impacts and Results: In 2019, a pilot fleet of 17 electric buses and the necessary charging infrastructure was introduced in São Paulo, before its involvement in the ZEBRA initiative. This pilot project allowed the city to identify some of the limitations and advantages of making its full fleet of over 14,000 buses electric. The pilot project has reduced the annual consumption of diesel by approximately 600 thousand litres and, consequently, prevented the emission of 1,580 tons of CO_2, 40 kg of particulate material, and 4.26 tons of nitrogen oxides. ZEBRA's role has been to monitor this pilot, take the lessons and overcome barriers to facilitate future projects, directly related to the commitments of manufacturers and investors, encouraging more private sector participation in potential electric bus projects in São Paulo, in addition to more competition between manufacturers. Also, ZEBRA is tracking the performance of this pilot to ensure scalability and ultimately aims to support the deployment of over 1,000 electric buses in the city. This deployment would help prevent the emission of many tons of CO_2 each year, as well as drastically reduce local pollutants, directly decreasing mortality from respiratory diseases.

Challenges and Lessons Learned: After decades of using diesel-powered fleets, São Paulo faces the difficulty of upgrading and adapting its transportation system for electric vehicles. Some of the key challenges include the required radical shifts in the operating system, resistance from local operators, and the absence of a competitive local market for electric buses. These challenges are being addressed by building a strong case for zero-emission buses through real-life data, developing ways for incentivizing investments, for example through leveraging guarantees, and considering different business models for meeting the different needs of bus operators.

Long-term Sustainability, Replicability, and Potential for Upscaling: The key for the long-term sustainability of the ZEBRA initiative's efforts is the creation of a self-sustaining local electric bus market in Latin America together with manufacturers and investors, which is already under way. The ZEBRA initiative's approach is being replicated in the initiative's core cities and has the potential for being replicated further in other cities in Latin America and other regions, such as Africa or South-East Asia.

UN Habitat Highlight ☀

Working with Innovators and Start-ups to Promote Electric Mobility

Electric mobility solutions can be implemented at various scales, ranging from the large-scale deployment of electric buses to last-mile connectivity provided by e-bike sharing systems connected to public transport and e-mobility options for small freight deliveries in cities. UN-Habitat's experience of supporting a "mobility accelerator" at the University of Nairobi C4DLab in Kenya, led to the idea of "challenging" local innovator communities to come up with e-mobility solutions in collaboration with city authorities. Under the EU supported SolutionsPlus project (http://www.solutionsplus.eu/), 10 proposals from cities, including, Hanoi, Vietnam, Pasig City, Philippines, Kathmandu, Nepal, Dar es Salaam, Tanzania, Kigali, Rwanda and Quito, Ecuador, were selected.

In Quito, Ecuador, Plural Consultora will develop and deploy a freight delivery system using electric tricycles and electric cargo bikes in collaboration with two other companies, Bixi Cargo, Tacuri Bicycles, the Municipality of Quito, and the network of bicycle couriers that operate in the historic centre of Quito.

In Dar es Salaam, Tanzania, the Sustainable Energy Services Company is introducing new and retrofitted electric three-wheelers ("e-Tuk Tuks") and setting up charging stations with battery swapping services to serve as a feeder to the Bus Rapid Transport System.

In Kathmandu, Nepal, Shree Eco Visionary aims to remodel three-wheeler electric public transport vehicles ("Safa Tempo") with a new multi-purpose concept design (modular three-wheeler) and with minimum modifications to the vehicle technology, SEV will also design an e-shuttle van which will be used for heritage site-seeing purposes in Kathmandu.

This experience shows that cities can similarly adapt their standard procurement process to "procure" and "co-develop" innovative e-mobility solutions with start-up communities. Based on UN-Habitat's experience, cities can consider the following steps to collaborate with start-up communities:

- Engage with national and local universities and technical institutions in establishing "start-up/ mobility accelerators";
- Carry out a market assessment of what is available – cities can run a process or competition asking start-up communities to present their innovative ideas and conduct a city-industry meet;
- Frame more detailed specifications and invite competitive bids from the market for broadly defined solutions e.g., a bike-sharing or a freight delivery system;
- Launch a call for proposals and compare bids based on objective criteria such as passenger or freight kilometres offered by the e-mobility solution;
- Frame contracts and make payments to the successful start-up based on performance criteria.

4.5. Fostering sustainable urban construction in Paraguay

Source: GIZ

> ▶ **Where?** Asunción, Paraguay
> ▶ **Who?** Paraguayan Council for Sustainable Construction, National Institute of Technology, Standardization and Metrology (Paraguay), Colombian Council for Sustainable Construction, Federal Ministry for Economic Cooperation and Development (Germany), Gesellschaft für Internationale Zusammenarbeit (GIZ) (Germany)
> ▶ **What?** Sustainable construction
> ▶ **When?** Since 2019
> ▶ **Climate benefits?** Mitigation with adaptation co-benefits
> ▶ **Which SDGs?** SDG 11, SDG 12 and SDG 17

Summary: Paraguay, in cooperation with Colombia and Germany, is developing a local green building rating system and advising a third-party certification body for sustainable construction on the road to sustainable cities.[16]

Innovative Experience: Housing plays an important role in sustainable development. It consumes large amounts of resources, including land, energy, water and building materials, and contributes significantly to air and water pollution. At the same time, housing

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[16] Further information available at: https://www.intn.gov.py/index.php/noticias/proyectan-una-certificacion-de-construccion-sostenible-para-paraguay, https://www.stp.gov.py/v1/el-sector-publico-y-privado-se-unen-para-que-paraguay-cuente-con-una-certificacion-de-construccion-sostenible and https://www.cccs.org.co/wp/download/becas-casa-2020.

is exposed to various environmental impacts and risks such as natural disasters and climate change. Sustainable housing, therefore, has a key role in meeting the objectives of the New Urban Agenda.

Source: GIZ

The Paraguay Green Building Council (PYGBC or CPYCS by its acronym in Spanish) is specialized in facilitating and promoting sustainable building design and construction. In cooperation with the National Institute of Technology, Standarization and Metrology, CPYCS set up a technical committee for standardization that includes representatives of public institutions, private companies, consumer associations, and universities, and has established standards in the following five areas: architecture, material resources, water efficiency, environmental quality, energy and air.

To advance the implementation of these national standards, Paraguay is partnering with Colombia on creating favorable conditions for the establishment and operation of a national third-party certification body and local certification system. Supported by the Federal Ministry for Economic Cooperation and Development of Germany through the GIZ-managed Regional Fund for Triangular Cooperation with Latin American and the Caribbean Partners, Paraguay is learning

from, and building on, Colombia's knowledge and experience in this area.

The Colombia Green Building Council (Colombia GBC or CCCS by its acronym in Spanish) has been successfully leading CASA Colombia a green building rating system for housing (including social housing) with more than 10.000 dwelling units and 30 projects in process over the past six years and is sharing its insights and lessons learned with CPYCS under this project. CCCS, together with partners from academia, developed an integrated sustainability certification system, which has proliferated the concepts of green building, health and wellbeing, integrative process design throughout the country, reaching stakeholders with different socio-economic backgrounds.

CCCS is providing knowledge and experience regarding the development of a certification system and a training system for auditors, considering the region's environmental and economic circumstances. CCCS is also supporting CPYCS with the development of a digital national platform for sustainable materials and products, where technical data sheets on locally available sustainable materials and products will be published to showcase their benefits. The use of sustainable materials and products will translate into the significant reduction of GHG emissions, waste, and costs. In addition, CPYCS, CCCS, and GIZ are working together on the development of an innovative process for data generation as well as a digital platform to support the promotion of sustainable construction. The digital platform will facilitate the observation and documentation of certified projects in Paraguay and Colombia.

Impacts and Results: The project is still ongoing, but initial results include the establishment of a local green building rating system which has been submitted for public consultation and a model for a third party certification body. The project is contributing to the achievement of Paraguay's national development plan, in particular concerning competitiveness and innovation. Once in place, the certification system will also have a decisive impact on environmental sustainability and

the reduction of GHG emissions[17] and waste from construction and housing.[18]

Challenges and Lessons Learned: Challenges include the low implementation capacity in terms of the limited number of trained personnel; the lack of adequate awareness of the population in general on sustainability issues; and the effective communication between the private and the public sector in the context of a triangular cooperation project. Lessons learned are that it is important to accept unforeseen changes in project implementation as part of the learning process; seek solutions collaboratively with all stakeholders; and set aside time for understanding the principles, scope, and procedures of technical triangular cooperation at the beginning of the project.

Long-term Sustainability, Replicability and Potential for Upscaling: The certification system for sustainable construction is sustainable in the long-term as it is being institutionalized by a public entity in collaboration with various stakeholder groups, including construction companies, material producers, project developers and other technical experts as well as real estate owners, operators and maintenance providers. As demonstrated through this project in Paraguay, the approach for the development of a national certification system for sustainable construction, as initially developed and implemented in Colombia, is replicable in other countries. The certification system certainly has potential for upscaling, for example by increasing the scope of activities being carried out in support of its implementation.

UN Habitat Highlight ☼

City Resilience Action Planning (RAP) Tool

Published in 2018 by UN-Habitat, The City Resilience Action Planning (CityRAP) Tool aims to enable local governments of small to intermediate-sized cities, or neighbourhoods / districts of bigger cities or metropolitan areas, to plan and undertake practical actions to strengthen the resilience of their cities. The four-phase plan has been carried out in 34 locations in 13 countries to date, helping to trigger community self-mobilisation and encourage local authorities to mobilise funds. Its application in Chokwe, Mozambique in 2015 resulted in the resettling of a community located in a flood risk area, the improvement of two neighbourhoods through opening and widening streets which also serve as evacuation routes during emergencies and the mapping and opening of natural drainage channels. This case study highlights how a bottom-up approach aimed at empowering local administration and communities can be a powerful instrument to raise funds for the practical implementation of climate resilience projects.

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[17] A GHG emissions calculator is under development.

[18] In Colombia, the certification system has a mandatory requirement for projects to divert from landfills 30% of total construction and demolition solid waste, managing them through strategies such as recycling, donation and reuse. Projects that achieve higher percentages are recognized by granting them additional points that allow them a better level of certification.

4.6. Demonstrating green hydropower solutions in Lishui, China

Source: International Network on Small Hydro Power (INCSHP)

> **Where?** Lishui, China
> **Who?** International Network on Small Hydro Power (INSHP), Lishui Water Resources Bureau
> **What?** Renewable energy
> **When?** Since 2018
> **Climate benefits?** Mitigation with adaptation co-benefits
> **Which SDGs?** SDG 1, SDG 5, SDG 7, SDG 8, SDG 13 and SDG 17

Summary: The Lishui International Demonstration Zone for Green Hydropower project developed an innovative model for the effective integration of green hydropower, water and biodiversity conservation, urban development, and eco-tourism. The model includes effective policies, regulations and incentives, technology innovations, gender-sensitive approaches, and international and domestic financing solutions. In Lishui City, the implementation of the model resulted in a city-wide innovation system for sustainable energy and urban development with remarkable achievements regarding low-emission climate-resilient development and the SDGs, including through South-South and triangular cooperation.

Innovative Experience: Lishui City, located in Zhejiang Province in the east of China, has a total area of 17,300 km2 and a population of 2.7 million. In Lishui, rivers are widely distributed with high drops and abundant hydropower resources. In response to hydropower development policies and incentives, a large number of local private stakeholders invested in hydropower projects, which facilitated infrastructure development, created jobs, led to income generation from electricity sales, and therefore turned hydropower generation into one of the region's leading industries. However, the industry faces several key challenges, including sustainable urban development and environmental protection, in particular with regard to ecological water discharge,

water quality and the conservation of biodiversity and river landscapes. Given this background, INSHP and the municipal government of Lishui initiated the Lishui International Demonstration Zone of Green Hydropower project, which contributed to the further development of the hydropower industry, effectively promoted regional and urban development, and improved environmental conservation. By 2020, more than 800 small hydropower stations, mostly diversion hydropower stations, were built in Lishui with an annual generation of 7 TWh, of which 90% were privately owned. More than 60% of Lishui's electricity was supplied by hydropower. Hydropower projects provided more than 15,000 local employment opportunities and benefited 150,000 people.

Based on the urban development plan and guided by the concept of sustainable development, a series of policies, plans, and incentives were formulated to promote the development of green hydropower demonstration zones, construction of green hydropower stations, technical modernization of hydropower stations, comprehensive renovation of rivers and development of ecological river demonstration zones. The development of green hydropower demonstration zones increased hydropower generation, initiated a hydropower and tourism integrated programme, and improved the supervision of administrative departments. The construction of green hydropower stations reflected the concept of green hydropower and highlighted the indexing requirements for the discharge of ecological flow, emissions reduction, and ecological restoration. Activities focused on a comprehensive renovation of rivers and the development of ecological river scenic areas has been carried out to protect wetlands, lakes, and water cultural heritage, as well as to develop the water scenic areas by utilizing local landscape and hydropower resources.

Through this project, international gender-sensitive approaches[19] and innovative technologies were introduced and an international research collaboration on green hydropower and water ecology was carried out, including through the Global Environment Facility project on "Upgrading of China Small Hydropower Capacity" jointly implemented by the Ministry of Water Resources of China and the United Nations Industrial Development Organization (UNIDO).

One of the most important long-term objectives was to enhance the city's capacity for South-South cooperation on climate action and promote knowledge and experience sharing. This project has developed a replicable model for green hydropower development and carried out knowledge sharing through South-South cooperation. Knowledge sharing activities include organizing research, developing knowledge products and experience manuals, conducting international training and seminars, and sharing experience. Relevant policies, technologies and standards have been applied to projects in Africa, Asia, and Latin America.

Impacts and Results: With an annual average output of 7 TWh, the hydropower plants under this project replace the use of 2.8 million tons of standard coal and therefore reduce the emission of 7.28 million tons of CO_2, 84,000 tons of sulphur dioxide and 56,000 tons of smoke dust. In addition, 100,000 hectares (ha) of forests are protected annually by replacing the use of firewood for cooking with electricity generated from the hydropower plants.

The project's main results include:

- The establishment of 12 green hydropower demonstration zones, which increased hydropower generation and improved the supervision of power plants through the remote management of safe production and a digital ecological discharge monitoring system;

- The refurbishment of 110 hydropower plants to meet new green hydropower standards that ensure a reduced impact of the construction of green hydropower plants on the environment;

- The comprehensive renovation of rivers and development of ecological river scenic areas to protect wetlands, lakes, and water cultural heritage,

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[19] The project design and implementation included a gender index system that ensured gender equality in all project activities.

including a demonstration river section in the urban area of Lishui with improved flood control, water quality, and environment;

- The introduction of international technologies for the modernization of power plants, the restoration of river landscapes, beaches and landscapes, and the increase of water efficiency;

- The enhancement of capacity for South-South cooperation on climate action and knowledge and experience sharing, including through knowledge products, training materials, and information platforms;

- The development of China's first guidance document on an incentive mechanism for the ecological discharge of hydropower projects.

Source: International Network on Small Hydro Power (INCSHP)

Challenges and Lessons Learned: The design, implementation, and promotion of green hydropower development need to be adjusted to the different circumstances of regions and countries in line with their different policy, socio-economic and cultural environments. It is necessary to ensure that green hydropower development is driven by local needs and priorities and aligned with local development plans. The private sector plays a key role in green hydropower development and therefore needs to be effectively engaged, including through awareness-raising, training, international exchanges, and an incentive mechanism. Local communities need to be engaged in the development of new green hydropower plants from the start and financing models that foster local ownership should be considered. One of the new power stations developed under this project with an installed capacity of 2.4 MW was successfully jointly financed together with 127 households from seven neighbouring villages, who obtained investment yields of 18%. In addition, taking a holistic approach by expanding hydropower development from the utilization of clean energy to include water security, river restoration, and eco-tourism greatly facilitates stakeholder engagement.

Long-term Sustainability, Replicability, and Potential for Upscaling: This project innovated a model for the effective integration of green hydropower, water and biodiversity conservation, urban development, and eco-tourism, which has been successfully replicated in a series of demonstration projects implemented through South-South and triangular cooperation. The model is sustainable in the long term as it combines long-term socio-economic benefits with environmental protection.

4.7. Increasing resilience through experience sharing between Esteban Echeverria, Argentina and Osasco, Brazil

Source: Esteban Echeverria Municipality

> ➤ **Where?** Esteban Echeverria, Argentina and Osasco, Brazil
> ➤ **Who?** Esteban Echeverria Municipality, City Hall of Osasco, United Nations Office for Disaster Risk Reduction (UNDRR) (formerly UNISDR),
> ➤ **What?** Urban resilience
> ➤ **When?** 2019
> ➤ **Climate benefits?** Adaptation
> ➤ **Which SDGs?** SDG 1, SDG 3, SDG 5, SDG 6, SDG 11, SDG 13 and SDG 17

Summary: The cities of Esteban Echeverria in Argentina and Osasco in Brazil increased their resilience to the adverse effects of climate change by learning from each other through technical visits, joint development and the replication of successful solutions on early warning and rescue systems, flood water and landslide management and post-disaster sanitation measures.

Innovative Experience: The UNDRR Global Campaign "Developing Resilient Cities: My city is getting ready"

strengthened cooperation and collaboration between local governments to reinforce their commitments to building prosperous, safe, and resilient communities. The main objectives of the campaign were to promote the integration of actions for disaster risk reduction and adaptation to climate change in development policies and practices as well as to identify and highlight local innovative solutions.

The cities of Esteban Echeverria and Osasco cooperated

under this campaign, carrying out several technical visits to exchange experiences and lessons learned. The cooperation was initiated under the Mercosur Cities Network (MERCOCIUDADES)[20] in which both cities actively participate, including in the thematic working group on environment and sustainable development.

Source: Esteban Echeverria Municipality

Impacts and Results: The cooperation facilitated the exchange of knowledge and the provision of training on technologies applied under similar socio-economic and environmental circumstance as well as on approaches to ensure the successful uptake of those technologies in coordination with national, provincial and municipal government levels. Through this, both cities were able to make important advancements in disaster risk reduction and climate resilience, including with regard to early warning and rescue systems, flood water and landslide management, and post-disaster sanitation measures.

Challenges and Lessons Learned: The main challenge was the limited availability of financial resources to implement solutions for disaster risk reduction and climate resilience identified through the exchange of experiences and lessons learned.

Long-term Sustainability, Replicability, and Potential for Upscaling: The city-to-city exchange not only resulted in the increased resilience of both cities, but also created networks and partnerships between different municipal stakeholders on both sides that continued beyond the end of the project. The project is replicable as the methodology for the organization of the exchange between cities can be easily used by other cities with similar socio-economic circumstances. There is a vast potential for upscaling of activities as many identified solutions could not be implemented due to the lack of financial resources.

UN Habitat Highlight ☀️

Climate Change Vulnerability and Risk: A Guide for Community Assessments, Action Planning and Implementation
Published in 2020 by UN-Habitat, this tool provides guidance for teams tasked with facilitating Vulnerability and Risk Assessments (VRA) and climate change Action Planning (AP) processes at the community level, with emphasis on the household level and on the vulnerabilities and resilience needs of specific groups such as women, youth, the elderly, people with disabilities, indigenous peoples or minorities. The tool has been piloted in Lao PDR, Fiji & the Solomon Islands, with its application in Nasoata settlement, Fiji in 2020 leading to the creation of a Vulnerability Assessment and Climate Action Plan that has increased the understanding of underlying causes of vulnerability, identified key perceptions on climate change and disaster risks, and gathered information on the spatial dimensions of key assets and hazard exposure. The tool provides a step-by-step guidance on how to conduct community-based Vulnerability Assessments and Climate Action Plans through people-driven information and participatory approaches for equity focused interventions.

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[20] Further information available at: https://mercociudades.org.

4.8. Pioneering integrated urban solutions in Santa Marta, Colombia
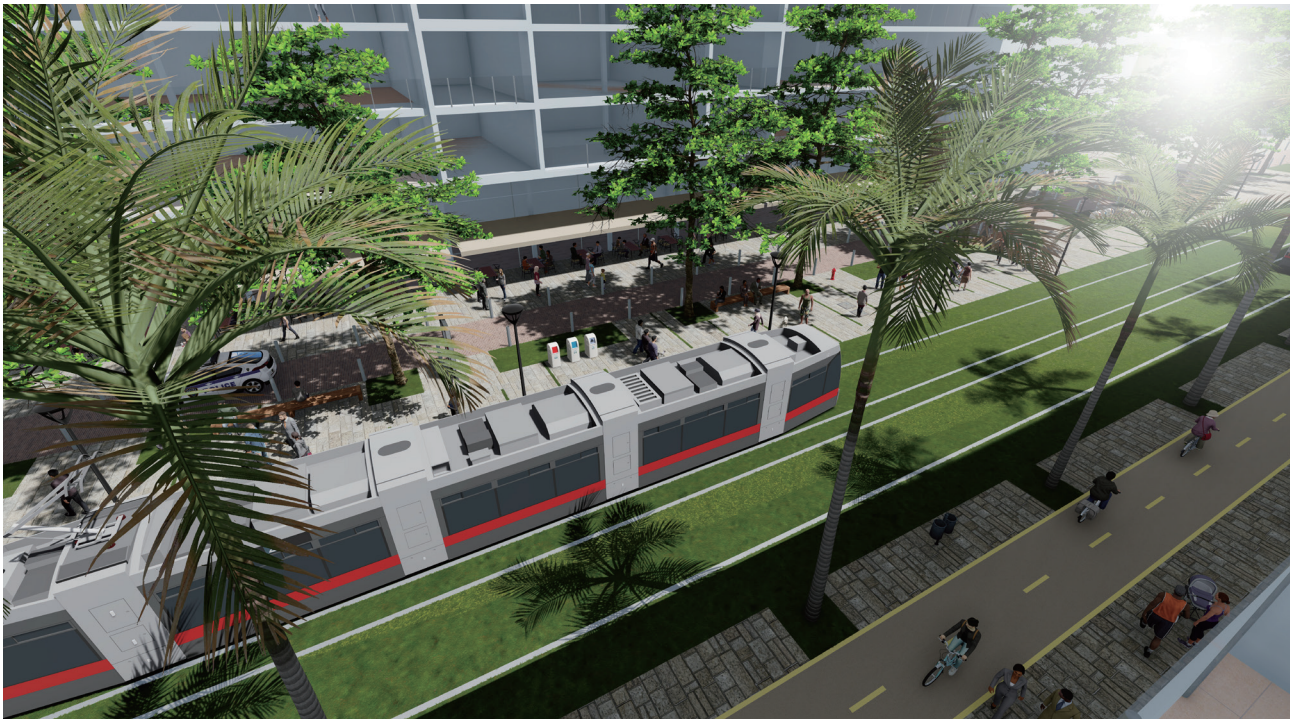
Source: UN Habitat

> ▶ **Where?** Santa Marta, Colombia
> ▶ **Who?** City of Santa Marta, UN-Habitat
> ▶ **What?** Urban planning
> ▶ **When?** Since 2020
> ▶ **Climate benefits?** Mitigation with adaptation co-benefits
> ▶ **Which SDGs?** SDG 1, SDG 5, SDG 6, SDG 7, SDG 8, SDG 9, SDG 10, SDG 11, SDG 13, SDG 15, SDG 16, and SDG 17

"Integrated Urban Operations are developed based on a shared code of values with people at the centre of development" (Ignacio Alcalde, Urban Planning Expert)

Summary: Located in the city of Santa Marta, the Integrated Urban Operations (IUOs) are an approach developed by UN-Habitat to create urban centralities that offer formal job opportunities and urban equipment to improve livelihoods in the city. The IUOs aim to promote eco-tourism and agroindustry, while creating new inclusive and safe public spaces as well as sustainable housing and transport solutions.

Innovative Experience: UN-Habitat's IUO approach is based on a code of values inspired by the principles of the New Urban Agenda and the SDGs. IUOs aim to trigger sustainable urban transformations in strategic areas of a city through innovative public-private governance models. IUOs facilitate economic development, the generation of social and cultural opportunities and new public spaces

and infrastructure, while conserving biodiversity and natural habitats.

The city of Santa Marta faces uncoordinated urban growth with high rates of unemployment (18%) and informal work (63%) as well as a lack of public spaces, infrastructure, and utility services. In addition, the city has yet to be able to derive socio-economic benefits from its rich natural environment and cultural wealth.
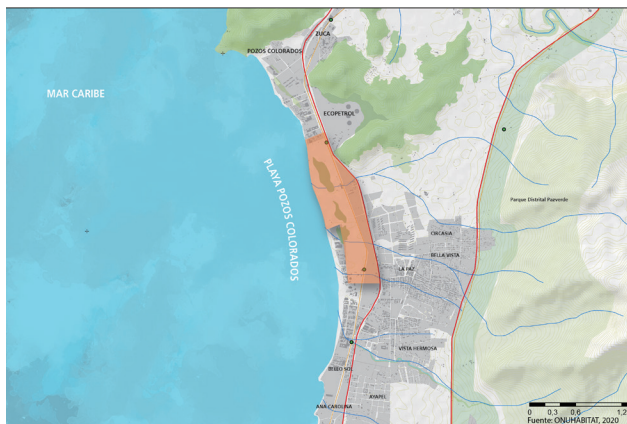
Source: UN Habitat

The IUO projects aim to address these challenges by creating new employment opportunities, quality public spaces, affordable housing, and infrastructure, while preserving existing ecosystems. Regarding economic development and job creation, one of the two IUO projects focuses on the promotion of eco-tourism, and the other on agroindustry. Both projects foster the creation of new public spaces that can enable social inclusion through a varied supply of housing and public facilities. The projects also promote the consolidation of a multimodal mobility system that fosters low or zero-emission transport solutions, bringing together air, maritime, rail and road transportation networks. These interventions will significantly contribute to increasing the city's scoring on the quality-of-life index.

The IUO approach puts people at the centre of development and therefore considers the needs and priorities of different stakeholders in all interventions with viable management and financing models that encourage public leadership, private participation, and citizen engagement.

The IUO projects in Santa Marta include South-South learning as they benefit from insights from the successful application of the IUO approach in Manabí, Ecuador, in particular concerning planning beyond urban boundaries, encompassing the region and all its productive and social systems as a whole, while generating a network with greater interconnections with other urban centres of the region.

Impacts and Results: The two IUO projects in Santa Marta will result in 21.2 ha of additional space allocated for businesses, production, and tourism; 21.6 ha of space for technology and innovation; 28.2 ha of sustainable buildings, of which 2.1 ha are housing solutions for seniors and young people; 1.5 ha of health and wellness facilities; 35.2 ha of inclusive and safe public spaces; and two new low-emission transportation systems that integrate train and tram modalities with boat services.

Challenges and Lessons Learned: The main challenge of the IUO projects is financing, which has been exacerbated by the ongoing COVID-19 pandemic. To overcome this challenge, the projects are fostering cooperation between different public entities at the local, regional and national levels as well as with the private sector. Thereby, the projects model and apply different scenarios that are tailored to available financial resources and allow for a phased approach in their realization.

Long-term Sustainability, Replicability, and Potential for Upscaling: The IUO projects are sustainable as they are integrated into the long-term development plan of the city of Santa Marta and designed to generate sufficient investment and revenue for being economically self-sufficient. The IUO approach can be easily replicated in different environments and has already been successfully applied in other cities in the region such as in Cali, Colombia and Manabí, Ecuador.

Her City Toolbox

Her City toolbox is a web-based step-by-step methodology developed by UN-Habitat that guides local government and urban actors to make urban cities better for everyone by adopting a more sustainable and inclusive urban planning approach. It is run for, by and with women and girls by adopting a participatory planning and co-designing approach.

Women and girls are often underrepresented in decision-making processes; hence many urban projects do not include them nor respond to their needs. Inclusive participatory processes are essential for sustainable urbanisation, but in many parts of the world, there is still a lack of capacity and experience in conducting meaningful participatory processes, especially when it comes to including vulnerable groups. Moreover, due to COVID-19, restrictions on gatherings have further limited opportunities to engage vulnerable groups with in-person workshops and activities.

UN-Habitat has, together with partners, experts, and stakeholders, created a digitalized toolbox to set up efficient and inclusive participatory processes to inform and improve the regular planning processes within cities. The toolbox contains 9 building blocks as a digital guideline on how to assess, co-plan and co-implement public spaces and better cities from a girl's perspective. Each block contains a series of activities and clear steps with a specific level of participation from girls and young women, ensuring as such their engagement throughout the process. Different digital tools developed by UN-Habitat and external partners are included under each of the building blocks. The platform is open source, user-friendly and encourages active dialogues between professionals and young citizens.

4.9. Utilizing artificial intelligence for improved solid waste management in Kiambu, Kenya

Source: De-graft

> ▶ **Where?** Kiambu, Kenya
> ▶ **Who?** Kiambu Municipality within Nairobi Metropolitan Region, De Graft Management Ltd., Ministry of Environment and Natural Resources of Kenya, and Kenya Association of Waste Recyclers
> ▶ **What?** Waste management
> ▶ **When?** Since 2021
> ▶ **Climate benefits?** Mitigation
> ▶ **Which SDGs?** SDG 5, SDG 6, SDG 7, SDG 8, SDG 9, SDG 10, SDG 11, SDG 12 and SDG 17

Summary: In Kiambu only 38% of waste is collected and 10% of waste is recycled. A new artificial intelligence-enabled technology aims to improve waste management in the Nairobi Metropolitan Region through automating the disposal, collection and recycling of solid waste; incentivizing tenants to recycle more; supporting responsible waste disposal; and raising awareness of the importance of waste separation at source.

Innovative Experience: In 2018, Kiambu generated about 2,500 tons of waste per day of which only 38% was collected and 10% recycled. Kiambu Municipality, located within the Nairobi Metropolitan Region, is partnering with De Graft Management Ltd. (DGM) to develop an artificial intelligence-enabled technology to engage waste stream stakeholders in a single, centralized and secure cloud-based online platform. This allows stakeholders to automate, track and monitor the lifecycle of solid waste, and it addresses

key pain-points of the sector. This solution is innovative as it advances property and asset management technology and introduces new business standards and good practices in waste management. In particular, the technology will:

- Automate the disposal, collection and recycling of waste for tenants, owners, landlords, property managers, waste collection and recycling service providers;

- Process waste management issues, complaints, feedback, requests for refuse and recycling bags and collections;

- Support regular and safe waste collection and recycling and improved health and safety;

- Automate communication and workflows between stakeholders via reporting and analytics;

- Incentivize tenants and owners via the incorporation of discounts on service charges levied by property managers based on the level of recycling undertaken;

- Provide service providers with analytics based on the amount and type of waste generated, collected and recycled;

- Provide segregation of waste and recycling training through local partners;

- Build awareness of solid waste source separation and recycling as essential components of sustainable waste management;

Source: De-graft

- Improve the tenant/property management experience; reduce time logging and resolving issues.

Kenya's National Environment Management Authority, the Kenya Association of Waste Recyclers, and local waste management companies are also engaged in the project and will contribute to the piloting of the technology and adjustments to the technology design to ensure a fully user-centred approach.

Impacts and Results: The project is still ongoing, but expected impacts and results of applying this technology include a significant reduction of waste generation and increased recycling, improved and more regular waste collection, a more efficient disposal system, and reduced GHG emissions from landfills. A forthcoming life-cycle assessment of the technology will deliver insights into alternative waste management options in Kenya, including possible GHG emission reductions from the use of the technology.

Challenges and Lessons Learned: Lessons learned include the importance of stakeholder consultations and the use of a user-centred system designed to understand specific challenges and develop effective solutions. As an African, female-led company that works within the technology sector, DGM is addressing the challenges of creating technologies that are fit for purpose within the Kenyan and wider African contexts. The company also actively supports and promotes equality, diversity and inclusion within the sector where issues of unconscious bias are challenged and addressed particularly in relation to developing artificial intelligence-enabled technology for the African market.

Long-term Sustainability, Replicability and Potential for Upscaling: Long-term sustainability of the project is ensured through fostering local ownership of the technology and a broad range of benefits for different stakeholders. There is a high potential for replication and upscaling within Kenya and Africa, given that more than 90% of waste generated on the continent is still burned or disposed of at uncontrolled dumpsites and landfills. DGM is already working with local partners in the Gambia, Ghana and Sierra Leone to deploy the technology there.

4.10. Promoting agroecology for sustainable food systems in Tandil, Argentina

Source: Municipal Government of Tandil

➤ **Where?** Tandil, Argentina
➤ **Who?** Municipal Government of Tandil, Agroindustrial Chamber of Tandil, Tandil Agrotechnological Institute, and Secretariat of Family Agriculture
➤ **What?** Urban resilience
➤ **When?** Since 2018
➤ **Climate benefits?** Adaptation with mitigation co-benefits
➤ **Which SDGs?** SDG 2, SDG 3, SDG 4, SDG 8, SDG 12 and SDG 17

Summary: The city of Tandil is spearheading an agroecology initiative to foster a sustainable food system for its local population. The initiative successfully introduced institutional arrangements at the municipal level for advancing agroecological production and demonstrated the socio-economic and environmental benefits of this production method.

Innovative Experience: The district of the city of Tandil has a strong track-record of agriculture and livestock production sustained by its good soil quality, water retention capacity, skilled labour and required capital. However, driven by economic interests, the focus has mainly been on the production of commodity crops, rather than food. Tandil is now refocussing on the local production of food in line with agroecological principles[21] to provide its population with a variety of quality food in sufficient quantity to foster well-being, food security and the sustainable use of resources. National and provincial policies on food productions exist, which Tandil is now localizing at the municipal level to achieve sovereignty in its food consumption over the next five to ten years.

Tandil's initiative takes a holistic view to achieve the local and sustainable production of agroecological

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[21] Agroecology has ten main elements that are interlinked and interdependent: Diversity, synergies, efficiency, resilience, recycling, co-creation and sharing of knowledge, human and social values, culture and food traditions, responsible governance, and circular and solidarity economy. Further information available at: http://www.fao.org/documents/card/es/c/I9037EN.

foods supported through educational activities and training, the engagement of the local community, the promotion of entrepreneurship, including through the establishment of cooperatives, and local industrialization. The initiative has three main components:

- **Institutional Arrangements:** An Agroecology Coordination mechanism was established under the municipal government to manage information and establish and coordinate networks within the agroecological and food sectors and in particular:

  ○ Gather and analyse information on the agroecological productive sector and generate follow-up metrics and action plans according to the information;
  ○ Articulate at the local level the policies and projects promoted by the National Directorate of Agroecology;
  ○ Create and implement support instruments for agroecology, including training, financing and marketing;
  ○ Interact with citizens, producers and institutions promoting the approach and their participation in the sector.

- **Horticulture Development:** To provide the population with a variety of quality food in sufficient quantity for a healthy diet, the production of fruits and vegetables is essential. To supply the population of Tandil, 400 ha of orchards and 30 ha of covered orchards would be required, which would generate direct employment for 600 people. Currently the city only has 30 ha of orchards dedicated to the production of vegetables. Therefore, the initiative aims to:

  ○ Improve the functioning of local markets, emphasizing the value of agroecological foods and differentiating local production to generate greater demand for the products;
  ○ Survey the land that is available and suitable for developing agroecological garden projects;
  ○ Provide facilities for the establishment of new agroecological gardens and information, advice,

financing and distribution channels for products;
  ○ Facilitate access to the necessary machinery by renting them or financing their acquisition;
  ○ Promote urban gardens.

- **Agroecological demonstration:** Agroecological production was demonstrated on 21 ha of land and the produce was provided to public canteens, hospitals and people in vulnerable situations. Through voluntary work by 35 members of the local community, it was possible to grow 3 ha of squash without chemicals, generating about 70,000 rations for about 5,700 people.
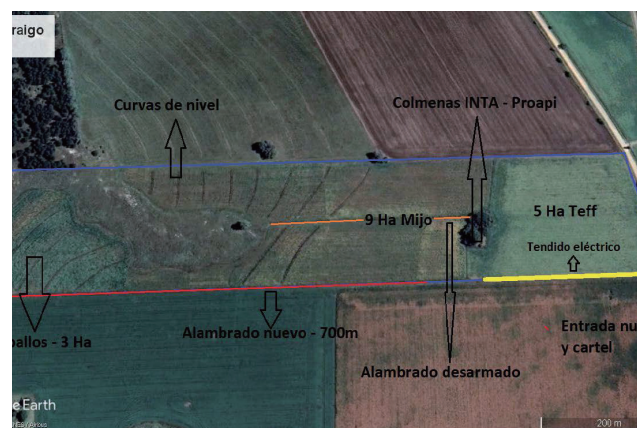
Source: Municipal Government of Tandil

Impacts and Results: The initiative resulted in greater awareness of the benefits of agroecology for communities and the environment, including policy coordination on the matter between the national, provincial and municipal levels. New agroecology food production units were put into operation, including 21 ha of land and community gardens. 15 food production projects were supported financially and 12 food production projects received technical and networking support. Through a volunteer programme, food was produced that benefited more than 5,700 people.

Challenges and Lessons Learned: A key lesson learned is that it is possible to transform the prevailing industry-centred food production systems into human-centred higher quality systems that are economically, socially and environmentally sustainable. Such transformation is a long-term process, but already shows visible impacts in the short- and medium-term.

Long-term Sustainability, Replicability and Potential for Upscaling: The initiative is sustainable in the long term given its support by the community and its institutional arrangements. Project costs were mainly covered by the municipality of Tandil with some contributions made by civil society organizations. The possibility of scaling up and replicating the project in other cities is high, given that the institutionalized Agroecology Coordination generated the planning tools necessary to adapt the project to different local circumstances.

Source: Municipal Government of Tandil

4.11. Spearheading community-driven waste management in Dehradun, India

Source: Waste Warriors

- ➤ **Where?** Dehradun, India
- ➤ **Who?** Waste Warriors Society, Dehradun Municipal Corporation, Uttarakhand Pollution Control Board, Uttarakhand Forest Department, Lal Family Foundation
- ➤ **What?** Waste management
- ➤ **When?** Since 2019
- ➤ **Climate benefits?** Mitigation
- ➤ **Which SDGs?** SDG 6, SDG 8, SDG 10, SDG 11, SDG 12, SDG 13 and SDG 17

"Residents have now started to see waste in categories of organic, recyclable and hazardous and most of them are participating in this community-driven waste segregation and collection scheme" (Resident of the city of Dehradun)

Summary: The Model Ward Programme is a community-driven waste management initiative that raises awareness and provides training to residential communities, businesses and public institutions to improve solid waste management by changing behaviours towards segregation of waste, organic composting, and the use of dustbins.[22]

Innovative Experience: The city of Dehradun sends large amounts of solid waste directly to landfills due to the lack of source segregation and composting. As waste is not regularly collected from households it is often dumped on the streets or burned, which greatly pollutes the local environment and contributes to global warming.

The Model Ward Programme takes an integrated approach through stakeholder engagement, behavioural change campaigns, and showcasing the effectiveness and potential of coordinated community efforts. The programme has four main components:

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[22] Further information available at: https://wastewarriors.org/what-we-do/dehradun.

- Analysis of sources of waste and collection systems to foster public participation in data-backed interventions;

- Awareness-raising through trained community mobilizers, including through daily door-to-door visits and the distribution of bags for the collection of recyclable waste and training on home composting;

- Collection and processing of solid waste after reaching a minimum number of participants in the "municipal ward", meaning a certain neighbourhood. Waste collection vehicles are regularly deployed to collect waste from households and businesses for a fixed fee. The segregated collected waste is then further processed at the only Material Recovery Facilities in the entire state of Uttarakhand, which is also operated by the Waste Warriors Society;

- Local waste pickers are integrated into the Model Ward Programme through training on safe and efficient waste handling and the provision of standardized rates for collected waste. Training is also provided to active community members to educate households in their neighbourhood on how to better segregate their waste, improving the further segregation and sorting of mixed solid waste.

Source: Waste Warriors

Impacts and Results: In the financial year 2019 to 2020, the Model Ward Programme covered 1,500 households in one municipal ward in Dehradun, providing 50 awareness-raising and training sessions. In 2020 to 2021, the programme expanded to a new municipal ward together with five trained community mobilizers conducting door-to-door awareness-raising

on source segregation of waste. The programme is operating three waste collection vehicles that collect solid waste from more than 1,200 households, with more households being added every week. In the areas where the program is active, 94% of households participate in the waste segregation and collection efforts, which has reduced waste dumping and burning from 27% to 5%. 67 local waste pickers have successfully been integrated into the programme and received support not only in the form of training sessions, but also through advice on livelihood development and revenue generation through the sale of recyclables at the facility.

Challenges and Lessons Learned: The main challenges have included delays in receiving permission from municipal authorities and in mobilizing sufficient manpower to start the programme. Behavioural change cannot be guaranteed and is a long-term process. Despite regular and ongoing awareness-raising efforts and even daily follow-up in some cases, it requires a great deal of patience to convince some households of the benefits of participating in the programme. Often households are hesitant in paying user-fees for waste collection and recognizing the waste collection as a service, which causes payment backlogs and increased operational deficiencies.

Long-term Sustainability, Replicability, and Potential for Upscaling: This Model Ward Programme has proven that it is feasible and more affordable and effective than other similar initiatives by the municipal government. The programme can be scaled up and replicated in many, if not all, areas of the city as well as in other cities. It has a huge potential for becoming financially self-sufficient or even profitable through the revenue generated from user fees and the sale of recyclable materials and fertilizer from composting.

Source: Waste Warriors

4.12. Improved urban planning through monitoring of land use and land cover change in the Greater Metropolitan Area of San José, Costa Rica

Source: UNDP Costa Rica

> ➤ **Where?** Greater Metropolitan Area of San José, Costa Rica
> ➤ **Who?** Ministry of Environment and Energy, Ministry of Housing and Human Settlements, National Geographic Institute, Local Committee of the María Aguilar Interurban Biological Corridor, local governments, and the United Nations Development Programme (UNDP)
> ➤ **What?** Urban planning
> ➤ **When?** Since 2019
> ➤ **Climate benefits?** Mitigation with adaptation co-benefits
> ➤ **Which SDGs?** SDG 3, SDG 5, SDG 11, SDG 13, SDG 15 and SDG 17

Summary: The government of Costa Rica and UNDP developed a new tool for monitoring changes in urban landscapes that enables improved planning and decision-making processes regarding the maintenance, extension, and connectivity of urban green areas in the Greater Metropolitan Area of San José.

Innovative Experience: In the Greater Metropolitan Area around Costa Rica's capital city of San José, urbanization has been mostly spontaneous, and
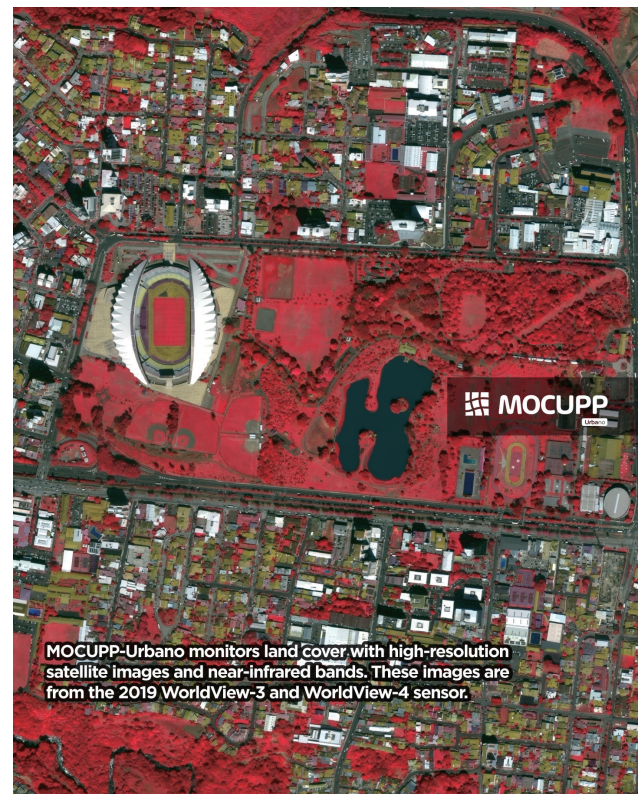
unplanned. Even though the government has been promoting the development of parks, recreational, and forest protection areas near water bodies, green areas in the urban regions remain fragmented and disconnected. This has led to environmental deterioration and ecosystem functionality losses. In response to this, the government has established urban biological corridors, in particular the Maria Aguilar Biological Interurban Corridor, in the most populated micro-basin of the city of San José.

Since 2015, UNDP had been applying the tool "Monitoring Land Use and Land Cover Change in Productive Landscapes (MOCUPP in Spanish)" for monitoring land change externalities of extensive monocultures, such as pineapples, palm oil and pastures, on water, soil, and biodiversity. Based on the experience from its use, UNDP developed a new tool called "Monitoring of Land Use and Land Cover Change in Urban Productive Landscapes (MOCUPP-Urbano)" as a tailored solution for monitoring urban productive landscapes in the Maria Aguilar Biological Interurban Corridor. MOCUPP-Urbano allows monitoring and annual assessments of green areas in urban and inter-urban environments. Based on high-resolution satellite images and remote sensing techniques, the tool helps measure changes within green areas, identifying urban heat islands and corresponding needs for improving ecosystem services and urban landscape restoration.

Costa Rica and UNDP have shared experiences and learned lessons regarding the use of the MOCUPP-Urbano with other developing countries to help strengthen the capacity for monitoring land-use changes. These exchanges have also contributed to learning experiences in Costa Rica. This South-South cooperation was undertaken through field work and virtual meetings with Brazil, Ethiopia, Ghana, Guyana, Indonesia, Ivory Coast, Madagascar, Morocco, Papua New Guinea, Paraguay, and Peru. Experience sharing through South-South cooperation is also planned for the new insights gained from the application of the MOCUPP-Urbano.

Impacts and Results: The MOCUPP-Urbano tool was launched in 2021 and has already been successfully applied to the first mapping of green areas in the Maria Aguilar Biological Interurban Corridor. The data

obtained resulted in new insights- for example, the largest loss of green areas is caused by the removal of natural vegetation in private gardens. This is a fundamental challenge in urban planning that requires the creation of incentives and agreements with private households to conserve these green spaces. The mapping results also enabled local governments to strategically select sites for reforestation.

MOCUPP-Urbano monitors land cover with high-resolution satellite images and near-infrared bands. These images are from the 2019 WorldView-3 and WorldView-4 sensor.

Source: UNDP Costa Rica

Challenges and Lessons Learned: One of the lessons learned from the development and use of the MOCUPP-Urbano was that monitoring tools must be complemented by technological instruments, such as remote sensors that allow precise and dynamic surface mapping and monitoring of land use and land cover changes over time. Another lesson was that low-cost or open-source solutions are key for ensuring the economic sustainability of the tool. In addition, a broad engagement of various public sector stakeholders is important for ensuring the successful uptake and application of the monitoring tool and its

results. Furthermore, South-South cooperation has not only contributed to sharing Costa Rica's experience internationally but also to enhancing local capacities and solutions through insights from other countries.

Long-term Sustainability, Replicability, and Potential for Upscaling: The MOCUPP-Urbano tool and its methodology can easily be replicated by other cities in Costa Rica and internationally as it is adaptable to different scales and contexts. The main requirements are access to satellite imagery from the focus area and personnel with expertise in geographic information systems and remote sensing technologies. The long-term sustainability of the tool is guaranteed through its cost-efficient approach and the successful engagement of various local and national level public institutions.

UN Habitat Highlight ☼
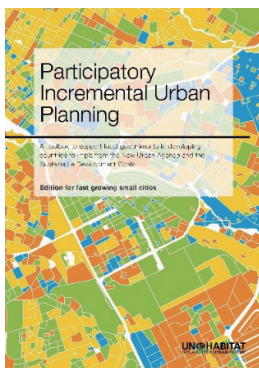
Participatory Incremental Urban Planning Toolbox
The Participatory Incremental Urban Planning Toolbox (PIUP) is a step-by-step methodology, developed by UN-Habitat, to support the local governments of small and intermediate-sized cities in developing countries to implement the principles of the New Urban Agenda and the SDGs in urban planning practices. It guides users through a participatory and incremental process divided into phases, blocks and activities, utilizing tried and tested methods to build local capacity and ownership. Based on the objective, the available capacities, and the urban planning framework, local governments can adjust and follow a tailored path to achieve sustainable urban development for and with inclusive communities.

Complex urban planning frameworks and instruments in combination with weak planning capacities can hinder the preparation and implementation of strategic plans, action plans and projects. For this reason, UN-Habitat has developed an incremental planning process that progressively supports governments to build more complex instruments as their legal frameworks, financial resources and planning capacities are strengthened.

Based on its decades of experience leading participatory planning processes tailored to specific contexts around the world, UN-Habitat developed the PIUP methodology to meet the challenges that impede planning processes today. The PIUP methodology proposes four main phases that reflects the urban planning process: Assessment; Plan; Operationalization; and Implementation. Local governments can adjust and follow a tailored path to achieve sustainable urban development for and with inclusive communities. The PIUP methodology includes a series of innovative and open-source tools developed and tested by UN-Habitat in multiple projects (e.g., GIS Spatial Analysis methodology, Kobo Toolbox, Participatory Mapping, Block by Block workshop, Smart Mixed Land Use Plan Tool, etc.) and sets the right framework for local government to strengthen its relations with multiple stakeholders (e.g., national entities, investors, donors, civil society, academia, communities, etc.)

5. Conclusions

The struggle towards addressing climate change and achieving environmental sustainability will be won or lost in our cities. UN-Habitat calls the 21st century the "urban century" not only because more and more people are living in cities, but also because of the key role that cities play for shifting towards sustainable development pathways to safeguard an opportunity for our species to live in peace and dignity on this planet.

It is increasingly recognized that the real challenge of implementing international and national policies lies at the local level. Cities play a dominant role in global consumption, production, and pollution. However, the concentration of population, activities, and resources used in cities also brings potential for important efficiency gains and innovative solutions.

The 12 case studies, presented in Chapter 4 above, have shown a plethora of innovative approaches pursued by cities towards environmental sustainability and climate change adaptation and mitigation actions. In particular, the case studies show that:

- **South-South cooperation is a key driver for the development, replication and scaling-up of innovative solutions** through the exchange of knowledge, experiences and technologies between urban stakeholders that face similar challenges within similar socio-economic environments (e.g., case studies 4.3, 4.4 and 4.7);

- **Developed countries can effectively contribute to South-South cooperation through triangular cooperation,** by enabling, facilitating and enhancing cooperation (e.g., case study 4.5);

- **Collaborative efforts among various stakeholders are needed** to mobilize the necessary public and private support as well as resources for effectively carrying out innovative solutions (e.g., case studies 4.1, 4.2 and 4.3);

- **Effective and inclusive stakeholder engagement** is also key for fostering local ownership, benefiting from endogenous knowledge, and ensuring that solutions are responding to specific local needs and circumstances (e.g., case studies 4.3, 4.4 and 4.9);

- **Innovative solutions are possible without major investments,** for example in the area of waste management (e.g., case studies 4.1, 4.9 and 4.11);

- **Long-term sustainability** of solutions can be achieved, inter alia, **through institutionalization and self-sustaining business models** (e.g., case studies 4.2, 4.3, 4.6 and 4.10);

- **Replication and scaling-up** of many innovative solutions in line with different local needs and circumstances is possible and has tremendous **potential for making significant contributions to GHG emission reductions, climate resilience and environmental sustainability** in cities (e.g., case studies 4.3, 4.5 and 4.12);

- Successful approaches towards fostering environmental sustainability and climate action also lead to **significant socio-economic co-benefits for local communities,** including job creation and food security (e.g., case studies 4.6, 4.7 and 4.10).

6. Join the South-South Cities Clusters

Under the UNOSSC's Cities Project, the South-South Cities Clusters platform aims to bring networks of cities, institutions, and experts together under the South-South Galaxy digital platform, to facilitate horizontal cooperation and exchange. The initiative enables local government representatives and cities partners to connect and engage in South-South and triangular cooperation capacity development and knowledge-sharing activities for mutual benefit.

Cities representatives and partners are invited to select or propose the thematic areas they are interested in and join the South-South Cities Clusters. At first stage, cities from the Global South have proposed the following seven thematic clusters:

COVID-19 Response and Recovery & Public Health

Sustainable Transport & Air Quality

Waste Management, Green Cities & Renewable Energy

Sustainable Agriculture Value Chain Development

Sustainable Tourism, Heritage Protection & Creative Economy

E-Commerce Digitalization & Smart cities

Disaster Risk Reduction & Mitigation inResilient Cities

For more information about the South-South Cities Clusters visit
https://www.southsouth-galaxy.org/cities-clusters/

About the Cities Project
https://www.southsouth-galaxy.org/maritime-continental-silk-road-cities-for-sustainable-development-project-cities-project/

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