U20

RIYADH 2020

URBAN

The Post-COVID-19 Circular Economy:

Transitioning to Sustainable Consumption and Production in Cities and Regions

Circular, Carbon-neutral Economy

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List of Definitions and Acronyms

Circular economy: It entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system maximizing the value of resources by keeping them in use for as long as possible.

4Rs of waste prevention: Techniques commonly summarized as the so-called 4Rs: reduction, reuse, recycling and recovery.

Industrial symbiosis: Mutually beneficial collaborations, where what is considered waste by one company becomes raw material for the products of another.

Living Labs: In contrast to a traditional laboratory, a living lab operates in a real-life context with a user-centric approach. The physical and/or organizational boundaries of a living lab are defined by purpose, scope, and context. The scope, aims, objectives, duration, actor involvement, degree of participation, and boundaries of a living laboratory are open for definition by its participants (FISSAC 2020).

Urban Metabollsm: As defined by Victor Notovny (2012), is the way that cities as complex systems "accept, transform, use and attenuate inputs and produce and emit outputs."

About Urban 20

Urban20 (U20) is a city diplomacy initiative that brings together cities from G20 member states and observer cities from non-G20 states to discuss and form a common position on climate action, social inclusion and integration, and sustainable economic growth. Recommendations are then issued for consideration by the G20. The initiative is convened by C40 Cities, in collaboration with United Cities and Local Governments, under the leadership of a Chair city that rotates annually. The first U20 Mayors Summit took place in Buenos Aires in 2018, and the second took place in Tokyo in 2019. For 2020, Riyadh City is the Chair city and host of the annual Mayors Summit. The first meeting of U20 Sherpas was convened in Riyadh, Saudi Arabia, on the 5th – 6th February during which the foundations were laid for the U20 2020 Mayors Summit in the Saudi capital later this year.

About the Urban 20 Taskforces

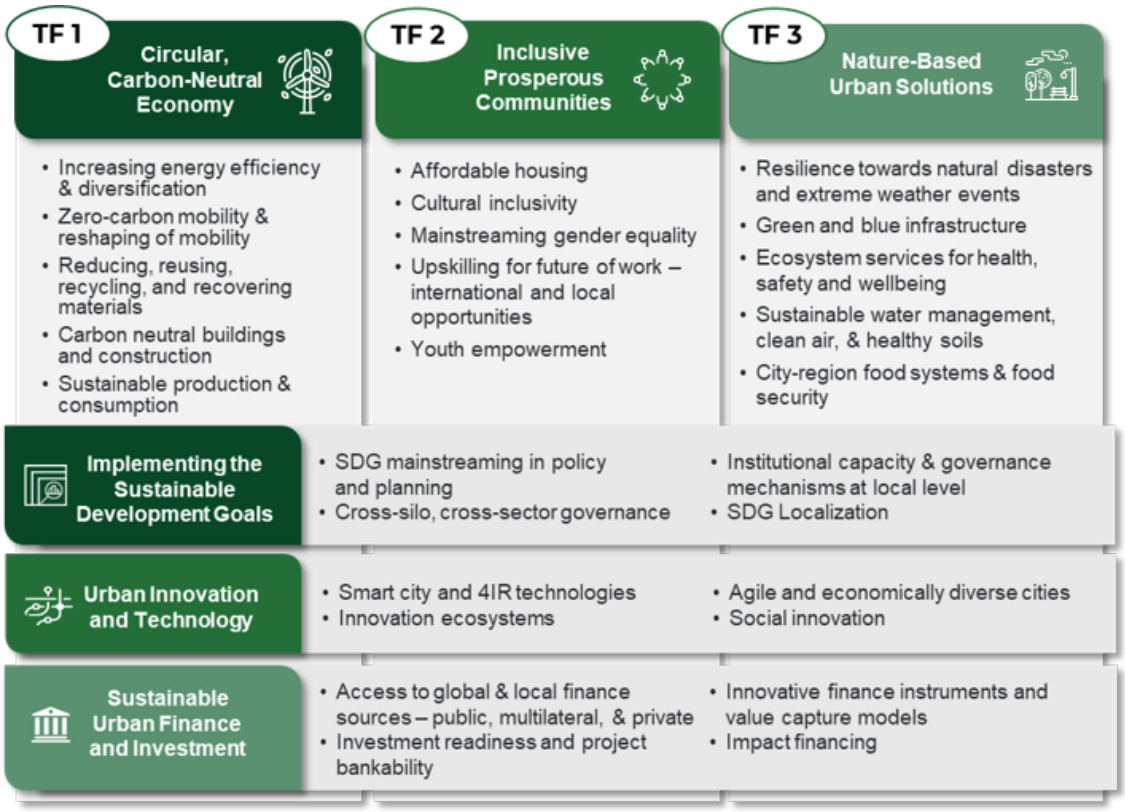
As U20 Chair, Riyadh has introduced taskforces to add additional structure and focus to the U20. These taskforces explore specific priority issues and bring evidence-based solutions to the final Communique.

Each taskforce has commissioned whitepapers led by chair cities, and with input from participating cities and knowledge partners. These whitepapers help us build an evidence-based, credible and achievable set of policy recommendations.

Taskforces activation

The taskforces workstream was an innovative and recent introduction to the three-year-old U20 initiative by the chairmanship of the city of Riyadh this year. Three thematic taskforces, each guided by one of the U20 Riyadh 2020 overarching themes of Circular, Carbon-neutral economy, Inclusive Prosperous Communities, and Nature-based Urban Solutions, were officially launched and activated during the U20 First Sherpa meeting back in February. During the meeting, the U20 priority topics that fell within the three overarching themes and intersecting with the three cross-sectional dimensions of Implementing the Sustainable Development Goals, Urban Innovation and Technology, and Urban Finance and Investment were prioritized and refined through the statements delivered by all attending cities. The top 5 topics were then chosen to be the focus of whitepapers for each taskforce.

The top 5 topics under each of the three taskforces and cross cutting dimensions were then chosen to be the focus of whitepapers for each taskforce:



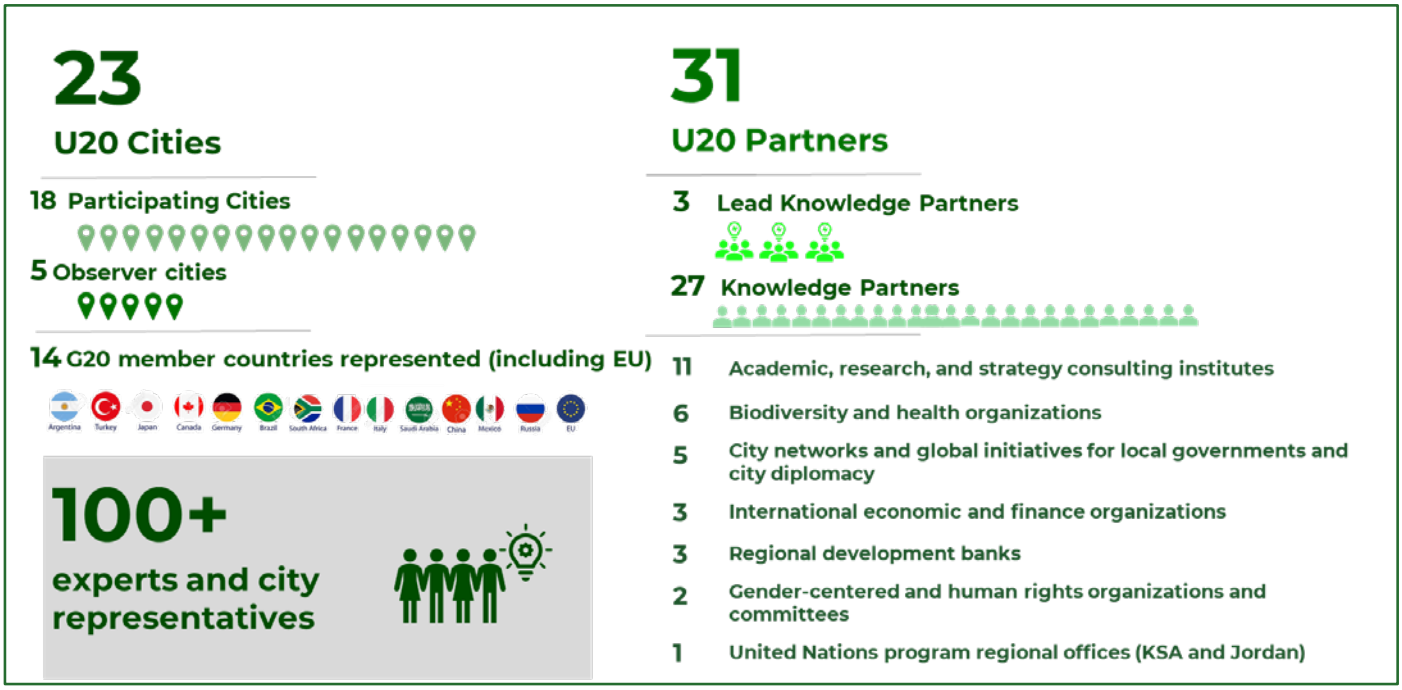
Cities and Partner Engagement

The vast majority of the twenty-three cities who attended the first Sherpa meeting, representing 12 G20 countries, along with the U20 Conveners, agreed to the importance of having taskforces as interactive platforms to produce knowledge-based and evidence-based outcomes that can effectively feed into an actionable U20 Communique. During and following the meeting, several cities demonstrated interest in volunteering in the capacity of chairs and co-chairs, leading and overseeing the activities of each taskforce. The cities of Rome and Tshwane co-chaired Taskforce 1 on Circular, Carbon-neutral Economy, Izmir Taskforce 2 on Inclusive Prosperous Communities, and Durban on Nature-based Urban Solutions. Others expressed interest to participate in the taskforces, some in more than one, both during and after the meeting.

Alongside interested U20 cities, several regional and international organizations proffered to engage in the work of the taskforces, in the capacity of knowledge partners, to share their knowledge and experiences with cities in producing whitepapers. Some of the knowledge partners volunteered to play a leading role as Lead Knowledge Partners, supporting the taskforces' co/chairs in review and guidance

All participants who actively took part of the taskforces were subject matter experts nominated by the cities and knowledge partners and have enriched the taskforces' discussions with their know-how and experiences. In over 3 months, all three taskforces, with great effort and commitment from all their participants, produced a total of 15 evidence-based focused whitepapers, bringing about more than 160 policy recommendations addressing the national governments of the G20 Member States.

The taskforces content development efforts is comprised of 23 U20 cities and 31 U20 knowledge partners. The 100+ experts and city representatives produced 15 whitepapers which widely benefited and informed the development of the first draft of the communique.



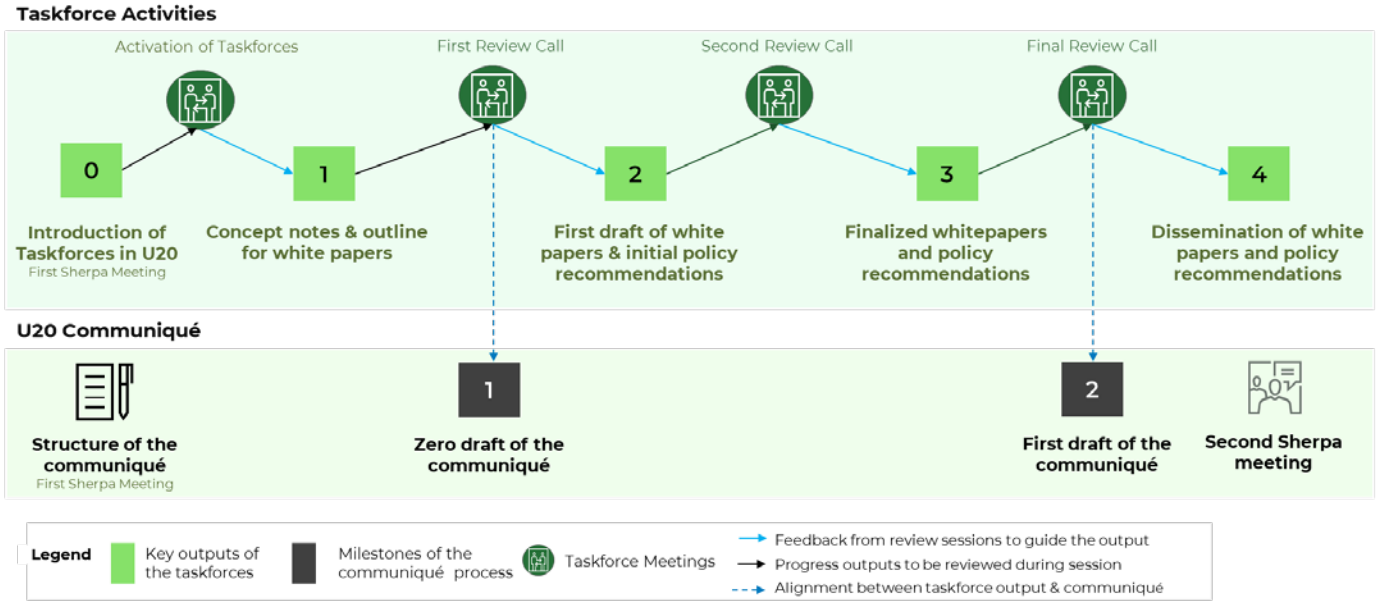
Content Development

Under the leadership and guidance of the co-chair cities, Rome and Tshawne , and the lead knowledge partner, OECD, the work of Task Force 1 kicked off with an orientation for all participants in mid-March.

During the period between March and April, the participants of Taskforce 1 presented more than 20 concept ideas and 12 concept notes and developed initial outlines for the whitepapers focusing on topics of interest. Teaming up into four author groupings, the cities and knowledge partners developed four outlines of whitepapers. Refined and revised outlines were then developed into draft whitepapers that underwent several iterations for development and finalization, ensuring that each paper delivers a set of concrete and targeted policy recommendations that address the different U20 stakeholders.

The four whitepapers under task force 1 (listed below) started with the exploration of the concepts of circular economy across different sectors, with the other three papers zooming into the concepts of circular economy in energy, mobility and buildings sectors :

1. The Post-COVID-19 Circular Economy: Transitioning to Sustainable Consumption and Production in Cities and Regions
2. Efficiency and Diversification: A Framework for Sustainably Transitioning to a Carbon-neutral Economy
3. Reshaping Mobility in Cities for a Carbon-neutral Future
4. Carbon-neutral Buildings and Recycled Materials : How Cities Want to Solve the Challenge



Along the taskforces timeline of activities, three review meetings were held where co/chairs and lead knowledge partners presented and discussed with the U20 Executive Team the progress and findings of the taskforces they represent, leading to the U20 Second Sherpa meeting that took place during the first week of July. Parallel to the taskforces activities, the first draft of the U20 communique was developed by the U20 Executive team incorporating recommendations presented at the third (and final) review meeting.

About the Circular, Carbon-neutral Economy Taskforce

Meeting the global climate targets requires transforming our urban energy systems to be more efficient and based on clean renewable energy sources, while also shifting from a linear material economy to a circular model that reduces, reuses, recovers and recycles scarce and carbon intensive resources

De-carbonization measures in cities such as building retrofitting for energy efficiency, provision of sustainable mobility of people and urban freight based on public transportation and vehicle electrification coupled with the expansion of renewable energy sources could deliver over half of the emission reductions needed to keep global temperature rise below 1.5 degrees Celsius City planning and management approaches can greatly encourage Carbon-neutral lifestyles, through neighborhood walkability and cycling infrastructure, reorganization of food production and distribution for local and organic produce, or support programs for green technology and investment Greenhouse gas emissions from material processes such as infrastructure construction, industry, and household waste need to be taken into account in a full life cycle approach Cities need to reduce the use of carbon intensive and otherwise scarce materials, reuse urban infrastructure and consumer products to extend their lifespan, recover carbon intensive or otherwise scarce material from household waste, industry and physical infrastructure and recycle all materials from plastic to steel, from organics to rare earth materials in a circular economy model that decouples economic growth from carbon emissions.

15 cities

U20 Participating cities

Buenos Aires
Guangzhou
Madrid
Mexico city
Rio de Janeiro
Riyadh
Sao Paulo
Strasbourg
Tokyo

Co-chair cities

Rome
Tshwane

U20 Observer cities

Amman
Dammam
Helsinki
Singapore

13 knowledge partners

Lead knowledge partner

OECD

Knowledge partners

- Cities Climate Finance Leadership Alliance
- Inter-American Development Bank
- King Abdullah Petroleum Studies and Research Center
- National Institute of Urban Affairs
- Université Nationale Gustave Eiffel
- Center for the Implementation of Public Policies for Equity and Growth
- International Finance Corporation
- World Economic Forum
- University of Pennsylvania, Institute for Urban Research
- World Wildlife Fund
- Coalition of Urban Transitions
- International Association of Public Transport

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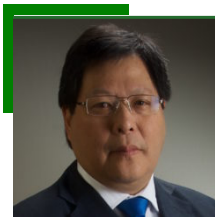

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Disclaimer Note
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Executive Summary

Executive Summary

The COVID-19 pandemic is providing an opportunity for cities as they recover from the shock, to transition to the circular economy and its 4R principles (reduce, recycle, recover and reuse). While governments are most concerned with responding to the immediate emergencies, they will later turn to economic recovery programs, necessarily focused on cities, drivers of national GDPs. In this effort, cities can make use of their capacities in asset management, service delivery, regulation and legislation, and procurement. A successful transition program requires a plan in which a city identifies its roles (facilitator, promoter, enabler), uses a systems approach, develops financing strategies, establishes a monitoring system, engages stakeholders, has a capacity-building program, and promotes research and knowledge sharing. In choosing how to pursue a transition to a circular, Carbon-neutral economy, working with their respective higher- level governments, cities in low-, moderate- and high-income countries will select suitable approaches according to their resources and capacities. Examples from Mexico City; Philadelphia; Milan; Riyadh; Rome; Sao Paulo; Singapore; and Washington, DC, illustrate the opportunities and challenges of localities' initiation of circular economy projects. National regulatory and financial support along with multilevel governmental alignment will advance these efforts.

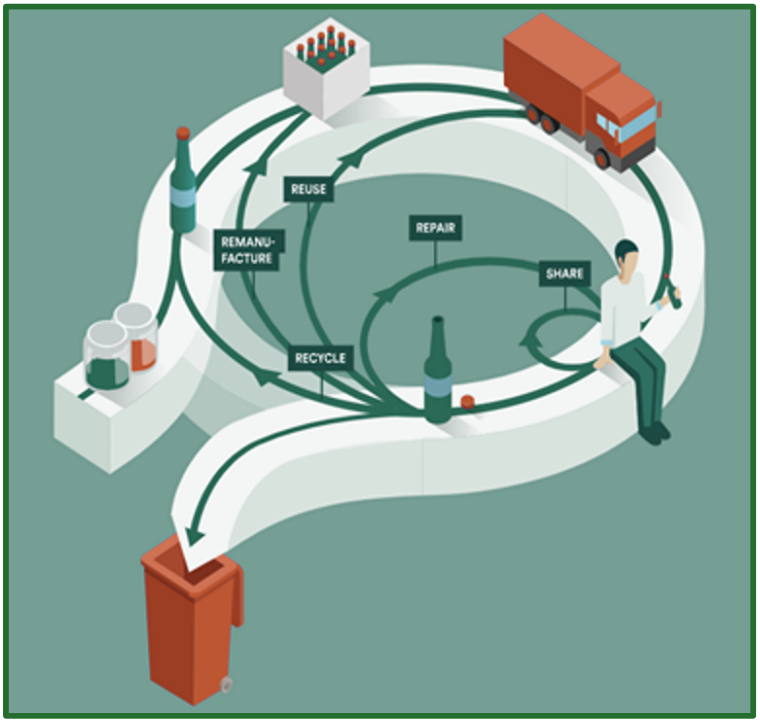
Background

Background

This paper engages with 2020 Presidential Agenda for G20, especially the themes of Safeguarding the Planet that calls for advancing sustainability in energy, food, and water and Shaping New Frontiers that advances technology – its use in infrastructure, resilience, and smart city applications. It builds on previous Leaders' Declarations to provide further thoughts for consideration in the 2020 summit. Further, it addresses key issues in the G20's five-part *Action Plan – Supporting the Global Economy Through the COVID 19 Pandemic,* namely its commitment to return to "strong, sustainable, balanced and inclusive growth" in the recovery period (G20 Finance Ministers and Central Bank Governors 2020).

In particular, this paper emphasizes how cities, in shifting towards a circular economy, can go a long way to achieving a sustainable Post-COVID recovery while ensuring their respective roles as drivers of their nations' economies.

Figure 1.
The Four Rs of the Circular Economy



Observers use different definitions of the 4Rs, nonetheless the basic principles are the same: "maintain the value of products materials, resources as long as possible and minimize the generation of waste." (Source: Eurostat https://ec.europa.eu/eurostat/documents/2995521/8587408/8-16012018-AP-EN.pdf/aaaaf8f4-75f4-4879-8fea-6b2c27ffa1a2

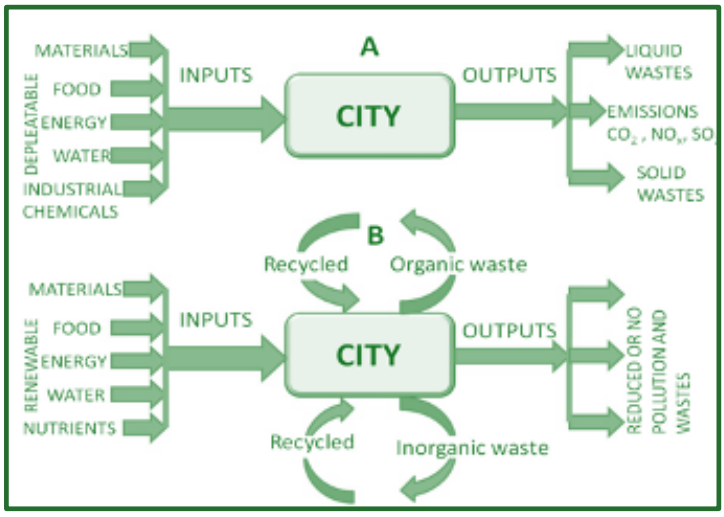
Several cities and knowledge partners contributed to this paper. They include (in alphabetical order): IDB, Mexico City, Milan, Paris, Philadelphia, OECD, Riyadh, Rome, Sao Paulo, Singapore, and Washington, DC.

Introduction

Introduction

The sweeping pandemic of 2019-2020 may well be the turning point for the accelerated adoption of the circular economy worldwide. While it exposed the fragility of places dependent on linear models of consumption and production in public health, the shock revealed problems with other linear systems underlying urban life. In fact, it has put pressure on cities' service delivery capacities, finances, and supply lines for local businesses. Thus, it is an indicator of the unfavorable effects of the dominant "take, make, dispose" model. It is bringing attention to the necessity of addressing many other real and potential shocks, including those associated with climate change. On a positive note, it also illustrated the ability of manufacturing firms to shift quickly from producing one type of goods (automotive parts) to another (medical equipment), of people to make behavioral changes (more biking and walking) and municipalities to accommodate the new needs quickly through improvised but important policy decisions (e.g. expanding public open space, reorganizing public transport, transforming waste collection and engaging in new procurement efforts) [Berliot 2020, OECD 2020a].

Figure 2.
Urban Metabolism Systems



The term "urban metabolism" that describes the ways cities "accept, transform, use and attenuate inputs and produce and emit outputs" can take two forms, linear and circular. The 4Rs apply to the circular version above (Source: V. Novotny 2012).

While governments, regardless of level, are most concerned with immediate public health and economic responses, their later recovery programs can be impactful in building higher resilience outcomes in cities, the drivers of national GDPs. Hopefully in this effort, the responses to the

Introduction

pandemic will inspire the G-20 to move from *recognition* of the need to improve resource *efficiency* as noted in the 2019 Osaka Leaders Declaration (para 38) to a *commitment* to do so, incorporating elements of the circular economy in the relief and recovery processes.[1] To this end, the G20 can take note of the Tokyo U20 Mayors' Declaration that provided clear directions for improving resilience, environmental sustainability, social inclusion and economic prosperity based on circular economy principles (paras c and d).[2] These ideas with their underlying allegiance to the Sustainable Development Goals take on even more importance today as the basis for a green recovery, one premised on the principles of the circular economy (Romano 2020).

Cities are uniquely positioned to promote the circular economy. They have a large number of inhabitants – 55 percent of the global population – and consume the majority of world's total natural resources (75 percent) and energy (80 percent) while producing 75 percent of global carbon emissions and 70 percent of the world's solid waste (Campbell-Johnston et al., 2019, 1232). Further, they are a major source of global GDP (70 percent), whose efficiency and functions are now threatened by the growing local fiscal crisis resulting from lost revenue and high expenses in dealing with COVID-19.

[1] *From the G 20 Osaka Leaders Declaration*

38. We recognize that improving resource efficiency through policies and approaches, such as circular economy, sustainable materials management, the 3Rs (reduce, reuse, recycle) and waste to value, contributes to the SDGs, as well as to addressing a wide range of environmental challenges, enhancing competitiveness and economic growth, managing resources sustainably, and creating jobs. We encourage work with the private sector towards innovation in the cooling sector. We will also work with stakeholders in order to increase the demand for recycled products. We look forward to the development of a roadmap of the G20 Resource Efficiency Dialogue under the Japanese Presidency. https://g20.org/en/g20/Documents/2019-Japan-G20%20Osaka%20Leaders%20Declaration.pdf

[2] *From the 2019 Urban 20 Tokyo Mayors Summit Communiqué*

c. Enhance energy efficiency, encourage energy system transition and zero-emission transport

I. Commit to decarbonizing the energy grid, with 100% renewable electricity by 2030, and 100% renewable energy by 2050. II. Enact national regulations and/or planning policy to ensure new buildings operate at net zero carbon by 2030 and all buildings by 2050 with a suite of supporting incentives and programmes. III. Promote research, development and collaboration with suppliers, fleet operators and businesses in order to expedite the transition to zero-emission vehicles and support cities' efforts to diffuse such vehicles through emissions standards, incentive schemes, and charging infrastructure roll out. IV. Accelerate the transition to green and healthy streets through the promotion of sustainable public mobility concepts and corporate mobility management, people friendly planning policies, increased rates of walking, cycling and use of public and shared transport

d. Increase resource efficiency and promote circularity

I. Commit to measure and reduce consumption-based emissions substantially; including through new and ambitious global initiatives to reduce emissions from the construction, food production, automobile, aviation and apparel sectors. II. Recognize that increasing consumption of biomass resources causes the loss of tropical forests, which contain high carbon stock and restrict the use of biomass in the energy sector so it is used efficiently and limited to applications where other forms of renewable energy cannot be used. Promote a responsible supply chain management to limit the loss of tropical forests and protect biodiversity. III. Reduce the generation of plastic waste in view of the critical situation concerning marine litter, by phasing-out certain single-use and hard to recycle plastics in particular and by considering a new legally binding international agreement, in line with the regulation of the international trade of plastic waste by the Basel Convention. (https://www.seisakukikaku.metro.tokyo.lg.jp/en/diplomacy/2019/05/images/01_communique_tokyo_engl.pdf)

However, as centers of resources, knowledge and economic activity, cities have the competencies that enable them not only to pivot quickly in a crisis but also translate global goals into a reality (Sanchez-Levoso, A. et al., 2019, 1). However, the key issue, within today's context, is finding ways to ensure that nations understand how recovery activities can be integrated with municipal strengths. In fact, in choosing how to pursue a transition to a circular, Carbon-neutral economy, cities working with their respective higher-level governments in low-, moderate- and high-income countries will select suitable approaches according to their resources and capacities. The following discussion endeavors to meet this aim. It demonstrates opportunities for promoting the circular economy in four key areas most relevant to cities: energy use and asset management, service delivery (solid waste, water, food), regulatory standards and legislation (building codes, waste) and procurement, discusses the challenges of implementation, and outlines areas for additional research.

This paper has three parts. Part I. Overview of the Role of Cities in the Circular Economy; Part II. Challenges and Opportunities; Part III. Recommendations, References and Appendices.

Overview of Cities in the Circular Economy

Part I: Overview of Cities in the Circular Economy

Since cities control specific activities within their municipal responsibilities, have special competencies, relating to their ability to convene, regulate, finance, pilot, and tax, they are ideal places to lead in the transition to the circular economy, in coordination with national governments. Further, through the use of these tools they can influence, directly or indirectly, private-sector activities. While cities are extremely complex systems having different metabolisms, footprints, and institutional structures, they have common areas of concern, including energy use, service delivery, regulation, and procurement, that offer a foundation for establishing their roles in the circular economy and provide ideas to their respective nations in tailoring circular approaches to individual contexts.

Several necessary and sufficient conditions trigger a successful transition to a circular economy, a process that encompasses developing a plan and associated policies. Among them are 1. Determining the roles that the city will play in enabling, promoting and facilitating the transition; 2. Understanding that a systems approach in the areas that they control is key; 3. Determining financing arrangements; 4. Establishing a monitoring system to measure the baseline conditions and indicators of progress in selected areas; 5. Developing methods and incentives to change behavior to gain stakeholder support; 6. Establishing workforce training to install, operate and maintain municipal circular activities; 7. Supporting a research agenda and knowledge-sharing platform on key unresolved issues and questions that may arise during the transition.

Part I: Overview of Cities in the Circular Economy

1. The Role of the City: Promoter, Facilitator, Enabler

Cities play different roles in the transition to the circular economy: **promoters, facilitators and enablers** (OECD 2020b, OECD 2020c): [3]

- Cities can **promote** the development of plans, roadmaps and strategies as exemplified in Paris (France), Brussels (Belgium), London (United Kingdom) and Amsterdam (Netherlands). In so doing, they identify priorities, concrete projects, and engage stakeholders.
- Cities can **facilitate** connections across public and private sector stakeholders operating along the value chain and strengthen their collaboration and originate voluntary agreements among the players. For example, they can help expedite contacts, share information about existing projects, and provide supportive soft and hard infrastructure. The City of Phoenix (United States) is illustrative: with Arizona State University, it created a Resource Innovation and Solutions Network (RISN)

[3] Examples of specific tasks associated with each role are: (OECD 2020b, OECD2020c)

Promoter

Be a role model, by implementing exemplary practices
Identify circular opportunities for industrial symbiosis or potential collaborations across usually unrelated sectors.
Develop a strategy on the circular economy with clear goals and targets and Include employment opportunities and associated skills
P**romote a circular economy culture**, by raising awareness and improving communication, promoting educational programmes and developing technical capacities on the circular economy,

Facilitator

Establish horizontal and vertical co-ordination mechanisms to align policies at various levels of governments and across city departments
Connect with the business community: support knowledge and practice sharing, establish , secondary material exchanges, serve as launching customer,create incubator
Connect with universities and citizens to provide solutions to city's problems through transparent selection processes.
Facilitate the connections between urban and rural areas for the food sector, construction, biomass and delivery sectors.

Enabler

Identify gaps and ways forward to support the adaptation of laws and regulations for circular business to happen.
Establish green public procurement containing circular criteria.
Create a scheme to offer subsidised loans or credit guarantees to circular economy companies, in co-operation with private and semi-public financial institutions.
Stimulate entrepreneurship and enable experiments and pilots.
Use planning as a tool to promote a more circular city.
Generate an information system for the circular economy.

Part I: Overview of Cities in the Circular Economy

Incubator to host local entrepreneurs' startup. Similarly, following the ban on the use of single plastic in 2019, The municipality of Providencia, in Santiago, Chile, has created a successful program, "Providencia Circular". From its office of Local Economic Development, Providencia has launched a support system for local entrepreneurs who want to develop businesses with circular processes. They offer office space, a network of renowned private sector mentors and small grants. [4]

- Cities can **enable** by providing incentives, funds, regulations and procurement programs. Examples are the London (United Kingdom) Waste and Recycling Board's "Advance London" venture capital fund to support SMEs in innovations in waste design; the City of Amsterdam's (Netherlands) low- interest, long-term and revolving-sustainability fund for businesses and the City of Paris's (France) circular economy incubator, Paris & Company, launched in 2017.

2. A Systems Approach

By nature, the circular economy encompasses multiple systems locally, regionally and nationally. A transition program requires a holistic and systemic approach that cuts across often siloed sectors to integrate policies and programs. Identifying these key sectors and possible synergies avoids short-term fragmented projects and supports long-term sustainable policies.

Above all, cities are the fulcrum of inflows and outflows of resources, materials and products from surrounding areas and beyond. This phenomenon calls for considering functional areas (not administrative boundaries) tailored to the qualities of specific sectors and policies. For example, managing food and water systems requires recognizing urban and rural linkages. Dealing with electric and electronic waste may involve national and global systems. In the end, the aim is to evolve policy that promotes closed loop efforts and local production, whereby somebody's waste can be a resource for somebody else as the circular economy provides the opportunity to foster complementarities across policies (OECD 2020b).

[4] https://providencia.cl/provi/site/artic/20191029/pags/20191029164025.html

Part I: Overview of Cities in the Circular Economy

"A systems approach refers to a set of processes, methods, and practices that aim to affect systems change. For governments, this approach has several implications: to develop a vision and related strategies to transform the system in the face of changing circumstances; to mobilize a broad range of actors to achieve a common good rather than narrow institutional interests; to confront problems that traverse administrative and territorial boundaries in a holistic manner; and to face constant adjustment throughout the policy cycle, with implications for the ways in which institutions, processes, skills, and actors are organized. For this to happen, certain conditions should be in place, such as having a champion committed to change; capacity to experiment; ability to engage with internal and external stakeholders; and sufficient resources to delay a business-as-usual approach (time, capital, etc.). Understanding problems and needs requires identifying underlying gaps and synergies across sectors and actors and connecting the dots" [Romano O. et al, 2020 in Hynes, W. M. Lees and J. Müller eds. (2020)].

3. Finance

In adopting circular economy programs, cities can develop new or use existing financial instruments to subsidize or incentivize the work. These include taxes and fees on wasteful products (e.g. water usage, plastic bags), tax credits for desirable activities (e.g. use of solar energy), grants or interest-free loans and points or exchange values, rewards for desirable behavior to be exchanged for specified city services (e.g. plastic bottles used to pay for public transport). These circular economy financial programs have multiple aims ranging from stimulating behavioral change to dealing with pricing differentials.

4. A Monitoring System

Establishing and maintaining a monitoring framework is essential to determine baseline conditions and rate progress, including tracking phases or accomplishments for the different elements and identifying areas for improvement. In general, the criteria for a successful monitoring framework is that it has easily accessible, relevant and timely indicators.

To date, cities are on their own in the selection of indicators with which to measure their efforts. While some 55 sets of indicators exist, no universal system is in place (Saidani et al., 2018). Some of the better-known systems are the United Nations Statistical Commission's indicators for Goal 12 (UN 2020) and the European Union's Eurostat dashboard that looks at four broad areas: production and consumption, waste management, secondary raw materials, and competitiveness and innovation.

Part I: Overview of Cities in the Circular Economy

5. Stakeholder Support

The circular economy is a shared responsibility across levels of government, the private sector and civil society who constitute stakeholders. They all play a role in shifting toward circular economy production and consumption pathway based on new models of business and governance. Important exercises in developing stakeholder engagement programs involve mapping those who can ease and oppose the transition, identifying appropriate methods for soliciting, developing and integrating the shared visions, insights and recommendations that constitute a city's program (OECD 2020b).

6. Capacity Building

The circular economy not only creates new jobs requiring new skills to execute them but also makes some jobs obsolete in the public and private sectors. Municipalities in partnership with various stakeholders (unions, academic institutions, private sector) can develop training programs that range from orientation sessions that explain the mission, organizational structure and expectations of a municipal circular economy program to those focusing on the technical aspects of new jobs. To this end they can produce practical manuals, offer workshops, create training or innovation hubs to demonstrate different techniques in materials reuse or product repair (Ellen MacArthur Foundation 2019, 16).

Cities have many tools to facilitate, enable, promote, industrial symbiosis, the transformation of one entity's waste into another's raw materials. They do this through many modalities, ranging from adopting land use plans that enable the process to supporting innovation hubs and living labs, to assemble relevant actors from the public, private and non-profit sectors to collaborate on specific, real-life problems (FISSAC 2019).

7. Research & Development (R&D) and Knowledge Sharing

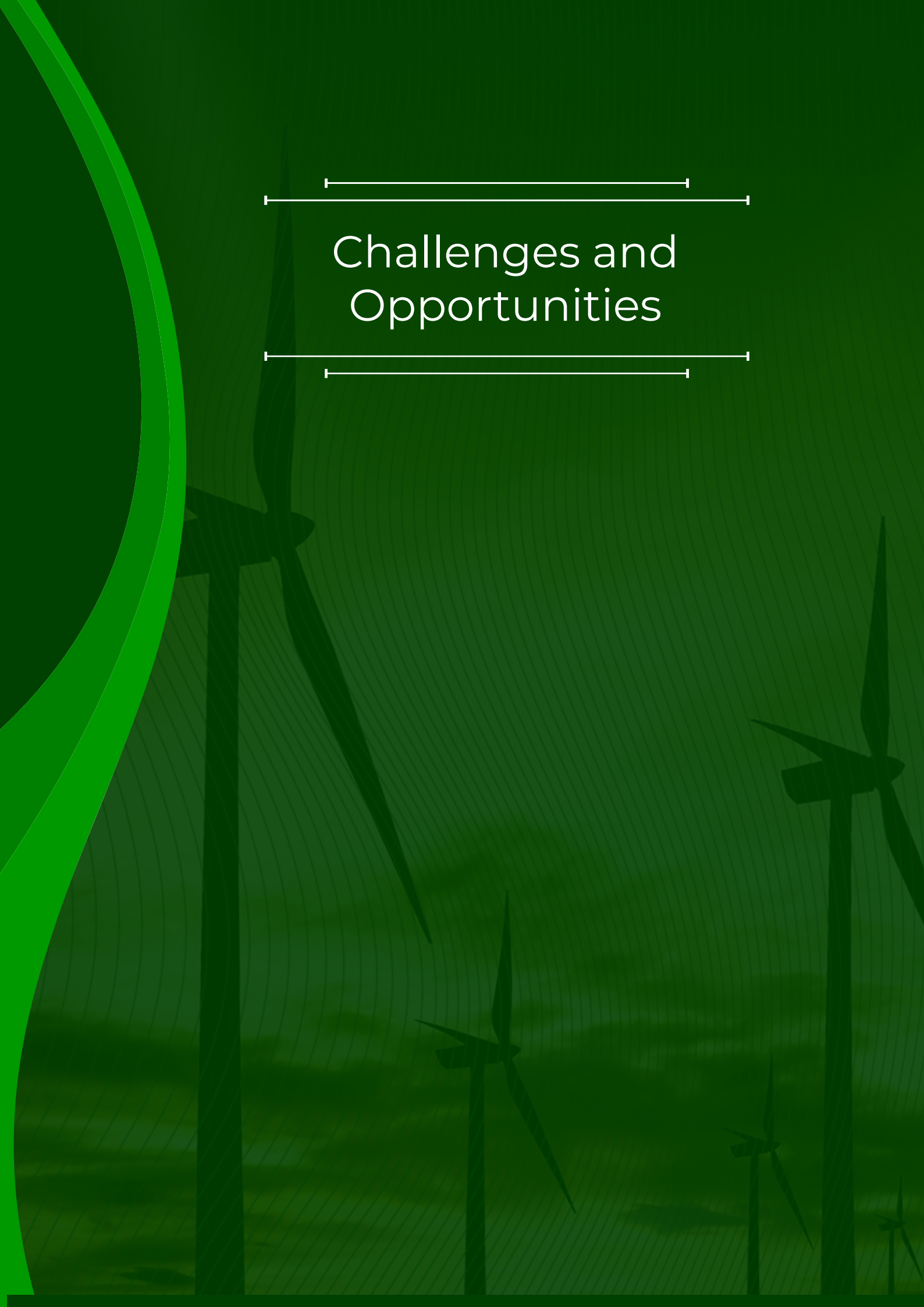
Research on the circular economy is ongoing occurring in several arenas: academia, business, non-governmental organizations, philanthropy and others. Dissemination occurs in print produced by academia as in the *Journal of Cleaner Production*, in more popular reports and videos offered by the Ellen MacArthur Foundation, the OECD and such business entities as the World Economic Forum (2018), World Business Council on Sustainable Development, US Chamber of Commerce; such websites as The Circle Economy that publishes city circular economy plans, and IDB's sustainable cities blog. Their topics range from the political (governance, stakeholder engagement), economic (Stagno 2020; business models, setting sectoral priorities) to technology (understanding the quantities and qualities reusable waste). An active research community is identifying the gaps in several areas including re-use of building materials (Munaro et al., 2020) waste to energy (Malinauskaite et al., 2017) and others.

Part I: Overview of Cities in the Circular Economy

Networks are extremely important vehicles for sharing knowledge and best practices. Among them are: URBELAC, the European and Latin American and Caribbean coalition founded by the European Commission and the Inter-American Development Bank that last year focused its meetings on the challenges and opportunities of the circular economy (Stagno 2020) with attention to waste materials, regulation and infrastructure investment. PACE, the Platform to Accelerate the Circular Economy is another. While Its 75 members represent global leaders from the public, private and non-governmental sectors and it showcases urban projects dealing with consumer behavior and food waste, no mayor or local leader is included. In contrast, ICLEI - Local Governments for Sustainability is solely composed of subnational leaders.

Knowledge-sharing can take many other forms. For example, cities can pilot exemplary projects as is Mexico with its Solar City program described below, host conferences and competitions as is Helsinki with its energy saving competition. They can sponsor “pitch” contests for emerging entrepreneurs to vie for start-up funds. Cities can instruct their service delivery, planning and economic development departments to target specific circular economy efforts.

Challenges and Opportunities



Part II: Challenges and Opportunities

While some believe that cities function as resource drains by consuming energy and materials and producing waste, others see cities as facilitators, enablers and promoters in addressing each of these areas through the circular economy. They also realize that challenges or barriers will affect the speed and thoroughness of any transition. They categorize the challenges as "hard" (financial, technological) and "soft" (institutional, social; Campbell-Johnson 2019, WEF 2018).

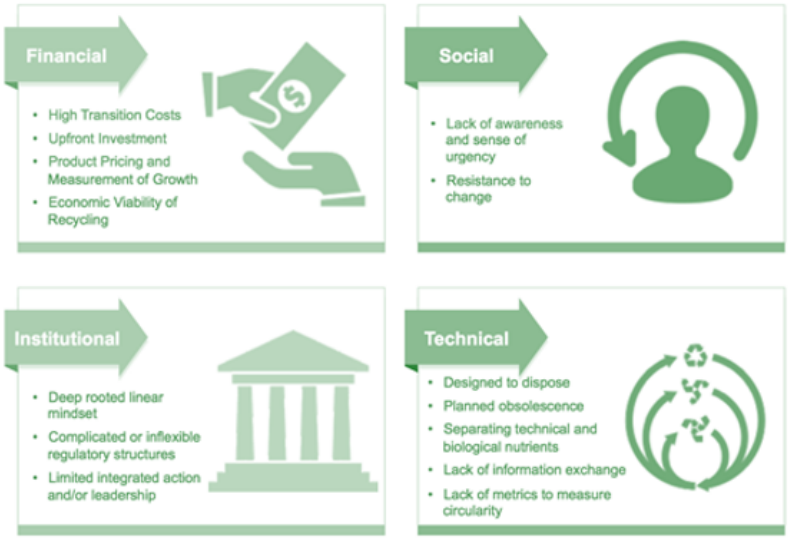
Challenges

Hard challenges revolve around financial and technological issues. Within the financial realm are numerous issues including the cost of transition (management, research, development of goods and services), need for upfront investments and inserting life cycle accounting into decision-making, figuring out pricing, and the business models for a large variety of efforts ranging from using renewable energy to valuing recycled products. In the technological arena the issues range from concerns about reusing materials – how to deal with the quantity and quality of waste streams, scaling up of energy solutions, understanding the relationships between the public and private sectors in the various activities.

Of note, during the 2020 pandemic, the public and private sectors and citizens pivoted quickly to deal with the emergency. For example, manufacturing firms switched production from consumer goods to personal protective equipment (PPE); cities devised new ways of dealing with waste; individuals responded to government instructions with regard to personal habits. In so doing, they exhibited a high level of flexibility, innovation, resource aggregation, and adaptability, behavioral qualities that they can employ in meeting circular economy challenges.

Figure 3.

Circular Economy Challenges



Source: *WEF Circular Economy in Cities 2018*

Part II: Challenges and Opportunities

Opportunities

Within the U20, several cities have begun the transition to the circular economy. They are doing so by taking advantage of opportunities in at least four areas: energy use and asset management, service delivery, legislation and regulation, and procurement (See Table 1). The descriptions below offer examples from the U20 cities that took place before the pandemic. They serve as examples to be replicated in the recovery. These descriptions include data on the seven circular city attributes (role of the city, systems approach, finance, monitoring, stakeholder involvement, capacity-building, and research/evaluation. In addition, they discuss the projects' alignment with the SDGs and use of technology. Detailed case studies follow in the Appendix.

Table 1

Opportunities for the Cities' Engagement in Circular Economy Efforts

Activity	Energy Use and Asset Management (in alignment with national and regional practices)	Service Delivery	Legislation and Regulation	Procurement
City Role	Promote, Enable	Promote	Promote, Enable	Promote, Facilitate
Examples	Mexico City (Solar for Municipal Buildings) Riyadh (Solar-powered model home)	Singapore (Waste) Rome (Waste) Sao Paulo (Food) Milan (Food)	Washington DC (water/zoning code) Philadelphia Wastewater treatment)	Amsterdam (building tenders) Rome (Training and tenders)

Part II: Challenges and Opportunities

Energy Use and Asset Management

While cities usually do not control the energy supply, they do own a number of buildings and such other assets as parks, markets, parking lots, schools, entertainment venues, all requiring energy for their operation (See U20 White Paper on Energy Efficiency and Diversity). A city can convert to renewable energy in these places, a program that not only offers practical examples but also strengthens the market.

Mexico City Solar City *(Ciudad Solar)* Example

In May, 2019, Mexico City Mayor Claudia Sheinbaum Pardo launched the Solar City program that addresses energy-consuming systems in buildings: water heating and lighting/ power through the use of renewable energy. It will install solar photovoltaic systems and solar heaters in public and private buildings throughout the city, aiming to gain 350MW of green energy by 2024. The city is jumpstarting the transition with its "Public Buildings with Solar Energy Program" that will equip 300 publicly-owned buildings at the rate of 50 buildings a year. The first installations included rooftop PV arrays on the Secretariat for Economic Development (SEDECO) offices and a 25 MW solar car park for the *Central de Abastos*, the city's wholesale food market covering 327 hectares (810 acres). Future plans include powering all the stations in the city's light rail system, SME participation and a new building code regulation mandating solar heating in new construction.

Financing the $33 million program comes mainly from the Government of Mexico City's budget, with financial contribution of the municipalities (alcaldías) that integrate its territory and the private sector. This investment will be key to generate a paradigm shift and provide the necessary incentives to foster the local market and the demand for cleaner energy. It will also contribute to the creation of jobs, increasing its competitiveness, and encouraging investments in sustainable energy supply systems among micro, small and medium companies in the city.

In developing the program, the city engaged the private sector, business chambers, the national government, international financial institutions and the community. Because of the dimensions of the city and the innovation in the technology used and the financial mechanisms implemented, it has the potential to become an energy transition model for the country (other cities within Mexico have already approached the city government to learn more about this experience).

(Continue)

Part II: Challenges and Opportunities

Mexico City Solar City *(Ciudad Solar)* Example

The program also encompasses training for solar technicians for installation and maintenance of the systems. Technology is an integral part of the project because it involves using new and better photovoltaic systems to produce greener energy; but the real innovation that the government wants to foster is a change of paradigm and the way people, companies and other relevant stakeholders produce and use energy in the city. The successful execution of Ciudad Solar meets SDGs 7 - energy), 8 - decent work, 11 -cities, 12 - sustainable consumption and 13 - climate change.

Figure 4.

Mexico City's *Ciudad Solar*

Ciudad Solar installations are being undertaken at the Mercado Central de Abastos car park (left) and on the rooftop of SEDECO (right).

Part II: Challenges and Opportunities

Riyadh Home of Innovation Demonstration Villa Project

SABIC, the state-owned petrochemical company, has a broad research and development program with some of its facilities located in the Riyadh Techno Center, an innovation district within the King Saud University campus. It includes SABIC Plastics Application Development Center (SPADC) and the three- building Home of Innovation containing a Welcome Center, a LEED Gold Collaboration Center and a high-performance model villa called "Demonstration Home." The 8,000 -square -foot Demonstration Home, the first residence in the Middle East to receive a LEED Platinum rating, is a net zero building due to it being run completely on solar energy. It In addition, the architects, Zuhair Fayez Partnership Consultants, have incorporated the following energy and water- saving innovations:

- 28.8kWp solar PV system (grid connected with battery back-up), supporting net-zero energy consumption
- Conditioning of the HOI demonstration home, as well as water heating and other energy using systems is controlled by a computer-based building management system that gives precise control, immediate response to demand changes and real-time tracking of all variables and performance
- Two high-efficiency central heat pump systems, augmented by a variable refrigerant flow system (VRF) with seven mini-splits serving multiple zones throughout the home
- Insulated concrete form (ICF) exterior walls and roof, providing enhanced insulation values and a thermally massive structure to resist outdoor temperature swings
- High-performance insulated windows feature an exceptional solar heat gain coefficient, reflecting most infrared radiation heat away from the interior, while permitting visible light entry
- Reduced air infiltration, controlled at a low 1.6 air changes per hour (ACH), providing fresh air without sacrificing energy performance
- High-efficiency bath exhaust fans
- Home energy recovery ventilator (ERV), providing continuous tempered fresh air plus a further reduced cooling load
- Solar hot water system, which requires very little energy compared to conventional tanks
- MERV 13 air filters, reducing allergens[5]

(Continue)

[5] Details provided by Adrian Welch, "SABIC Home of Innovation in Riyadh, Saudi Arabia" e-architect, March 11, 2020 https://www.e-architect.co.uk/saudiarabia/sabic-home-of-innovation-riyadh-ksa-building

Part II: Challenges and Opportunities

Riyadh Home of Innovation Demonstration Villa Project

This project is notable for its ability to illustrate the construction of a sustainable dwelling with commercially available materials while meeting Saudi building codes and producing a 40 percent reduction in energy and potable water use. In addition, the solar power system produces excess energy that flows into the grid.

This project supports SDGs6 (water and sanitation), 7 (energy), 11 (cities), and 12 (sustainable consumption).

Figure 5.

Riyadh Home of Innovation and Demonstration Home

Seeking to strengthen its knowledge platform related to sustainability, SABIC has established research facilities in King Saud University's Riyadh Techno Center including a LEED Platinum Demonstration Home

Part II: Challenges and Opportunities

Service Delivery: Waste, Water, Food

Cities generate many kinds of waste, each requiring special attention in the circular economy. These include plastics, building materials, food, electronic and medical waste. In addition to using policies to reduce and recycle waste, cities can also engage in waste-to-energy projects whose technology has been advancing in recent decades. Case studies from Singapore and Rome follow. Additional examples from Ecuador and Slovenia are in the Appendix.

With regard to water, a city needs to invest in its basic infrastructure to eliminate leakage. Further, it can initiate means to reduce its own water usage, mandate metering to monitor use and set user charges and regulate actual usage (watering lawns, installation of low flow toilets, faucets, and other appliances). It can invest in advanced energy saving wastewater treatment technologies. Riyadh offers an example.

Food systems offer many opportunities to pursue the 4Rs as can be seen in the Sao Paolo and Milan examples.

Singapore Solid Waste Example

Dealing with solid waste has long been an issue in the small island state of Singapore due to land scarcity and the warm humid climate in which the refuse decomposes and becomes hazardous. In 2019, Singapore's Ministry of the Environment and Water Resources launched the city-state's inaugural Zero Waste Masterplan. The masterplan responds to Singapore's vision to be a sustainable, resource-efficient, and climate resilient nation via a circular economy approach. It addresses Singapore's 7-fold increase of solid waste in five decades and its only 350-hectare offshore sanitary landfill on Semakau island for disposal of non-biodegradable waste, which is projected to exhaust by 2035. All biodegradable waste in Singapore are currently collected daily and disposed of at four WTE (waste-to-energy) plants. The masterplan targets to hit a national recycling rate of 70 percent by 2030.

The Zero Waste Masterplan targets three waste streams – e-waste, food waste and packaging materials, including plastic. For e-waste, it mandates the Extended Producer Responsibility Framework, in which producers take financial or physical responsibility for the end of life treatment of their products. This applies to ICT equipment, large electrical and electronic appliances, batteries, lamps and solar panels.

For food waste that is not recycled or treated, it will be disposed of at the WTE plants for energy recovery. A pilot project in Singapore has demonstrated that co-digestion of food waste with sludge from wastewater treatment plants yields more biogas compared to treatment of the sludge alone. A full-scale plant to treat a mixture of food waste and sludge will be constructed at the soon to be constructed Tuas Nexus, the city's award-winning integrated water, energy and waste management facility. The city has also set up special bins to collect food waste from households.

(Continue)

Part II: Challenges and Opportunities

Singapore Solid Waste Example

For packaging materials, National Environment Agency (NEA) in 2007 introduced the Singapore Packaging Agreement, a voluntary government-industry partnership to reduce packaging waste through re-design of manufacturing processes and product packaging, introduction of supply chain initiatives, and consumer education and awareness. Together with businesses, grassroots organizations and NGOs, the NEA has launched an initiative to encourage Singaporeans to bring their own bags for shopping and marketing. NEA is currently conducting a pilot project using mechanical biological treatment (MBT) facility to transform plastics, ferrous and non-ferrous metals into solid recovered fuel, and harvesting incinerator bottom ash for use in construction.

In Singapore, the government regulates the control and management of waste collection, treatment and disposal. Except for Semakau offshore sanitary landfill and 2 WTE plants, which are owned and operated by NEA, private companies collect, treat, dispose as well as recycle waste in Singapore.

In forming the program, NEA engages in massive stakeholder outreach detailed in the plan. The plan also outlines training programs for repair and reuse of electronics, and for a variety of jobs in environmental services. Monitoring activities include companies to submit mandatory reports on their plans to reduce the amount of packaging materials used and their targets to the National Environment Agency.

The plan supports SDGs 11 (cities), 12 (sustainable consumption and production) and 13 (climate action). Technology plays a large role in the program.

Figure 6.

Singapore's Zero Waste Masterplan

Semakau Offshore Sanitary Landfill is reaching capacity (left)
while Singapore researchers actively explore the reuse of lithium batteries (right)

Part II: Challenges and Opportunities

Rome Waste: Focus on Plastics

On the initiative of the Capitoline Council, the Rome Councilor for Sustainability was appointed in 2018 to administer the "Plastic Free Challenge" campaign (#PFC), launched by the Italian Ministry of Environment, Land and Sea Protection (Italian: Ministero dell'Ambiente e della Tutela del Territorio e del Mare, also known as MATTM), and to undertake all the necessary measures for reducing the amount of plastic waste, both within the Municipal offices and in the Rome as a whole. By 2019, guidelines for the challenge were in place. Their primary focus was on replacing disposable tableware (plates, glasses and cutlery), straws and bulk plastic containers for food products, with compostable products or reusable materials.

A new "Regulation for the Management of Urban Waste", which is currently nearing completion, will ban plastic tableware, cutlery and any other disposable plastic food/drink container at all public events, such as festivals, local fairs, marathons, social, cultural and sport events and any other event taking place in public spaces, where it involves the production of waste. This law will mandate that event planners provide compostable products food and drinks, including cutlery, plates and drinks.

Riyadh Water Conservation Example

Since 1970, Riyadh's population of 0.4 million grew 16 fold to 6.9 million while its urban area grew exponentially by 22, from 64 square kilometers, to 3,115 square kilometers, with an urban density of 4,664 hab/km^2. To put int o perspective, the urban area of New York is 10,431 while Paris is 21,438 hab/km^2). Despite Riyadh's desultory sprawl, the city has an extensive potable water supply covering 98.9 percent of its population, and 88 percent of its population have access to improved sanitation, while 84 percent benefit from wastewater collection.

Despite its desert environment, Riyadh has one of the highest water consumption rates in the world (350 litters/person/year) compared to 222 liters in London. The city of Riyadh is currently completing construction of a massive citywide transportation scheme integrating six rapid transit line and three bus routes. The 176km metro has 85 stations and the 1900km bus system has 3,000 bus terminals, stations and stops built to LEED and Sustainable Sites criteria. The $22 billion project incorporates many green features related to energy, materials, waste and water. With regard to water, it is generally halving water usage and sewage in the stations by requiring efficient fixtures (faucets and toilets), installing compact filtration systems yielding recyclable gray water, minimizing impermeable surfaces in surrounding plazas and recycling stormwater and lastly, using native planting in landscaping. This project aligns with SDGs 6 (water and sanitation), 7 (energy), 11 (cities), and 12 (sustainable consumption).

(Continue)

Part II: Challenges and Opportunities

Riyadh Water Conservation Example

Figure 7.

Riyadh's Water-Conserving Mass Transit Stations

The Riyadh Metro Station landscaping includes native planting while all interior fixtures will be water efficient

Sao Paulo Circular Economy for Food Example

Sao Paulo is also one of the three cities selected to take part in the Ellen MacArthur Foundation Food Initiative of Circular Economy for Food, an affiliate project of the World Economic Forum's Platform for Accelerating the Circular Economy (PACE). Within this program, since 2019, Sao Paulo is addressing a variety of sustainability issues, including disordered urban growth, food insecurity and disposal of organic waste. To deal with these issues systematically, the municipal government has an overall objective to support regenerative food production. It has begun with a broad stakeholder engagement process by establishing five working groups, each attacking a set of problems. They are: 1. Large generators with a focus on upcycling and composting 2. Digital approaches inclusive of connecting large generators with treatment centers and monitoring; 3. Co-production of a recovery center(s) with mixed technologies for compost, energy, biogas and bio fertilizers; 4. Restaurant collection system for redistribution and recovery; 5. Circular economy restaurants/chefs to develop seasonal menus with local foods and combat waste.

(Continue)

Part II: Challenges and Opportunities

Sao Paulo Circular Economy for Food Example

With technical support from the Ellen MacArthur Foundation, the city of Sao Paulo will work to develop large-scale circular economy food solutions. The multi-year project is part of Ellen MacArthur's Food Initiative project that seeks to reach a global transition towards a regenerative food system based on the principles of circular economy. It includes two cities beyond São Paulo, London and New York. This program aligns with SDGs 2 (hunger), 3 (good health and well-being), and 12 (sustainable consumption).

Milan Food Policy: An Innovative Framework for Making Urban Food System More Sustainable and Inclusive

In 2015, Milan, Italy's second most populous city, home to more than 1.4 million people, launched the "Milan Food Policy Pact", an innovative protocol calling for its signatories, now numbering 210 cites, to implement and monitor sustainable food systems policies and programs covering governance, sustainable diets and nutrition, social and economic equity, food production, food supply and distribution, and food waste. The initiative has developed monitoring systems, published an e-book on good practices, established an award program, and regularly convenes mayors' summits regionally and globally.

To date, the policy has generated more than 40 initiatives related to reuse, recycling waste food and reducing food miles. The policy initiative cooperates with other international organizations, including Eurocities Working Group Food, the EU Platform for Food Losses and Food Waste and the C40 Food System Network.

A key innovation in the Milan Food Policy initiative is a new model of urban governance, which is based on an integrated cross-sectoral or a "systems approach" among public agencies, social organizations and the private sector.

The initiative facilitates the exchange of knowledge through community, local organization and international partners. It focuses on SDG 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture) and SDG 11 (Make cities and human settlements inclusive, safe, resilient and sustainable).

Part II: Challenges and Opportunities

Legislation and Regulation: Planning the Built Environment, Water and Waste Rules

Cities have myriad capacities to stimulate the circular economy within their mandated regulatory powers. For example, with regard to the built environment, a city can use its urban planning, zoning, building code and zoning regulations to support circular economy outcomes. These may involve incentivizing or mandating compact, energy-saving development (or transit-oriented development) supportive of such sustainable mobility outcomes as more walkability, public transit, bike- and EV-auto shares. A city could also introduce congestion pricing and high parking fee to reduce vehicular use These kinds of developments lend themselves to district heating and energy programs. Within buildings, a city can mandate energy budgets or the use of LED lighting and other energy saving elements. With regard to water, it can tax impermeable surfaces, offer special treatment for rainwater barrels, rain gardens and rooftop water harvesting, require water-conserving landscaping, mandate green area ratios, allow and protect solar panels and wind generation accessories. In treating waste, it can require recycling, ban or tax landfills, ban or tax plastic bags, straws and other consumables. It can also regulate construction waste, calling for its recycling. It could offer tax rebates to food companies that donate their food waste to charity.

Washington DC Green Area Ratio Zoning Code Requirement Example

Following the examples of European cities, notably Berlin and Malmo, the Washington DC municipal government instituted a green area ratio (GAR) requirement for new construction and major renovations of all buildings when it revised its zoning ordinance in 2016. The GAR aims to conserve rainwater, prevent storm run-off and ultimately reduce energy in sewage treatment plants. This provision incorporates a point system for landscape elements (trees, permeable paving, green roofs, bioretention facilities, rain harvesting, water features and plantings) used to calculate specified green area ratios within specific land use categories. The law requires the property owner to maintain the green area ratio in perpetuity. This program aligns with SDGs 6 (water), 7 (energy), 11 (cities), and 12 (sustainable consumption) [Washington DC Zoning Department 2014].

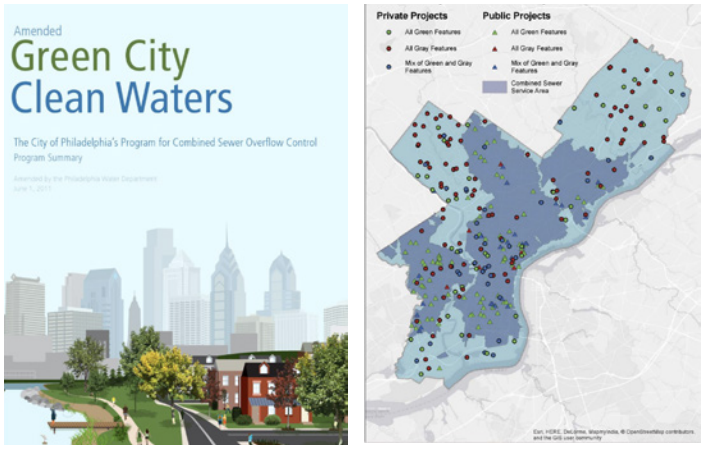
Part II: Challenges and Opportunities

Philadelphia's Green City Clean Waters Plan

Pressed by the US Department of Environmental Protection for violations to the Clean Water Act of 1972, due to the pollution caused by its reliance on a polluting combined sewer outflow (CSO) system, the city of Philadelphia developed a comprehensive response, Green City Clean Waters (2013). The plan, now being implemented outlined the required remedies based on a green infrastructure approach to take place over 25 years and involving a $1.2 billion in public investments and an estimated $600 million in private spending on a variety of projects ranging from stream restoration, stormwater capture devices (bump outs, tree trenches, rain gardens, pervious paving), grants for green roof conversion, job training, public open space purchases and impervious surface charges on all water bills. After five years, the plan has stimulated $60 million spending, 430 jobs, and $1 million in tax revenue. Monitoring is accomplished through mandated regular reports to the federal government and privately sponsored economic/environmental assessments. In crafting the plan, the city involved a range of stakeholders including relevant city agency heads, private sector actors from design, engineering and maintenance firms, and citizens. Ongoing research is occurring at local universities including the newly founded Water Center at the University of Pennsylvania. This example aligns with SCGs 6 (water), 8 (employment), 9 (infrastructure) 11 (cities), and 12 (sustainable consumption). In one use of technology in the project, the city's Water Department has installed an automated rate calculator based on its digitized parcel map on its website.

Figure 8.

Philadelphia's Green City Clean Waters Plan



Philadelphia's Green City, Clean Waters stormwater management plan (2013) (left) stimulated improvement projects throughout the city.

Part II: Challenges and Opportunities

Procurement and Finance

Cities have a good deal of purchasing power that it can use to support the circular economy. As discussed above, it can use energy from renewable sources in its buildings and other assets. It can also use circular economy criteria in purchasing furniture, equipment and supplies, in cleaning materials. It can specify that repairs and new construction be done with recycled or reused materials. It can use its borrowing power to help finance circular economy projects through public private partnerships. It can de-risk projects in other ways such as low-cost lending, direct investment and/or adjusting taxes and fees on projects. It could use underutilized city facilities for such specific operations as providing recycling storage or workrooms for reuse projects. ICLEI - Local Governments for Sustainability's *Public Procurement for a Circular Economy, Good Practice and Guidance* (2017) outlines these opportunities and provides several examples of its different forms, its management and evaluation.

Amsterdam Building Tender Example

The city of Amsterdam is aligning with national and regional circular economy strategies as indicated in its *Amsterdam Circular Economy Strategy 2020-2025.* In the plan, the city pledges to phase in implementation of 100 percent circular economy procurement by 2030. It specifies this policy to apply to all actions (building, maintaining, dismantling) related to city buildings and other real estate assets, furnishings, and catering. It promises to stimulate industry sectors (e.g. hotels, hospitals, ports) to develop specialized procurement programs. Beyond its strong support of the circular economy for environmental reasons, Amsterdam aims to use its purchasing power to create a market for the materials, products and services it buys (City of Amsterdam 2020).

Part II: Challenges and Opportunities

Rome Green Public Procurement

Europe's public authorities who are major consumers can use their purchasing power to choose environmentally friendly goods, services and works, thus contributing to sustainable consumption and production. These practices, labeled Green Public Procurement (GPP) or green purchasing, are in effect in Italy and its capital, Rome.

On April 18, 2016, to implement EU directives on government purchasing the Italian Council of Ministers passed Legislative Decree n. 50, *Code of Public Contracts* (50/2016), that sets criteria including low environmental impact, for awarding contracts. This law and a subsequent amendment have fortified Green Public Procurement practice in the country because they mandate the use of the minimum environmental criteria (CAM) in all public purchasing procedures concerning services/products/works on which a relevant decree of the Ministry of the Environment has been issued. In developing the CAM, the Ministry of Environment outlined progressive increases in several categories of services and supplies, raising the CAM percentage from a base of 50 percent to 100 percent the 1st of January 2020.

Furthering the implementation of 50/2016, the Ministry of Economy and Finance, operating through its totally owned subsidiary, Consip (Concessionaria Servizi Informativi Pubblici), an agency that offers technical assistance for public purchasing and oversees the environmental commitments, has extended the "green" requirements to new initiatives: about 91 percent of the active and awarded conventions, 60 percent of the Active Framework Agreements, 85 percent of initiatives on the PA Electronic Market and about 71 percent of those on the Dynamic PA Purchasing System now incorporate sustainability criteria. Thanks to these initiatives, the "green" purchases made by units under the ministry's jurisdiction through Consip instruments amounted to 13.2 billion euros in the last four years.

The Rome's mayor, Virginia Raggi and the City Council (known at the Roma Capitale) have prioritized the pursuit of environmental sustainability through the application of the Green Public Procurement (GPP) criteria in the city. They have executed a Memorandum of Understanding with the Ministry of Environment, Land, and Sea Protection of Italy (MATTM) with the aim of training municipal staff on how to apply the CAM in the purchasing goods and services. This collaboration has resulted in several in-person and remote-learning coaching sessions including those held in 2020, despite the setback caused by the COVID-19 health emergency. One result of this work was the creation of CAM specifications for a tender for the maintenance of the green areas surrounding Rome's social housing (Public Residential Buildings, ERP) in the Municipality of Rome VI delle Torri.

There is room for improvement in implementing this policy. For example, Rome does not collect aggregate data on its green purchases so the full impact of these policies is not yet known. However, Roma Capitale could mandate a citywide monitoring system.

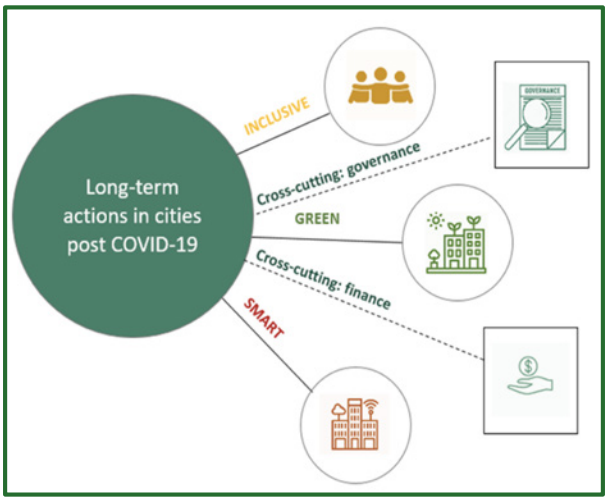
Part II: Challenges and Opportunities

Urban Responses to the COVID-19 Pandemic

Taken together, these case studies fit well into the OECD's recent advisory on the building on urban responses to the COVID-19 pandemic (OECD 2020a). In this regularly updated publication, the OECD has taken stock of policy measures in 50+ cities worldwide and crafted a roadmap of policy recommendations going forward captured in Figure 9.

Figure 9.

An OECD Perspective on Long Term Actions in Cities Post COVID-19



The pandemic offers many opportunities to build a "new normal" that greener, smarter and more inclusive (Source: OECD 2020a http://www.oecd.org/coronavirus/policy-responses/cities-policy-responses-fd1053ff/)

Within the green stream, the OECD advises local and regional governments to take the following action, building on the OECD Principles on Urban Policy, and related work on urban green growth, cities and climate change, and circular economy in cities and regions . They are:

"To build green cities that can transition to a low-carbon economy, all levels of governments should:

- Address negative agglomeration externalities, such as traffic congestion and air pollution, by reducing the use of private cars through congestion charges and ad hoc regulation that account for specific exemptions, improving multimodal transport, such as active and clean urban mobility (i.e. proximity & walkability. combining supply-side and demand-side transport management policies);
- Exploit the advantages of urban density and urban form (compact or sprawl) through forward looking spatial and land use planning to **prioritize climate-resilient and low-carbon urban infrastructure, for instance by designing and constructing green buildings and streets, and producing and procuring renewable energy where feasible** (emphasis added);

Part II: Challenges and Opportunities

- Encourage more efficient use of resources, and more sustainable consumption and production patterns, **notably by promoting circular economy** (emphasis added) to keep the value of goods and products at their highest, prevent waste generation, reuse and transform waste into resources.
- Mainstream climate mitigation and adaptation priorities in stimulus packages and investments to recover from the crisis, for instance by designing conditional subsidies, preferential loans and fiscal incentives for green investment projects and business practices, while setting accompanying measures for the most vulnerable groups who may be disproportionately affected;
- Stimulate the local economy (i.e. local food production), while rethinking short mile logistics."

Conclusions

As the discussion above illustrates, cities have many pathways for pursuing and supporting the circular economy, roles that have become more urgent in the face of the COVID-19 pandemic that is putting pressure on cities' finances, service delivery capacities and supply lines for local businesses. A successful circular economy program encompasses priority-setting, a systems approach, a financing strategy, monitoring, stakeholder engagement, capacity-building, and ongoing research and development.

Above all, as demonstrated in this paper, aligning their work with national and regional policies, cities can act as promoters, facilitators, and enablers using policy instruments at their disposal to fulfill these roles. Among the tools employed by cities are energy use and asset management, service delivery, legislation and regulation, and procurement.

In line with this approach, national governments can offer regulatory and financial support to support the execution of the enumerated local initiatives.

Recommendations

Part III: Recommendations

The general discussion and practical examples in this paper, prompt several policy recommendations for inclusion in the 2020 U20 *Communiqué* to encourage national governments to provide the enabling environment for their inclusion. They also stimulate ideas for a number of ideas to be adopted locally. The recommendations that follow include those for national government, followed by those for subnational authorities. These recommendations are the results of the examples illustrated above and the OECD work on the Circular Economy in cities and regions (OECD 2020,b,c).

National Government

While governments at all levels are currently crafting emergency and immediate relief measures to alleviate the health and economic outcomes of the pandemic, they will turn to longer term recovery programs shortly. The recommendations below target the upcoming efforts. Thus, the first criterion for nations is to **employ circular economy criteria in developing long-term COVID-19 recovery programs for cities and regions**.

Pursuing this currently critical goal calls for nations to undertake the following:

- ***Commit*** to the importance of integrating circular economy efforts in national programs.
- ***Overcome*** regulatory barriers to transitioning to the circular economy.
- ***Support*** developing local circular economy plans integrated with national goals and upscaling successful urban practices and strong multilevel governance.
- ***Articulate*** policies that recognize urban-rural linkages in food systems linking rural production and associated technical support for agroecological and organic transition with urban consumers; combat food waste along the entire food system chain; guarantee food security, especially for vulnerable populations during the times of the COVID-19 pandemic.
- ***Endorse*** relevant monitoring standards (adopt EC, UN or other sets tailored to a given nation).
- ***Invest*** in the transition to the circular economy as suitable to national and local budgetary arrangements and increased fiscal decentralization while correcting misleading incentives, abolishing inefficient subsidies and counting environmental externalities in the pricing.
  - ❍ Monetary policy: extend credit for circular economy projects or offer broad support for local governments' operational budgets (service delivery) with requirements to use circular economy criteria in distribution
  - ❍ Fiscal policy: invest in circular economy projects (e.g. innovative solid waste, renewable energy, food supply chains).

Recommendations

- ***Anticipate, protect and support*** the workforce of the future, including by developing transition plans for fossil fuel-based workers and industries
- ***Develop*** partnerships with public, private and non-governmental entities to sponsor capacity-building training programs for the operation and maintenance of circular economy employment.
- ***Fund*** basic research in unsolved issues related to circular economy efforts especially in the areas of material reuse, water conservation, and all types of waste with special attention to the varied stream (e.g. plastics, organic, medical, electronic).

Local Government

- ***Adopt*** appropriate roles (promoter, facilitator, and/or enabler) and undertake the tasks associated with each one in the context of current conditions.
- ***Create*** a city-wide task force composed of key public and private sector stakeholders to review current plans and/or develop new ones that incorporate circular economy values
  - ***Develop*** priority areas within areas of competency to pursue in the plan; assign targets and timelines to accomplish them
  - ***Establish*** a clear communications plan explain the plan and its programs.
- ***Accompany*** the plan with adequate implementation tools
  - Programs: asset management, service delivery, regulations, procurement
  - Finance: grants, incentives, fees, loans
  - Monitoring
  - Capacity-building

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Case Study from Mexico City: Ciudad Solar

Challenges and Opportunities

Mexico City, as the main center of economic activity in the country, has moderate adequate energy services coverage, nevertheless it has a narrow margin to face any possible energy market conflict regarding gas, gasoline and diesel. The city has great possibilities to optimize its energetic use, and also has potential to diversify and introduce energy generation of several sources, mainly renewable. We have the opportunity to accelerate the energetic transition to clean energy with all the positive green effects that come along, but taking in account the social benefits, such as job creation and entrepreneurship related with the use of renewable energy in Mexico City, as well.

The challenge is to use and produce energy with the least possible damage to the environment, benefit the local economy, and guaranty the long-term supply. For this, Mexico City must have a high quality reliable energetic system with accessible prices for the different sectors in the social structure.

With the previous in mind, Mexico City government has started initiatives based on renewable energies, mainly solar, under the Solar City Strategy, which includes programs such as Solar Energy Training, Solar Energy in Medium, Small and Micro Companies, and Public Buildings with Solar Energy, looking to boost the growth of solar energy economic activities and enhance its benefits related to job and wealth generation. This programs include professionalization of actions in areas like installation and supervision; the promotion of photovoltaic systems and solar water heating systems; encouraging the adoption of solar energy in the productive processes of medium, small and micro companies; incorporating photovoltaic systems in the public sector; actions for the correct internalization of the local environmental norms that make the usage of solar heated water mandatory on new buildings; actions for the recollection of used edible oils to produce biodiesel, among others.

The success of the measures heavily relays on the participation of commercial users, solar energy integrators, government, and the citizenship in general, in designing and implementing the initiatives.

Mexico City economic development requires a sustainable energetic growth, therefore there is the need to mitigate the impact that the activities of the medium, small, and micro companies have in air quality and in the atmosphere. Mexico City has great solar energy potential, which could be exploited to generate electricity via photovoltaic systems, or throughout solar water heating systems, all of which can benefit medium, small and micro companies. The boost to the instalment of renewal energies harvesting systems will create more job opportunities, create more businesses

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Case Study from Mexico City: Ciudad Solar

and add value to the green energy sector of the city. It must be considered that Mexico City has over 20,000 registered economic units in sectors of intensive demand of hot water, where introducing solar water heating systems is a highly profitable technological intervention. Also, there are over 100,000 economic units where photovoltaic systems would allow to reduce electricity consumption and cut production costs, which in turn would increase its competitiveness along with significant environmental benefits for Mexico City.

With this context into account, to help the transition towards energetic sustainability, improve medium, small, and micro companies cost effectiveness and competitiveness, bring down greenhouse gases related with energy consumption, and contribute to decarbonize Mexico City economy, the Secretariat of Economic Development implements the Institutional Action to Foment the Transition and the Energetic Sustainability of Medium, Small and Micro Companies, which is directed to services, trade, or industrial companies, to whom specialized technical advice is given to correctly identify and dimension the right energetic system for their needs, links with certified renewable energy tech suppliers, as well as with accessible financing sources that were developed to boost renewable energy exploitation. In this way, we look to eliminate barriers that impede further deployment of renewable energy exploitation technologies as we link potential users with suppliers of those technologies and accessible financial sources, always looking to maintain the quality of the technology. The sustained growth of the renewable energies sector will depend on the technical certainty and the trust that users give to systems, which must be based on the quality, that at the same time, relays in the professionalization of the system's installment activities.

Accordingly, with data from the National Council of Standardization and Certification of Labor Competencies,[6] there are, at national level, around 5,000 people certified on "Installment of Thermosyphon Solar Water Heating System in Sustainable Housing", "Installment of Forced Circulation with Thermotank Solar Water Heating System", and "Installment of Photovoltaic Systems in Houses, Business and Industry". Even as in the last years an increase in the demand of qualified personnel to supply, design, install, research, and develop solutions for the solar sector was showed, the supply of such personnel is not enough, since, accordingly with the National

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[6] This Council is a parastatal entity preside by the Secretary of Public Education and has the participation of other Secretariats, such as Labor and Economy, the business sector (trade and industrial cameras), the workers (workers confederations). The Council's goal is to give the country, through the National Competencies System, a tool to strengthen the economic competitiveness, its capacity to grow, and social progress. The National Competencies System is a national agreement between business, workers, social sector, academy, and government to have structures and mechanisms of national reach that allows to develop competency standards to boost organizations' competitiveness and certify individuals

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Association of Solar Energy,[7] less than 22 percent of the national personnel that works in the sector have formal education in the matter, therefore there is a need for courses, professionalization tools, and certification processes related to the exploitation of renewable energies in general, and of solar energy in particular.

Hence, the need to strengthen the quality of the activities relative to the installment of photovoltaic, solar water heating, and energetic efficiency systems through training/certification in competencies standards or through the best practices available, was identified in order to generate technical certainty in the renewable energy sector in Mexico City, and use it as element to create jobs, improve its competitiveness, and encourage investments in sustainable energy supply systems among micro, small and medium companies in the city. To achieve that purpose, the Secretariat of Economic Development implements the Institutional Action for the Strengthening of the Competencies in Solar Energy in Mexico City, directed to everyone older than 16 years with interest in receiving training and be certified in design, installment and promotion of photovoltaic and solar water heating systems.

The two strategies are reinforced with the impulse to the solar energy market that the government could exercise throughout its acquisitions. To encourage the solar energy market the program "Public Buildings with Solar Energy" was developed. The program installs photovoltaic systems on 300 public buildings owned by Mexico City government, where technical and economic feasibility is found. In this way the government settles an example of transition towards renewable energy sources, and stimulate the sector's development, where also quality standards and local specialized workforce are incorporated.

Case or Example

The Solar Energy for Medium, Small, and Micro Companies Program is one of the most relevant for Mexico City since it is oriented towards the adoption of clean energies as a general practice in the productive sector, the change of paradigm and consciousness, and as an engine of economic development.

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[7] The National Association of Solar Energy was formed officially in San Luis Potosí, Mexico in 1980 and is a Pioneer institution in the country regarding the promotion of solar energy use derived from solar radiation as well as from indirect phenomenon such as wind, biomass and microhydraulic.

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The Public Buildings with Solar Energy Program is characterized for the average 50 kWp installations per building. It will install a photovoltaic capacity near to 15 MWp with estimated annual benefit of 12,000 CO_2 avoided tons and savings of 70 million pesos per year, that, during the 25 years lifespan of the systems will get to 302,000 tons of gas and savings of 1,750 million pesos. This project also seeks to be a replicable model for all government, where savings in energy consumption will amortize the photovoltaic systems investment.

The economic units within the Solar Energy for Medium, Small, and Micro Companies Program, in which a solar water heating system or a photovoltaic system is installed, can have gas and electricity savings between 40 percent and 70 percent. Such is the case of the maize dough for the tortilla industry, where solar thermal energy can represent up to 70 percent of the required energy in the industry, with the savings that come along. There are other productive sectors in Mexico City like hotels, textiles, paper, restaurants, among others, that could benefit from solar water heating systems; meanwhile industries such as food processing, automotive, wood, graphic arts and printing, machinery, chemistry, and services like grocery trading and department stores, can benefit from using photovoltaic systems.

The effect that the projects could have in environmental issues mitigation and in the creation of a sustainable economic model will depend in its continuity and in the strengthening of the technology itself, with emphasis in the job quality and local benefits of the green activities.

Recommendations

Some recognized lessons and challenges from these policies are:

- Quality procurement of the renewable energies exploitation systems is fundamental for its general adoption, a high-quality system generates trust among users and financing sources.
- Government acquisitions and new governmental financial models can boost renewable energies growth.

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Case Study from Mexico City: Ciudad Solar

- Specific financial mechanisms in the renewable energy sector, that are flexible and attractive in order to appeal users, must be generated. In Mexico one of the barriers that Medium, Small, and Micro Companies, that are willing to invest in renewable energies, face is the lack of specialized financing sources, and the ones that exist establish loan requirements that companies hardly fulfill. Clean energy benefits diffusion as well as success stories among potential users is a key element for any energetic transition program.
- The strengthening of linked economic activities to solar energy (installation, supervising, promotion) allows to generate employment and business creation positive perspectives, especially in an adverse economic scenario.
- Solar thermal energy has better perspectives and chances because it has greater energetic efficiency values compared with photovoltaic solar energy, also requires smaller investment amounts. However, promote a greater usage of the solar thermal energy technology through specific policies to generate a wider knowledge of it is required because there is the common idea of solar energy focused on photovoltaic systems.
- In order to be able to develop renewable energies projects within the government in a more dynamic way, greater efforts to change ideas behind current government management models are required.
- The gap between diffusion and training needs for the activities related to solar energy: installment, promotion, sales, supervision, norm enforcement, government acquisitions, etc., is still important.

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Case Study from Maribor: Urban Soil 4 Food – Urban Innovative Actions

Area of intervention: Waste management, food self-sufficiency, land regeneration, citizens empowerment, food, citizens' education and knowledge transfer, innovation.

Project Summary: The project *urbansoil 4 food* has developed an integrated city-wide system, in which the city is using biological waste, waste from green trimmings and excavation materials from construction to produce innovative Urban Soil with a tailor-developed pilot production plant, and making it available for the citizens to use it for urban agricultural activities increasing their food self-sufficiency and strengthening their collaborative fiber.

Urban Soil 4 Food project starts from the challenge of using cities' internal waste (biological and mineral waste) in order to produce useful products (soil) to be later used for meeting the cities' needs (food production, cities parks, construction) all within city boundaries. Complementary it introduces urban food chain and uses open innovation processes to establish business support for innovative circular economy start-ups in the urban area. The project ends with certification of internationally standardized soil and with training, seminars and study visits for quadruple helix participants. The project will be implemented through 4 interconnected technical work packages: material circle, food circle, open innovation circle and knowledge circle backboned with 2 key investments: establishment of pilot system for urban soil production and establishment of 4 urban gardens. Key innovative products will be of standardized and internationally certified urban soil. The project will change current traditional waste-based society into circular economy oriented, proud of circular economy achievements and active in the process of achieving circular economy. If successful, the project would represent one of the strongest practical examples of a circular economy in the EU, because of its systemic horizontal approach, closing urban circles and co-creative inclusion of citizens. It would show to policy makers the importance to deal with a circular economy on a horizontal level and within urban areas.

The project offers development of 4 circles as interconnected objectives in order to present a comprehensive cross-sector circular economy solution that can be promoted and reused by other mid-size cities across Europe.

1) Material circle analyzes material flows of waste usable for production of urban soil, develops different types of soil and takes care of environmental and legal permits. Investment in the soil production system (construction, fermentation, mixing, pyrolysis) is being implemented in order to collect biodegradable waste, organic waste, waste from excavated urban material to produce safe and standardized soil rich with important nutrients and good basis for urban food production and urban construction.

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Case Study from Maribor: Urban Soil 4 Food – Urban Innovative Actions

2) Food circle started with turning currently unused municipality land into urban community gardens including land preparation, light constructions, land distribution, preparation of community gardens action plan, building a pilot case example of learning Urban garden and orchard as well as use of waste-heat for garden greenhouse. Second phase is actual agricultural activity in the urban and peri-urban area of Municipality, operation of municipal urban gardens & orchards, development of urban food label, establishment of local food chain and ICT supporting tools.

3) Open Innovation circle is being developed closely with end users, using co-creation methods. First, Agri-Living lab is established to develop and to test innovative pilot concepts in practice (urban soil social rehabilitation, urban flowers for urban bees, micro-urban gardening, urban food competition award, etc). The second part is the development and support of innovative start-ups and SMEs, who will work in the field of circular economy to ensure complementarity with material and food circle and long-term sustainability of circular economy concept.

4) Knowledge circle established several learning circles: policy learning, business learning and citizens learning. Policy learning includes study visits to spread the knowledge to other Slovenian cities and to similar mid-sized cities across EU. Business learning is focused on lessons learned from business models, spreading knowledge for production and standardization of urban soil. Citizens are able to learn new agricultural related skills, see how urban farms work in practice (practical workshops). Citizens are given different training opportunities of organic farming, food and wellbeing and use of traditional seeds. Knowledge circle will end with development of certificates and patents in order to bring urban soil technology and production to the international level.

Duration of the project 1.12.2017 – 30.11.2020

1.12.2017 – 1.5.2018 – initiation phase; 1.5.2019 – 30.11.2020 – implementation phase; 30.11.2020 – 30.11.2021 – closing and knowledge transfer.

Project partnership between:

- Municipality of Maribor – LP – local public authority
- Institute for Innovazion and Entrepreneurship – ZIIP – PP
- E-institute, institute for comprehensive development solutions – Ezavod – PP

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Case Study from Maribor: Urban Soil 4 Food – Urban Innovative Actions

- Snaga d.o.o. – public waste management company – Public service provider – PP
- Aktiviraj.se – development of social projects and promotion of active life association Aktiviraj.Se – NGO – PP
- Deltaplan d.o.o. – service and consulting company – SME – PP
- Slovenian national building and civil engineering institute – ZAG – PP – higher education and research
- Institute Wcycle Maribor - public service provider - PP

Budget: Programme – Urban Innovative Actions. Project Budget: 3.747.650,00 EUR; ERDF Budget: 2.998.120,00 EUR

Principles of circular economy adopted: REGENERATE – establishment of urban gardens (12.400m^2); OPTIMIZE – pilot plant for production of urban soil; LOOP – production of urban soil.

Role of the private sector: Knowledge, project tasks, infrastructural competences, services.

Role of the public sector: Regulator, financing, planning and supervising implementation.

Main results and outcomes:

A) Change of material flows from currently unused (landfilled) to recycled and reused within the city: 1. Decreased amount of currently landfilled waste: specifically, reduction of biological waste (for 2.400 tonns/year) and mineral waste (for 2.000 t/y). 2. Production of different types of soil (3.000 t/y) to be used for urban agriculture, parks, roadworks, constructions….). 3. Production of energy (590 kWh) to be used for the needs of operation of soil production.

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Case Study from Maribor: Urban Soil 4 Food – Urban Innovative Actions

B) Change of food flows from imported to locally produced: 1. Establishment of 7.398 m² on 12.400 m² of land for new urban gardens for public use. 2. Establishment of local labelled food (1 label, used by at least 50 farmers). 3. Established food chain from local farmer to local consumer (at least 10.000 users of local food per year). 4. Decrease of greenhouse emissions arising from moving resources inside the city (5 percent decrease from the same sources).

C) Enabling circular economy transformation to change society: 1.Established Agri-living lab brings circular economy closer to the people (6 social innovation pilots). 2. Workshops will increase people's involvement and interest to open innovation (200 participants of the workshops). 3. SMEs will get support for development of innovation and for working in the field of circular economy (15 SMEs). 4. developing an APP – InnoRural.

Risks/ Challenges/ Hurdles in Implementing the Project:

1) Opposition to circular economy by the citizens. The project had a predefined location for erecting the pilot device. The partners have presented the project and the device to the local citizens, which strongly opposed erecting the pilot in their vicinity. In order to save the project's timeline and the project itself, the city had to change the location of the pilot device. It was again presented to local stakeholders, and it was accepted by the local environment.

2) Ensuring quality pilot creation. Due to the innovative nature and complexities of the pilot device, there was a realistic fear that we will not be able to ensure all technological parts or their connectivity into one device. Several partners have been heavily involved since the project started in presenting the project to different potential technology providers across the EU to ensure proper solutions are found and are implementable.

For more information
https://www.uia-initiative.eu/en/uia-cities/maribor https://wcycle.com/portfolio/uia/

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Case Study from Cuenca: Footprint Management Mechanism and Circular Economy

Description of the project/initiative: Footprint Management Mechanism and Circular Economy (Reusing and Reducing Industrial Waste).

Cuenca is nationally recognized for the ceramic industry, wooden furniture, dairy processing, cardboard, graphic industry, tire production, among others. There are around 125 companies grouped in the Chamber of Industries, Production and Employment CIPEM that generate around 50,000 jobs, making it one of the main economic activities of the city. This industrial sector is also the second-largest generator of emissions after transport, with 16 percent of the total, and it is also a generator of waste and residues in a considerable volume, which are currently transferred to the sanitary landfill (waste wood, metal, canvas, plastics, among others).

After participating in URBELAC circular economy events, an innovative circular economy pilot project was generated in partnership with the private sector, called the “Footprint Management Mechanism and Circular Economy”. The pilot proposed to use the waste of participating industries as raw material for the elaboration of decorative elements that complement the production line of the same factories, e.g., wooden furniture factories are developing utensils and decorative elements such as chopping boards, picture frames, tea boxes, among others, with the same image of the main product that is the furniture.

The project has made industrialists aware of the waste generated that goes to landfills. The Project in general aims to: (i) Extend the useful life of raw materials and products; (ii) Find alternative uses for waste from factories; (iii) Employment generation; (iv) Increase the useful life of the landfill; (v) Reduce environmental pollution.

The project started in 2019, with the participation of 8 of the largest industrial companies in Cuenca, committing to measuring their footprints (carbon and water) and reducing waste, creating a novel baseline to be used in the future. A Cooperation Agreement was signed between the Municipality and the Cuenca Chamber of Commerce to develop the Footprint Management Mechanism project in 2019, but some of the original participants did not engage beyond their footprint calculation. Two industries followed suit in reducing or reusing their waste. These were: a manufacturer of wooden furniture and an advertising company, which produced a considerable amount of waste (pieces of wood, metal, acrylic, tarpaulins), that was being sent to landfills. These materials are being now used to produce decorative items and materials that complement the main production line, and the

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Case Study from Cuenca: Footprint Management Mechanism and Circular Economy

incorporation of new industries is in process. The part of innovation worth highlighting in this project is the alliance with the private sector (industries, companies, commerce), which was made possible through the signing of a cooperation agreement. Some level of environmental awareness of the industrial sector has been key to carry out this project.

Timeframe: 2019 to December 2020.

Core team and roles: Environmental Management Commission, Municipality of Cuenca (project management and coordination; the municipality acts as a promoter and provides seed investment. In the future, it will support regulatory reforms to facilitate the transition to other companies); Chamber of Commerce (project counterpart to facilitate the call with the private sector); Colineal furniture factory and Signal X (graphic designer) [Private Partners, committed to reusing waste and hiring designers and workers for transforming waste into products]; university (to investigate waste use alternatives, model design). The private sector, aware of the need to protect the environment, has been a fundamental actor in the project, shifting attitudes from simple "philanthropic" environmental compensation (through the maintenance of recreational parks, tree sponsorship, etc.) to measuring their carbon footprints and reducing waste. The 2 industries of the pilot also hired artisan/designers and workers for the manufacture of new products.

Budget: The Municipality of Cuenca allocated $40,000 for the identification of circular economy projects, $20,000 as a counterpart to the Chamber of Commerce.

Principles of circular economy adopted Optimize: Eliminate waste in the production and supply chain.

Risks/challenges/hurdles to implement the project: The pilot started with 10 companies; however, their managers did not sign in a timely manner and secondly, they did not join the project. Being a pilot, the businessmen were somewhat skeptical.

Main Results and outcomes: The impact of the project has been, mainly the raised awareness of the industrial sector, the increase in sources of employment and the decrease in waste. In the next future, the link with universities will facilitate research not only in using waste in production processes but also in the optimization of these processes to generate less waste.

Website: http://huellas-cuenca.solunes.site/inicio

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Case Study from Singapore: Waste Management

Since gaining independence in 1965, managing solid waste was one of the key environmental challenges that Singapore had to tackle. In line with population increase, urbanization and economic growth, the volume of waste grew by more than 7-fold over the past 50 years. As a small island city-state of about 720sq km, Singapore does not have large tracts of land for waste disposal. This had led to building incineration plants for 'land-saving' waste disposal method.

Singapore's climate is another key factor influencing our waste management strategy. Waste putrefies and decomposes rapidly under the hot and humid weather in Singapore, making it conducive to breeding of disease-carrying vectors. Daily waste collection is, therefore, essential to the prevention of disease outbreaks and for maintaining a high standard of public health.

Through technologies and learning from best practices in other cities, Singapore had developed an integrated solid waste management system with the strategies of (a) waste avoidance/minimization, (b) waste recycling, (c) waste-to-energy, and (d) landfill.

Today, Singaporeans enjoy a clean and healthy living environment, made possible, in no small way, by an effective solid waste management system.

Circular Economy Approach to Waste

In 2019, Singapore's overall recycling rate was 59 percent. The top 3 waste sent for incineration were plastic waste, food waste, and paper and cardboard.

To address our waste challenge, Singapore launched the inaugural Zero Waste Masterplan setting out the strategies to (a) move away from the linear economy of 'take, make, use, throw' towards a circular economy; and (b) reframe the waste challenge into an opportunity to create economic growth, while ensuring environmental sustainability. To drive the circular economy in waste, Singapore has adopted sustainable production, sustainable waste management and sustainable consumption.

Sustainable Production

In Singapore, sustainable production encompasses 'design-out', 'industrial symbiosis' and 'sharing' approaches.

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Case Study from Singapore: Waste Management

'Design-out' - Providing incentives for companies to design out waste from their processes, thereby placing responsibility on producers for the proper disposal of their end-of-life products. Singapore will be implementing the Extended Producer Responsibility (EPR) Framework for e-waste and plastic waste in 2021.

Industrial symbiosis - In land use plan, industries are sited closer together to facilitate the waste output of one industry is channeled to another as useful input.

Sharing - Providing incentives for companies to design products that last longer, and using materials that are easily recyclable, and to create a bigger sharing economy offering services and physical products such as bicycles, cars etc.

Sustainable Waste Management

In Singapore, technology and innovation are employed to turn waste remaining after 3R, which would otherwise end up in landfill or incineration plant, into useful materials. Examples include treating the bottom ash from waste-to-energy plants into material for construction and land reclamation projects, developing 'dirty' plastic processes, and feeding food waste to black soldier fly larvae to produce frass (insect excrement) used as compost.

Sustainable Consumption

For sustainable consumption, inculcating 'waste not, want not' mentality is the key strategy. There is a high potential to reduce waste from Singaporean households by making small lifestyle changes, as about half the total waste generated in Singapore is food waste. An extensive education program has been launched to promote the use of reusable bags for grocery shopping and encourage the practice of taking your own bottles or cups to meetings, using your own containers to buy cooked food. Besides the first two Rs (reduce and reuse), repair, refurbish and repurpose has also been promoted as equally, if not more, important for promoting circularity in physical goods.

Singapore's zero-waste journey will continue and gather pace in the years to come. To realize our vision of 'Zero Waste Nation', Singapore would need the support, participation and efforts of all the public, private and people sectors to drive the circular economy in waste, and take ownership of our shared future.

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Case Study from Rome: Strategy for Waste Management from 2017 to 2020

The “operational plan for the reduction and management of post-consumer materials of Roma Capitale” was approved on the 30th of March 2017 with the Capitoline Council’s Resolution n. 47. The Plan outlines the actions aimed at preventing waste production and food waste, and at improving the efficiency of recycling, innovation management and the adoption of best practices for the Integrated Solid Waste Management Cycle.

On the initiative of the Capitoline Council, the Rome Councilor for Sustainability was appointed in 2018 to adhere to the “Plastic Free Challenge” campaign (#PFC), launched by the Italian Ministry of Environment, Land and Sea Protection of Italy (Italian: Ministero dell’Ambiente e della Tutela del Territorio e del Mare, also known as MATTM), and to undertake all the necessary measures for reducing the amount of plastic waste, both within the Municipal offices and on the Rome’s territory. In 2019, the Capitoline Assembly approved the “Implementation Guidelines” following the adhesion of Roma Capitale to the Plastic Free Challenge campaign (Resolution n. 24 of 7 March 2019). The Implementation Guidelines appointed the competent Capitoline offices to adopt any administrative measure suitable for the gradual elimination of the use of plastics in every site, office and public establishment of Roma Capitale, according to the ministerial guidelines issued by the MATT for the “Plastic Free Challenge” campaign, with particular regard to the ban on the use of disposable tableware (plates, glasses and cutlery), straws, and bulk plastic containers for the supply of food products, to be replaced exclusively by compostable products or reusable materials.

A proposal by the Capitoline Council is being finalized for the introduction of experimental measures to contain the production of disposable plastic waste, starting from the 1st of October 2020, by the city’s seaside area of the city, and along the Tiber river. The Proposal includes all the current commercial activities, requiring the replacement of disposable plastic food/drink containers with washable or disposable material for carton/paper recycling or organic waste.

Roma Capitale is also finalizing a study on the sustainability of plastic packaging for the distribution of specific products, such as those for personal care, homeware and drinks. By comparing the products available on the market, this study identifies the preferences given by consumers in Rome to certain products, which can guarantee the least production of plastic waste, by comparing packaging, refills and bulk products. Based on the results of this study, Roma Capitale intends on launching an awareness-raising and training campaign aimed at citizens, with the objective of having an impact on the production of plastic waste, minimizing waste and the consequent CO_2 emissions.

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Case Study from Rome: Strategy for waste management from 2017 to 2020

The new **"Regulation for the Management of Urban Waste"**, which is currently nearing completion, introduces a ban on the use of tableware, cutlery and any other disposable plastic food/drink container at all public events, such as festivals, local fairs, marathons, social, cultural and sport events and any other event taking place in public spaces, where it involves the production of waste. Event planners are obliged to provide products for the supply of food and drinks made with durable, reusable and sanitizable materials; in the case of not being able to provide sanitizable tableware and cutlery, the distribution of food and drinks must take place using products made of recyclable materials that can be recycled through the collection of paper or the collection of organic waste (compostable materials).

It is also compulsory to set-up an area for the distribution of water and draft drinks, using returnable glasses or containers made out of materials that can be recycled through the collection of carton/paper or organic waste. The Regulation also foresees the use of returnable glasses/containers for the distribution of drinks with the inclusion of a deposit on the ticket price, where applicable. With the objective of minimizing food waste, the organizers should promote the so-called "family bag" and manage the redistribution of surplus food, in accordance with the current regulations.

With particular regard to the reduction of waste production and the optimization of the organic waste recycling, the current Rome administration has chosen to share the possible strategies with its citizens, to test proximity treatment systems, with the objective of a greater and effective involvement of users towards timely pricing and more efficient use of urban hygiene management's expenditure. Along with a strategic planning for the recycle of organic and green waste at a municipal level, it is of sure interest to think about a capillary distribution of the recycling treatment of this waste through the use of small plants.

The "Pilot project for collective composting in the city of Rome" was approved by the Deliberation of the Capitoline Council n. 208 of 21st September 2017. This pilot project consists of 15 collective composting machines, which can be referred to as "Combustible Body Recovery Cells" to be installed, for reasons of greater control both in terms of process and expenditure, mostly at the Collection Centers under the management of AMA S.p.a., the urban hygiene company of the Municipality of Rome. An experimental location is also envisaged in public areas, other than the recycling Centers, including a school and two urban vegetable gardens.

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Case Study from Sao Paulo: Circular Economy for Food

Circular Economy for Food: The Food Initiative

The current industrial model is mostly based on the culture of extraction and waste. Given the critical scenario of environmental crisis, social inequality and difficulty in accessing basic resources by a large part of the world population, there is an urgent need to strengthen models of sustainable production and consumption. Due to the pandemic of COVID-19 we are facing these days, these challenges intensify even more.

Circular economy is a perspective that brings a necessary complexity to economic production beyond the linear model. This model aims to redefine economic growth, with a focus on benefits for the whole society, not only intending to minimize the effects of economic activity but eliminating waste and pollution, keeping products and materials in use, and regenerating natural systems, creating economic, natural and social capital. An important point for this economic model is that circularity occurs in a diffuse and inclusive way, so it is necessary to consider the importance of its functioning at all scales of the process. Thus, with the active participation and collaboration between small and large companies, countries and cities with local communities, everyone involved in the production cycle is able to feel the benefits of circularity, having as one of its results also a social innovation.

According to the United Nations Department of Economic and Social Affairs (UN DESA) it is estimated that most of the food production will be aimed at cities by 2050. With technical support from the Ellen MacArthur Foundation, the city of São Paulo will work until 2022 to develop large-scale circular economy for food solutions. The project is part of the Food Initiative project, that seeks to reach a global transition towards a regenerative food system based on the principles of circular economy and has three emblematic cities: São Paulo, London and New York.

São Paulo is the largest city in the Americas and southern hemisphere and has approximately 12,5 million inhabitants. It is the center of a metropolitan region which has 21 million people and generates 18,5 percent of Brazil's GDP. São Paulo is the main developed center in the country. Nevertheless, the city faces all the common challenges to large urban agglomerations which have experienced rapid and disorderly growth. There is a portion of the less privileged population that still has limited food options due to the relatively high cost of basic foods, which represents almost half of the average income per capita and stands out for the wide and frequent price changes in some of its basic components. Solid waste is one of the most important by-products of the urban lifestyle

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Case Study from Sao Paulo: Circular Economy for Food

in São Paulo. In 2018, the city generated 5.68 million tons of Municipal Solid Waste from mailing household waste and urban cleaning services, of which about 50 percent is related to organic waste. One of the biggest challenges in the city is to guarantee adequate disposal for 2.84 million tons of organic waste.

On the other hand, São Paulo has important assets that allow the city to adopt a circular food economy, such as a diversified family farming scenario, access to strong economic markets and high capacity for collective innovation and the largest consumer market in Brazil.

São Paulo agricultural area is widely distributed among environmental protection units and about 30 percent of its territory is classified as a rural area, including areas of environmental protection and food production. In addition, the city is a recognized gastronomic capital, with more than 23,000 restaurants and a set of highly innovative chefs who already dialogue with the concept of circular economy for food.

From a previous research carried out by the Ellen MacArthur Foundation published in the report "Cities and Circular Economy for Food", it was identified that, to achieve a circular economy for food, cities will need to make the following interventions: source food grown regeneratively and locally, where appropriate; make the most of food (use by-products more effectively, prevent waste); design and market healthier food. The City of São Paulo has already started the Food Initiative implementation through the leadership of the Secretariat of Economic Development and Labor and is now working through five thematic working groups that involve the civil society, public and private sector. The projects being discussed in each working group are:

1) Cluster of large generators - group of companies / retailers sharing logistics costs for the destination and valuation of co-products, with a focus on composting and upcycling.

2) Digital platform - digital tool that connects large generators with transportation, composting and treatment centers, through smart data so that the entire process of generation, destination and valorization of organic co-products has traceability and allows the generation of data for monitoring and accuracy.

3) Co-product recovery center - construction of a co-product treatment and recovery plant, with mixed technologies for the production of compost, energy, biogas and biofertilizers.

4) Restaurant collection system - collection system for organic co-products from bars and restaurants for destination and recovery.

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Case Study from Sao Paulo: Circular Economy for Food

5) Circular restaurants -- group of restaurants / chefs that purchase ingredients from producers (preferably local) that use regenerative farming methods, preparing seasonal menus using local biodiversity, using food in their entirety, combating waste and destroying co-products for composting to be used by producers.

Challenges

At the last meeting in Osaka, G20 leaders were committed to contributing to the implementation of the 2030 Agenda for Sustainable Development and pointed out the importance of complying with the Paris Agreement. Complex global challenges such as climate change, resource efficiency, pollution, including plastic waste at sea, loss of biodiversity, sustainable consumption and production, among others, are challenges that know no borders, just as interconnection of the economic production.

Thus, the search for sustainable development through new solutions is a challenge for all countries and that is why it is important to promote circular economy as a global commitment. It is a model that promises to innovate, going beyond mitigating the negative effects of current economic production on the environment. The circular model seeks to eliminate waste, pollution from the beginning of the production and the regeneration of natural systems - fundamental actions for systemic changes that we need to generate. The circular economy for food, in particular, contributes mainly to the fulfillment of SDG 12 (Responsible consumption and production) and SDG 2 (Zero hunger), providing important environmental and social achievements.

São Paulo faces significant challenges associated with a scenario of profound inequality and the food system is increasingly considered an important vector for economic, social and environmental development. Valuable assets, such as a thriving gastronomic scene and a high capacity for innovation in its numerous research institutions, universities and corporations, suggest that the city occupies an exclusive position to develop an inclusive and distributed regional food system based on the principles of a circular economy.

The transition to a circular economy represents a huge challenge but also a systemic change that builds long-term resilience, generates economic and business opportunities, and provides environmental and social benefits.

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Case Study from Rome: Food Waste

Rome Case Study

The reduction of food waste is promoted by Roma Capitale through the implementation of Law 166/2016.

This legislation provides for the granting of a reduced fee on the collection of waste to commercial, industrial and professional activities that produce and distribute food products, when they distribute a portion of these products to those most in need and vulnerable people. Roma Capitale will be in charge of evaluating these activities and managing the distribution of surplus food.

Furthermore, a memorandum of understanding was signed by Roma Capitale, CONOE *(Consorzio nazionale di raccolta e trattamento degli oli e dei grassi vegetali ed animali esausti a fini ambientali)* and AMA S.p.a. (Executive decision n. 1201 of 07/10/2019) for the implementation of a pilot project for the collection of exhausted vegetable and animal oils and fats in some Municipalities of the territory. The exhausted vegetable oil, produced in the context of domestic activities, if not adequately collected, it is usually discharged into water drains, affecting the quality of water resources, with environmental and economic consequences for local authorities and the community.

The creation of dedicated means for the collection of waste vegetable oils is a key element in the protection of the environment and the development of a circular economy where waste oil is recycled to produce biofuels.

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