



CIRCULAR AND RESILIENT FOOD SYSTEMS

Urban Eats:

How cities can leverage opportunities to build resilient food systems through circular pathways

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CITIES
NETWORK

ARUP



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Preface

This white paper is a collaboration between the Resilient Cities Network (R-Cities) and Arup as a first step in the Urban Eats campaign launched by R-Cities. The campaign has two core objectives:

- ▶ **To inspire 20 cities to join the movement in 2022–25 to adopt and strengthen the resilience of their food systems through circular economy approaches.**
- ▶ **To drive institutional donors, philanthropic organizations and industry corporate social responsibility to support cities through an initial funding of \$3 million USD. This funding is to meet programmatic needs in 2022–25, and to contribute to catalytic funds that will bridge financing gaps to solve this issue in the longer term.**

The campaign will have three phases that will culminate in the launch of the Urban Eats program being designed by R-Cities to identify and implement key interventions towards building urban food resilience in cities across the globe:

Phase 1: Knowledge – Develop understanding of role of resilience and circularity in urban food security

Phase 2: Engagement – City engagement and fundraising for a food circularity program

Phase 3: Program launch – Initiation of Urban Eats program design

In this white paper, we outline our initial view on critical challenges faced by urban food systems today; possible approaches to address or mitigate these; and the key enablers that may help scale a circular and resilient urban transformation. We aim for this report to provide guidance to city stakeholders and key actors in the food system on how a circular economy transition can further their resilience efforts without harming their capacity to ably adapt and transform. As this white paper marks the first phase, we anticipate that the message being communicated in this document will evolve and be strengthened as we further develop an understanding of the intersections of resilience, circularity and food systems through the Urban Eats campaign and program respectively.

Lastly, we acknowledge that resilience and circular principles are sometimes in conflict – resilience often relies on building in redundancy where circularity values reducing material use and recycling. However, we believe that a circular economy can play an important part in building resilience to future crises, in surviving shocks and living through disruptions such as pandemics, conflicts, extreme water events, or other climate change related crises. Through a circular economy transition focused on minimizing food waste and developing stronger connections across the value chain, cities can unlock opportunities to strengthen their overall urban resilience.



RESILIENT CITIES NETWORK

Resilient Cities Network is the world's leading urban resilience network. We bring together global knowledge, practice, partnerships, and funding to empower our member cities to build safe and equitable cities for all.



ARUP

Arup is a purpose driven firm: we work to shape a better world. We do this by creating a sustainable future -for people, places and the planet. Creativity, lateral thinking and embracing the new are central to everything we do. We are collaborative in nature.



Food resilience in the urban context

The Covid-19 pandemic has caused major disruptions to the global food system. The conflict in Ukraine has further disrupted the global food supply chain, affecting supply and prices, and highlighting even more starkly the need to build resilient food systems. According to the World Bank, global food prices are on track to rise 23% this year, after having risen 31% in 2021, and the cost of the inputs and fuel required to produce and distribute food is rising. As a result of these crises, approximately 828 million people go to bed hungry every night.¹ Up to 71 million people from the poorest countries in the world are projected to be facing severe poverty as a result of the disruptions and soaring prices in food and energy supply chains caused by the war in Ukraine.²

While cities have limited ability to affect food production beyond their boundaries **there are opportunities for cities to leverage circular pathways to increase the resilience of food and other critical urban systems to ensure their residents have access to healthy and nutritious food.**

As cities work towards a holistic, resilient recovery and plan to 'build back better' across various sectors, urban food systems need to be a key component of those strategies. Cities are major food consumers – 80% of all food will be consumed in cities by 2050³ – so they have an opportunity to support the development of more resilient and regenerative systems. In addition, they can broaden the boundaries of food policy by integrating them into their urban development strategies and by promoting a circular economy approach, which aims to prevent food waste, improve distribution and boost efficiency. Furthermore, the opportunities include supporting local food production to diversify the food supply; addressing food distribution and supply chain issues; and making the most of food (e.g. using by-products more effectively and preventing waste). Adopting circular practices, with a 'resilience first' mindset will be essential for cities to ensure that they are working towards systems that are regenerative and sustainable. It will also allow them to better manage their food systems not just for public health but for the economy and the environment too. For the purposes of this paper, we are using the following definitions of resilience and circular economy:

Resilience is defined as the capacity of individuals, communities, institutions, businesses, and systems (within a city) to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience. Resilient cities or resilient systems demonstrate seven qualities (reference: [Resilient Cities Network](#)):



The circular economy gives us the tools and power to tackle the root causes of global challenges, such as climate change, biodiversity loss, waste, and pollution. Increasingly based on renewable energy, it is driven by design to eliminate waste, circulate products and materials, and regenerate nature. Distributed, diverse, and inclusive the circular economy is a bigger idea that provides opportunities for better growth and can scale fast across industries to provide the resilience and solutions people are calling for. (reference: [Ellen MacArthur Foundation](#))

Taken together, **a resilience framework that incorporates circular economy approaches can enable cities to maximize opportunities** in their food system to (a) ensure that their citizens have access to healthy and nutritious food through equitable distribution of resources; (b) minimize the amount of organic waste in the environment and reduce emissions; and (c) supplement food supply with urban food production approaches that can limit the

environmental footprint of food production while generating employment opportunities.

Cities are normally thought of as lacking sufficient control over their food systems due to their reliance on external supply chains. However, given the control they have over other systems such as waste management – that drastically influence the food system – cities are in a unique position to combine circular approaches with resilience to improve food security for their residents.

The waste and wastewater management systems controlled by cities inherently have huge potential for circularity. Cities also have a high density and concentration of businesses and consumers that generate material and resource flows with circular potential. The close proximity of citizens, retailers, and service providers (40% of cropland is within 20 km of cities)⁴, makes new business models possible. This presents cities with the opportunity to ensure that organic materials are composted and used as a resource.

Demand and procurement powers, due to the sheer volumes of food eaten, means that city businesses and governments are ideally placed to influence how food is sourced, produced, distributed and discarded. This power can be utilized to minimize waste throughout the food system, while simultaneously stimulating the market for more local and organic produce, ensuring equitable distribution of food and reducing cities' overall carbon footprint. Furthermore, cities can raise awareness of why and how households can reduce their food waste, promoting behavior change to enable more sustainable consumption.

Applying circular principles to urban food system resilience offers an opportunity to explore new approaches to traditional waste management systems in cities as well as to developing more circular food supply chains that can link to building the sustainable and resilient urban food system of the future.



Vulnerabilities in urban food systems

If we are to build more resilient cities and food systems, we must first understand what vulnerabilities cities face and which shocks and stresses impact food systems and the critical urban systems that they rely on. Based on our research and evidence from prior work with major cities across the world, we have identified the following four challenges that impact food security in cities: complex food supply chains; inequitable urban food distribution; excessive food waste; and a reliance on other key urban infrastructure susceptible to shocks and stresses, which may exacerbate the impact of disasters on the food system.



URBAN FOOD SUPPLY CHAINS ARE LONG AND COMPLEX

An increasing urban population combined with global trade networks means food supply chains have become long and complex, leading to more waste. On average, 14% of food is lost between harvest and distribution, costing over \$400 billion USD a year.⁵ Additionally, food imported to cities passes through limited supply corridors, making the

supply chains vulnerable to shocks such as earthquakes, civil unrest, flooding, volcanic eruptions, landslides and more.

Informal vendors and small-scale, decentralized markets play a crucial role in the last mile of the food supply chain – particularly for vulnerable urban populations due to these markets' flexibility in payment options, affordability, and proximity. In Cape Town, 60–70% of Capetonians access their food through informal traders.⁶ These actors, upon whom the most vulnerable population relies heavily, are substantially susceptible to supply chain disruption. The Covid-19 pandemic and the subsequent economic decline showed the equal criticality and vulnerability of these actors, prompting investment in building their resilience to ensure community wellbeing.



URBAN FOOD DISTRIBUTION IS INEQUITABLE

Poverty, food insecurity, and malnutrition become increasingly problematic as urban populations expand everywhere. Persistent child undernutrition, deficiencies, and an alarming rise in obesity in urban areas all highlight the increasing burden of malnutrition in cities. Globally, 150 million people living in cities and towns are food-insecure⁷ – meaning that they struggle, or are unable, to maintain a diet sufficient for good health – while huge amounts of food are lost or wasted in cities, generating vast quantities of methane and driving up solid-waste management costs.

Food insecurity, hunger and malnutrition occur largely due to issues around affordability for the urban poor, and to issues of supply and distribution. In particular the urban poor face a challenging food environment, with poor households in many developing countries spending more than 50% of their budget on food.⁸ Dependence on purchased food and employment in the informal sector – especially for women – leaves the urban poor vulnerable to income and food price shocks.

Most recently, the Covid-19 pandemic exposed the vulnerabilities and weakness of urban food systems. Lockdown and other supply chain disruptions exacerbated the uneven distribution of food supply. In Kigali, Rwanda, food shortages, price increases and unemployment caused by the Covid-19 pandemic have pushed more households into food insecurity.⁹

Solutions that address distribution – such as reducing food wasted by households and food businesses, redirecting food that is still edible from waste bins to food banks or other distribution centers that target vulnerable groups, or developing urban food production centers like

community gardens – offer an opportunity for cities to improve access to food and better distribute food to those who need it the most.



CITIES PRODUCE EXCESSIVE ORGANIC WASTE

Cities are responsible for creating over 2.8 billion tons of organic waste each year, but less than 2% of it is captured and returned to the ecosystem in a way that provides nutrients for growing food.¹⁰ Food waste that does not reach landfills ends up discarded in the streets, causing health hazards and clogging drains and sewer lines, resulting in an increase in flooding events. The food that does end up in landfills decomposes, giving off methane, a greenhouse gas that is 28 times more potent than carbon dioxide. Food waste alone accounts for 10% of all greenhouse gas emissions.¹¹ According to the Washington Post, the carbon footprint of U.S. food waste is greater than that of the airline industry.¹²

Incorporating circular economy approaches, like designing out food waste, recycling nutrients, keeping organic materials in use through composting or using organic waste as feedstock for food production can create resilience benefits. For instance, this can allow the creation of food by-products transformed into valuable new resources including compost for regenerative food production in lieu of synthetic fertilizers. Locally-based or community composting can build support for food recovery and create opportunities for community participation and ownership. Improving food and organic waste management can create urban jobs throughout the waste system – from collection to segregation to composting. This will improve overall waste management, reduce odor nuisance and pests, and can improve the income and working conditions of small-scale waste pickers and recyclers. Tackling organic waste can also contribute to

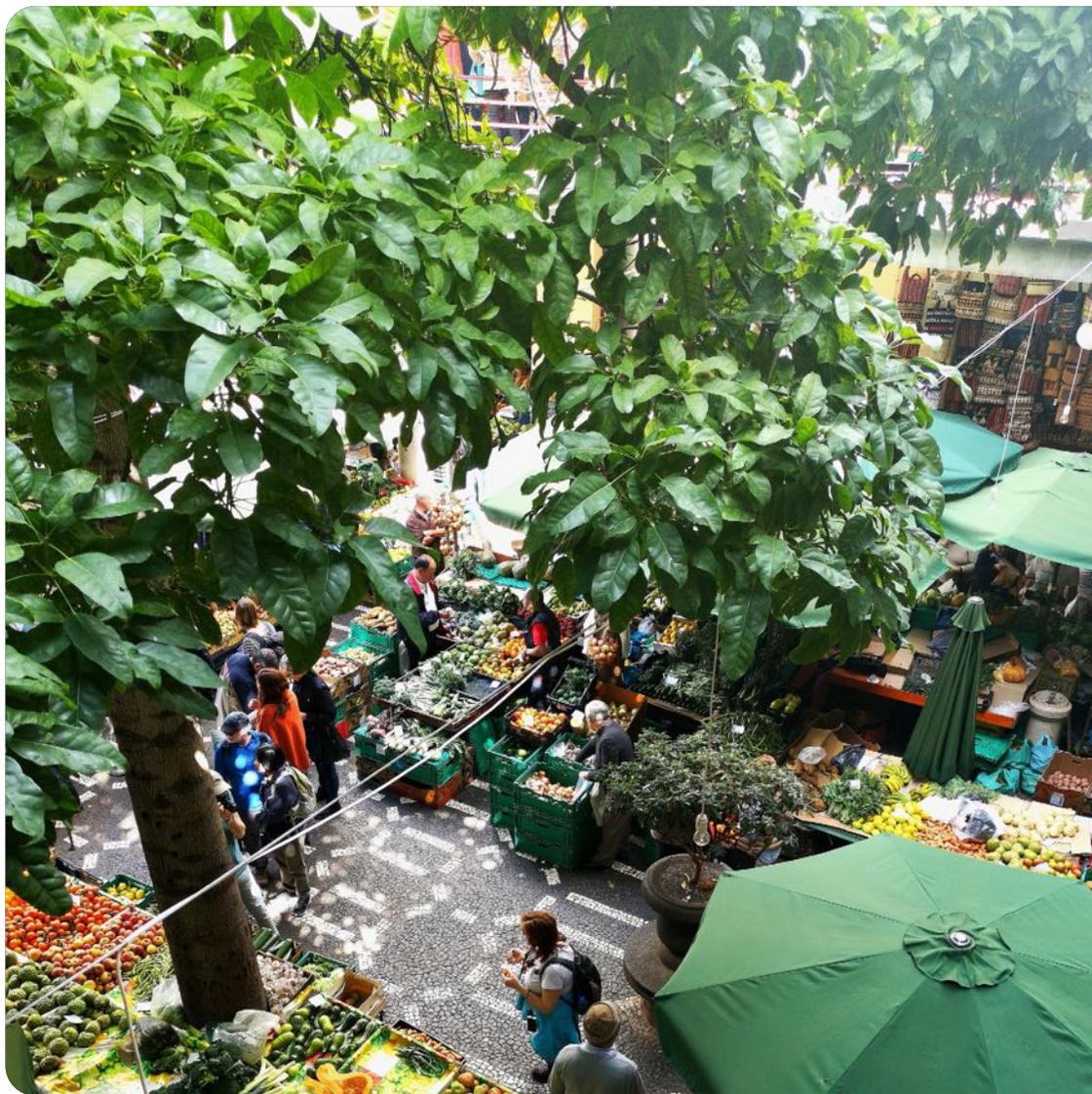
flood mitigation by preventing the clogging of drainage systems with organic waste. It can facilitate the protection of natural resources, particularly water sheds and water courses.

URBAN FOOD SYSTEMS ARE VULNERABLE TO DISRUPTIONS IN CRITICAL URBAN INFRASTRUCTURE

The production, processing, storage, distribution, retailing, consumption and waste management of food within a city's local food system depends on the resilience of other critical infrastructure in both the public and private realms. Storage buildings and processing plants, roads, rail lines and shipping facilities, markets and transport equipment are integral parts of the infrastructure that move food from farm to plate.

When shocks and stresses affect these interlinked systems, the impact of disasters on food systems multiply.

For instance, intermittency in energy supply limits the capacity of restaurants and stores to refrigerate and safely store food. This leads to food loss and spoilage. Energy poverty limits the capacity of households to store and cook food products, contributing to further inefficiency in food usage. Water scarcity and lack of access to clean water supply contribute to the production and consumption of contaminated food, creating disease outbreaks. Lack of effective transportation and logistics systems marked by congestion, inaccessibility, pollution, and high transport costs affect the last mile delivery of food to city dwellers.





Pathways to accelerate circularity and build urban food resilience

Pathways that allow cities to combine circularity and resilience approaches can strengthen solutions and help cities to identify opportunities to build food system resilience, especially if considered holistically so that any potential conflicts between the two approaches can be addressed.

One of the key areas where cities have particularly strong levers to improve food system resilience is by bringing in circular and resilient approaches in the waste management system.

Decreasing or designing out organic or food waste while enabling circularity through innovative methods is an increasing priority for cities and policy makers as well as private sector actors. Especially in rapidly urbanizing countries in Africa and South-East Asia, governments and service providers are increasingly aware that the development of resilient waste management projects can reduce waste while unlocking a triple dividend of creating jobs, improving public health, and facilitating local economic development.

In this section, we offer approaches to reduce the vulnerabilities of and mitigate the challenges faced by urban food systems identified above, with a particular

Within the R-Cities' network of cities:

Nearly

50%

of member cities indicate waste management as a priority to build urban resilience.

More than

20%

of member cities identify inadequate waste management systems as a major stress impacting the city and increasing risk and vulnerability of its communities.

40%

of member cities mention circularity – be it in the form of waste segregation, reuse, recycling, or the creation of economies around circular waste system – as having the potential to improve their resilience.

focus on opportunities to leverage circular economy approaches in the waste management system.

REDUCE FOOD WASTE BY LINKING POINTS OF SURPLUS TO POINTS OF SCARCITY

Challenges addressed:



Resilience qualities:



Cities are uniquely positioned to lead the fight against food waste through policy development and program implementation. Cities have direct regulatory control over solid waste management and many public health issues that dovetail with food waste.

By reducing wasted food, cities can stabilize municipal waste management costs and meet climate and sustainability goals. Because most uneaten food ends up in landfills and because of the climate impacts associated with growing, processing, transporting, and storing the food that isn't eaten, food waste is the largest waste-sector contributor to cities' GHG emissions.

At the same time, most cities are home to people who suffer from food insecurity, hunger and malnutrition because of insufficient access to food. By reducing the food wasted by households and food businesses and redistributing as much surplus food as possible, cities can tackle both of these problems together.



Linking food surplus to scarcity

Cape Town, South Africa

Cape Town recognizes that landfill diversion and food redistribution is key to achieving a competitive and sustainable food supply chain. In Cape Town, collaboration between private entities and organizations such as FoodForward SA, South Africa's largest surplus food redistribution organization, has been key to working towards this target, while unlocking multiple co-benefits.

FoodForward SA has been enabling the link between food surplus and food scarcity by connecting beneficiary organizations supporting communities in need directly to retail stores and food outlets with a history of high wastage of food. FoodForward SA has recovered and redistributed c.2,148 tons of surplus food to 203 Cape Town-based beneficiary organizations, mainly focusing on education, youth and women. In addition to addressing pressing food scarcity challenges in the city, this project has resulted in numerous co-benefits. This effort has created 30 direct jobs, supply chain upskilling opportunities for youth, and created about \$7.50 USD per 1kg of donated food. The reduced food wastage has resulted in the removal of 8,592 tons of GHG's for Cape Town.

More info [here](#).

CREATING VALUE FROM WASTE

Challenges addressed: Resilience qualities:



In a linear economy, waste is viewed as an externality, where we do not think about the possible value or uses for our refuse. Cities must work towards organic waste valorization (adding value to waste through reuse or recycling), to minimize the amount of organic/food waste that ends up in landfills and reduce related greenhouse gas (GHG) emissions.

As food and organic waste materials are a high potential target that can be easily turned into useful products, food waste valorization can provide resources to help build redundancies in other critical city systems or supply chains. Compost from organic waste can provide organic fertilizers for urban farms/gardens as compost facilities turn organic material into nutrient-rich soil. An increasing number of cities are looking to do even more with this untapped resource by turning it into usable energy called biogas.

Food waste can be composted into fuel to complement the needed supply for transportation systems. Methane gathered from organic waste can be used as a clean energy source. The effective utilization of waste helps create a more self-sufficient system that can better withstand future shocks that may impact the supply of necessary goods.

Waste valorization can be done by improving the systems of waste separation in our cities to become convenient for citizens and easy to manage for the authorities overseeing this. Simultaneously, transport networks must be strengthened so that the waste collected can be moved efficiently to where it is valuable.



Leveraging partnerships to reduce food waste and unlock co-benefits

Pune, India

Pune has taken the lead in integrating informal sector actors into the city's formal system to significantly improve service delivery. The city has done this through the SWaCH model, Pune's pro-poor public private partnership (PPP) wholly owned by self-employed waste workers.

Waste segregation conducted by SWaCH waste pickers sends non-recyclables to feeder stations, while organic waste is composted. Pune has created a PPP model that allows the city's food waste to be treated and recycled into fuel. This fuel is currently used in Pune's public transport buses which leads to reduced GHG emissions.

Currently, SWaCH collects 70% of municipal solid waste in the city through its network of 3,500 waste pickers and reaches 800,000 households daily.¹⁴ This model has not only increased Pune's capacity to effectively collect waste and reduce emissions, but has bolstered the socio-economic position of waste-pickers through the creation of consistent and dignified job opportunities that allow them to innovate and grow within the city's formal waste management system.

More info [here](#).

COMPLEMENT FOOD SUPPLY THROUGH LOCALIZED PRODUCTION AND DISTRIBUTION

Challenges addressed:



Resilience qualities:



Complementing food systems with local resources can help address food distribution and supply chain shocks by closing resource loops, shortening and simplifying supply chains and thus increasing the food self-sufficiency of urban areas.

Undertaking a bioregional approach that creates a closed loop between production, consumption and waste is one way to localize the food system. For example, food grown in urban peripheries can help supplement the food supply that is imported. In turn, organic waste can be sent back to the countryside to act as nutrients or input materials for growing food. Localizing food systems can also reduce the negative environmental impact of current food systems, by reducing distance travelled, and reducing the likelihood that food will be wasted as a result of either poor distribution systems or rotting.

Supporting localized and community-level food distribution systems also supports cities in addressing the myriad shocks and stresses their food systems face and protects their most vulnerable populations by ensuring equitable food distribution. As key access points for many low income and informal communities, small scale and informal markets must be supported as key stakeholders in cities' food supply chains.

To deliver localized food systems, city actors will need to co-invest the resources to undertake a sustainable urban planning exercise at the neighborhood, city and regional level to map vulnerable areas, available resources and key stakeholders.¹³



Shortening supply chains for improved food resilience

Quito, Ecuador

Quito citizens experience limited access to healthy foods due to long and vulnerable supply chains. This has also made the likelihood of food wastage and spoilage high. In response to this challenge, the city of Quito has made its food system a key priority and invested in increasing the accessibility of nutritional, locally sourced food by strengthening its long standing Participatory Urban agriculture program. This program has supported the reduction of food wastage by reducing the number of intermediaries within its supply chain. The city now has the capacity to produce and deliver 43% (580,000kg) of its food through various short supply chains, reducing spoilage and increasing accessibility. as a result, 11 tons of fresh and healthy food reaches vulnerable communities each week.

More details [here](#).



Strengthening access to food by supporting local and informal markets

Cape Town, South Africa

Cape Town has developed a food system program as part of its resilience building efforts. The program supports the comprehensive food system mapping of the city and fosters multistakeholder collaboration, which helped accelerate the city's response to the covid-19 pandemic.

The City leveraged community-based organizations and previous vulnerability mapping to identify and reach vulnerable communities pushed into food insecurity due to the Covid-19 pandemic. Cape Town complemented these efforts by developing a digital food voucher system that allowed citizens to regain agency and purchase food at their convenience and preference in local markets and informal stores. This inclusion of local and informal markets as part of the solution for tackling food insecurity during the pandemic not only increased access to nutrition in vulnerable communities, but stimulated their local economy by ensuring informal vendors had opportunities to sell their products.

More details [here](#).

CHANGE PERSPECTIVES AND BEHAVIORS ON FOOD AND WASTE

Challenges addressed:



Resilience qualities:



One of the most important factors in creating a circular economy is consumer behavior. Influencing behavior and driving cultural change around food habits will accelerate circular re-use of food and reinforce resilience of food systems. This can be done by a mix of initiatives to raise awareness of food-related issues, promoting sustainable and healthy habits, increasing visibility of resource use patterns to consumers, and tackling negative biases around waste reuse.

City leaders, educators and other stakeholders could develop programs to raise awareness among consumers to highlight the vulnerabilities of food systems and the importance of supporting local products in order to achieve resilience. Programs, events and campaigns built to educate people on nutritious habits, to discuss the environmental benefits of supporting local growers, or to outline the importance of the food supply chain in overall climate and urban resilience are key. This could be in the form of open-air markets that sell food produced in the region, community gardens that encourage city dwellers to participate, or even working with popular supermarkets to stock locally grown goods in order to ensure they are easily accessible.

Consumers should be discouraged from wasting food – through incentives to reduce their waste and disincentives to generate too much waste. This can be considered at the stage of growing, purchasing and disposal.

Lastly, in addition to advocating for the reduction of food waste, activities around effective waste management – from at-home waste segregation to the support of activities that valorize waste into valuable materials – should be encouraged.



Incentivizing behavioral change towards reducing food waste

Milan, Italy

Since 2015, Milan has developed a number of projects to meet its goal to achieve a 50% reduction in food waste by 2030. They have set up Neighborhood Food Waste Hubs, a pilot project to collect and redistribute food waste at the community level. The city has created a fiscal incentive to donate food by introducing a 20% waste tax break in 2018 for any food business donating its surplus food to charities and food banks. Milan has also invested in shortening supply chains by supporting the increase of locally procured food for school canteens.

Milan has instituted numerous awareness campaigns to reduce waste, particularly in schools. Milan also encourages the co-development of projects focusing on new solutions to recover food waste, recycling methods, green procurement and supplier relationships, and technology for agriculture with local businesses.

More info [here](#).

STRENGTHEN LINKS BETWEEN STAKEHOLDERS

Challenges addressed:



Resilience qualities:



Platforms that connect different stakeholders in the food system – including producers, consumers, distributors and government actors – foster an environment for collaboration to bring in circular approaches. Stronger links and communication can mobilize key actors across the food system – such as informal waste collectors, policy makers and researchers – to connect with one another and work together to develop new solutions to waste-related issues in their city.

Platforms like this can be used to bring visibility to urban dwellers and engage them in the issues faced by the city. Citizens can be informed about the importance of buying local, where they can access quality products and how they can help minimize waste.

Such platforms can also disseminate knowledge around the effort and resources needed to grow and prepare food items, revealing to end users the impact their consumption has on natural resources and labor forces. Not only does this empower those involved and build trust among consumers, but it promotes more effective leadership and management of the system as a whole and more efficient use of the resources needed. This speaks to the reflective and inclusive qualities of resilience, while also incorporating circular principles.



Forging direct links between producers and consumers

Leuven, Belgium

a group of local farmers, found at the heart of the local distribution platform Kort'om Leuven, are working towards a climate-neutral future for Leuven and aim to shorten supply chains and create direct relationships between farmers and consumers. This non-profit organization, established through Leuven 2030, a sustainability roadmap for the city, has developed a food distribution platform. It supports the collection of food products from the peripheries of Leuven and the easy delivery of them to supermarkets and restaurants in the city, on fixed days. As products are collected from farms or select collection points by Kort'om coordinators, it reduces the distance travelled by each individual farmer, thus lowering CO₂ emissions. In shortening supply chains and making locally produced foods more easily accessible, this project also results in the provision of more fresh and high quality produce. Lastly, it encourages the public to be more food and waste-conscious, by educating consumers about where and from whom their food comes.

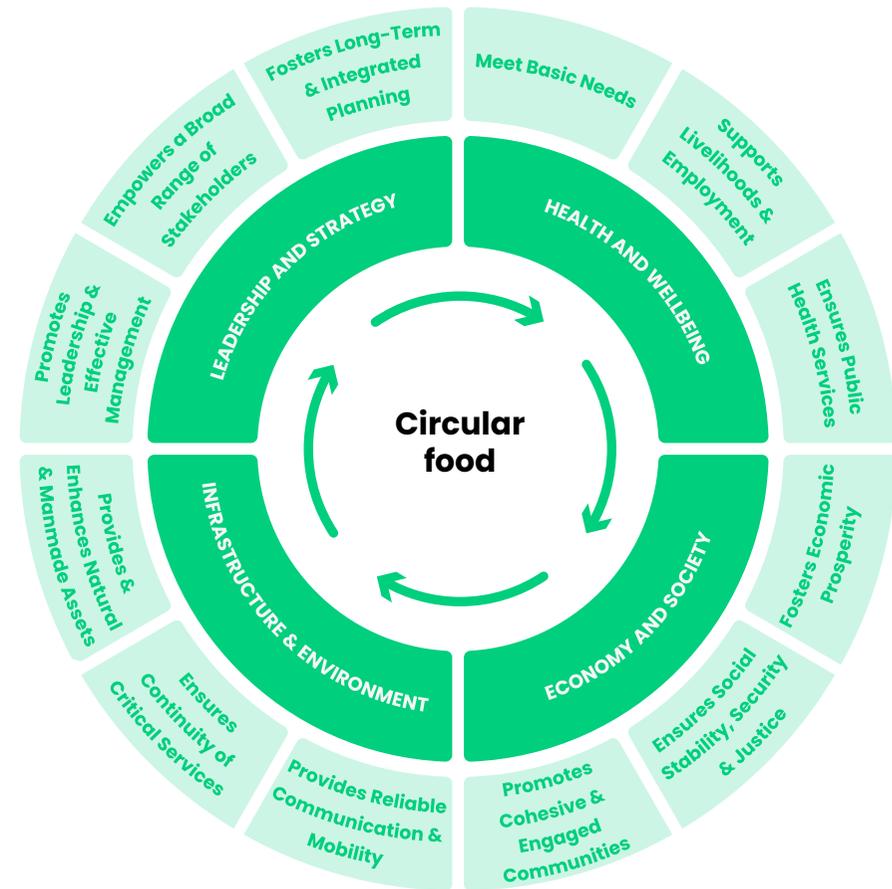
More details [here](#).



How resilience can enable a circular approach to foster food resilience

All of the above approaches highlighted in the previous section will be more impactful if they are underpinned by holistic and structured policy, advanced technology, effective empowerment of innovation and robust infrastructure. The following enablers can be used by different stakeholders across the food value chain to deliver solutions at scale and further advance resilience efforts:

- ▶ **Leadership and Strategy:** Creating effective policy environments to accelerate change
- ▶ **Infrastructure & Environment:** Ensuring effective access to dependable infrastructure
- ▶ **Health and Wellbeing:** embedding co-benefits in food resilience-building efforts
- ▶ **Economy and Society:** Leveraging technology to scale a circular economy around food



These enablers are informed by the City Resilience Framework (CRF), developed by Arup with support from the Rockefeller Foundation, which provides a lens to understand the drivers that contribute to urban resilience. The CRF has been implemented across R-Cities' network of cities in their resilience strategy development processes to assess the extent of their resilience, to identify critical areas of weakness, and to identify actions and programs to improve their city's resilience. Ensuring that they are integrated into circular approaches will support cities to improve food security without introducing new vulnerabilities into the food system.

LEADERSHIP AND STRATEGY: CREATING EFFECTIVE POLICY ENVIRONMENTS TO ACCELERATE CHANGE

Cities need to make building resilient and circular food systems a key policy objective. This will ensure that the necessary resources are available to take action in key areas. By defining a key policy objective, cities can also prioritize the creation of regulation around waste reduction, processing, and reuse. Inclusive policy making and robust communication is key to this process – particularly in bringing in circular principles to incentivize waste reduction among consumers.

Implementing appropriate policies will act as a necessary first step when seeking to address challenges, particularly in tackling the unequal distribution of food in urban areas. Moreover, policy changes will underpin the efforts made to improve municipal waste management and localize food systems. This may involve policies and guidelines to make land or space available for urban gardens, or to enable entrepreneurs or innovators to develop solutions to reduce or repurpose food waste.



Resilience Goal:

Foster long-term and integrated planning



One New York: The Plan for a Strong and Just City

New York, USA

A key component of New York's 2015 Resilience Strategy is "One New York: The Plan for a Strong and Just City." In this, NYC has taken a step to integrate findings from the Five Borough Food Flow study into its ongoing resilience planning by including initiatives and representatives from all parts of the food system to strengthen it. The plan includes initiatives such as establishing and expanding industry partnerships, creating bridge programs to prepare low-skill job seekers, providing career and technical education programs, and supporting local food distribution to empower food resilience. More details [here](#).

INFRASTRUCTURE AND ENVIRONMENT: ENSURING EFFECTIVE ACCESS TO DEPENDABLE INFRASTRUCTURE

To develop effective, localized economies and the necessary systems to better process and better utilize waste, appropriate infrastructure will be needed. As cities map their supply and distribution networks, they will be able to identify the various stakeholders involved, develop a better understanding of any vulnerabilities that may exist, and identify districts or neighborhoods that are currently underserved or oversupplied. In addressing any of these challenges, a city may find that their transportation systems and their underlying infrastructure are lacking or unequally serving segments of the urban population. Such a mapping will allow cities to make informed decisions about future infrastructure developments in order to improve spatial connectivity, ensure equal distribution of resources like food, and support waste collection and management processes.

Furthermore, a detailed mapping may reveal capacities to improve redundancies in infrastructure systems – while principles of circularity may call for eliminating redundancy, resilience calls for duplication of system components in order to increase an infrastructure’s dependability, assuming the redundant components remain functional and effective. Redundancy is essential to ensure that food distribution channels are not reliant on single pathways. For instance, with multiple logistics networks connecting cities with food-producing peripheries; different forms of waste management; or ensuring access to diverse energy supply mechanisms to preserve food items during transit and storage. Incorporating pillars of resilience into these discussions is particularly important to ensure that applying circular approaches does not result in the reduced resilience of infrastructure that is critical to urban food systems.

While cities may not have the ability to simplify long and complex supply chains, mapping the existing infrastructure and networks will help cities tackle inequalities in the distribution process and improve waste management

systems. Provision of diverse and effective infrastructure will also support attempts to localize food systems. This may include providing warehouses and cold storage facilities for urban farmers and producers. Finally, redundant capacity in urban infrastructure will ensure a city has a continuous food supply, without disruption, even in the face of significant shocks.



Resilience Goal:

Ensure Continuity of Critical Services



Strengthening urban infrastructure to promote food resilience

Kesbewa, Sri Lanka

Kesbewa promotes space-intensive home gardens, productive rooftops, rainwater harvesting, recycling of organic household waste, and rehabilitation of paddy fields in flood zones and wetlands to strengthen the infrastructure of the city for food resilience. In addition, they help put together plant nurseries and service outlets for seeds and other inputs. By developing these home-based solutions, food and water supply infrastructure is more diversified and the city is less reliant on public infrastructure. The city envisions agriculture, agro-parks, and green spaces being integrated in a future green city mosaic for mitigating climate change. Key benefits include the potential to reduce food miles, reduce the urban heat island effect and mitigate flooding, while improving waste management. It aims to optimize transport infrastructure, land use planning, and the use of available resources and knowledge at different levels.

More details [here](#).

HEALTH AND WELLBEING: EMBEDDING CO-BENEFITS IN FOOD RESILIENCE BUILDING EFFORTS

Addressing food resilience issues not only helps cities meet their nutrition needs, but can also be key to unlocking a wide range of co-benefits.

The economic opportunity that comes from valorizing food waste as part of the circular transition can provide employment opportunities. Localizing food supply through urban farming can help improve access to nutritious foods, while also creating much needed public spaces for city dwellers. Waste reuse can provide key resources to help drive green transitions in the energy and transportation system, through the valorization of waste for methane production.

In order to unlock these co-benefits, cities need to foster innovation in food resilience and break silos between different stakeholders, allowing them to tackle intersecting challenges in concert. This requires the equitable support of actors across the formal/informal spectrum and ensuring they are in a suitable environment to germinate and grow ideas into effective tools for accelerating circularity.



Resilience Goal:

Meet basic needs

Support livelihoods and employment



Unlocking multiple dividends through Latin America's largest urban garden

Rio de Janeiro, Brazil

The Hortas Cariocas Program, initiated by Rio's municipality in 2006, transformed previous idle land into a network of urban gardens across the city, including a large plot in Manguinhos Favela said to be the largest urban garden in Latin America. The project now includes 55 gardens that are located either in schools or in 'vulnerable' neighborhoods, such as favelas.

Developed to make use of idle land such as garbage dumping sites while fulfilling the necessary nutrition needs for residents of Rio's favelas, the program has also generated many co-benefits. It has generated employment for locals, who earn a stipend for tending the gardens run by the city and are able to sell produce left over from donating to the local community. The project has also created public spaces – which the city aims to grow into the largest urban edible park in the world. These public spaces provide heat relief for the residents of Rio's brick-clad favelas as well as helping residents with their mental health through access to much needed green space. The gardens also serve as education centers connecting residents – particularly youth – to the sources of their food.

The Hortas Cariocas Program was also a key tool for addressing the food insecurity that was exacerbated by the Covid-19 pandemic. The existing network of food donation allowed for the distribution of 82 tons of organic produce for communities in need in 2020 alone.

More details [here](#).

ECONOMY AND SOCIETY: LEVERAGING TECHNOLOGY TO SCALE A CIRCULAR ECONOMY AROUND FOOD

Leveraging advanced technology and digital tools can help scale a circular economy transformation and reinforce the resilience of urban food systems. Tools to collect real-time data across stages of the food chain can help identify the vulnerabilities of a system and factors that contribute to insecurity. Data can also be used to better model the intersection between food, energy, transportation and other sectors. This will allow for a more accurate mapping of vulnerabilities in a system and of aspects that impact resilience.

Among the technological developments which are creating new opportunities, social media networks are becoming increasingly important in shaping attitudes and can contribute to empowering consumers, raising awareness of food-related issues and mobilizing a behavioral shift. Technological tools can improve food production and distribution processes, for example through the use of automation. In addition, artificial intelligence tools can be used to help manage food waste. AI algorithms can help predict sales at food and beverage establishments, and AI-enabled tracking can help retailers identify items that are close to their expiry. Lastly, online platforms or mobile applications can support waste valorization by connecting urban residents to surplus food sources. Such platforms may also have the added opportunity to influence behavior and raise awareness around food waste and buying local products among the urban population.

This use of technology needs to be carefully considered, however, to ensure that food systems are not deeply reliant on a particular tool and that contingencies and redundancies are built in to maintain resilience. However, the emergence of tools that can reduce food waste by improving food distribution represents a tangible opportunity to improve resilience through the adoption of circular approaches.



Resilience Goal:

Foster economic prosperity

Promote cohesive and engaged communities



Olio App

United Kingdom

OLIO is a food sharing app developed in the UK that lets users post a photo of unwanted food items and share it with the local neighborhood. This non-profit allows users to give away unwanted food and other household items to neighbors for free. It is deeply committed to reducing food waste in the home and helping people to consume more locally and sustainably. OLIO now has over five million users globally who cumulatively have shared 25 million portions of food, equivalent to taking 75 million car miles off the road. The app has also resulted in the sharing of three million non-food items, supporting upcycling and reusing at a larger scale.

Initiatives like this help make reuse and recycling much simpler and even economical, so consumers do not feel inconvenienced. Furthermore, OLIO has worked to develop relationships with local restaurants to reduce food waste across the food and beverage industry as well. In the UK, OLIO has developed a relationship with Tesco, which put 2,700 stores on the platform in 2020. These businesses were able to leverage the OLIO network to redistribute their surplus food items as they neared their sell-by date. In response to the pandemic, the app ran the “cook for kids” campaign, resulting in over 30,000 meals prepared and offered to families in the UK. The app has proven it can help foster community-supported agriculture where growers are encouraged by consumers to adopt different practices, such as more diversity in their farming systems, heat-tolerant crops to remain climate resilient, and creating the appropriate natural habitat for pollinators.

More details [here](#).



Conclusion

City authorities have a real opportunity to employ circular economy approaches to improve the resilience of food systems in their cities. The waste system can be a key entry point to facilitate this shift. Many cities are already employing strategies that integrate circular economy and resilience in integrated pathways that will ultimately increase the food security of people living in their cities. There is an opportunity to share, replicate, and innovate on these strategies by working with cities and other stakeholders across the food supply system.

The shocks and stresses discussed throughout this white paper highlight to us where the major vulnerabilities and challenges lie in urban food systems. As cities work towards a resilient recovery from the covid-19 pandemic, planning for the post-Covid era is an opportunity to reform existing urban food systems and embed circularity from the outset.

By considering circularity and resilience together, cities and stakeholders will be able to deliver integrated pathways where the two approaches strengthen each other, rather than creating new vulnerabilities. The framework for

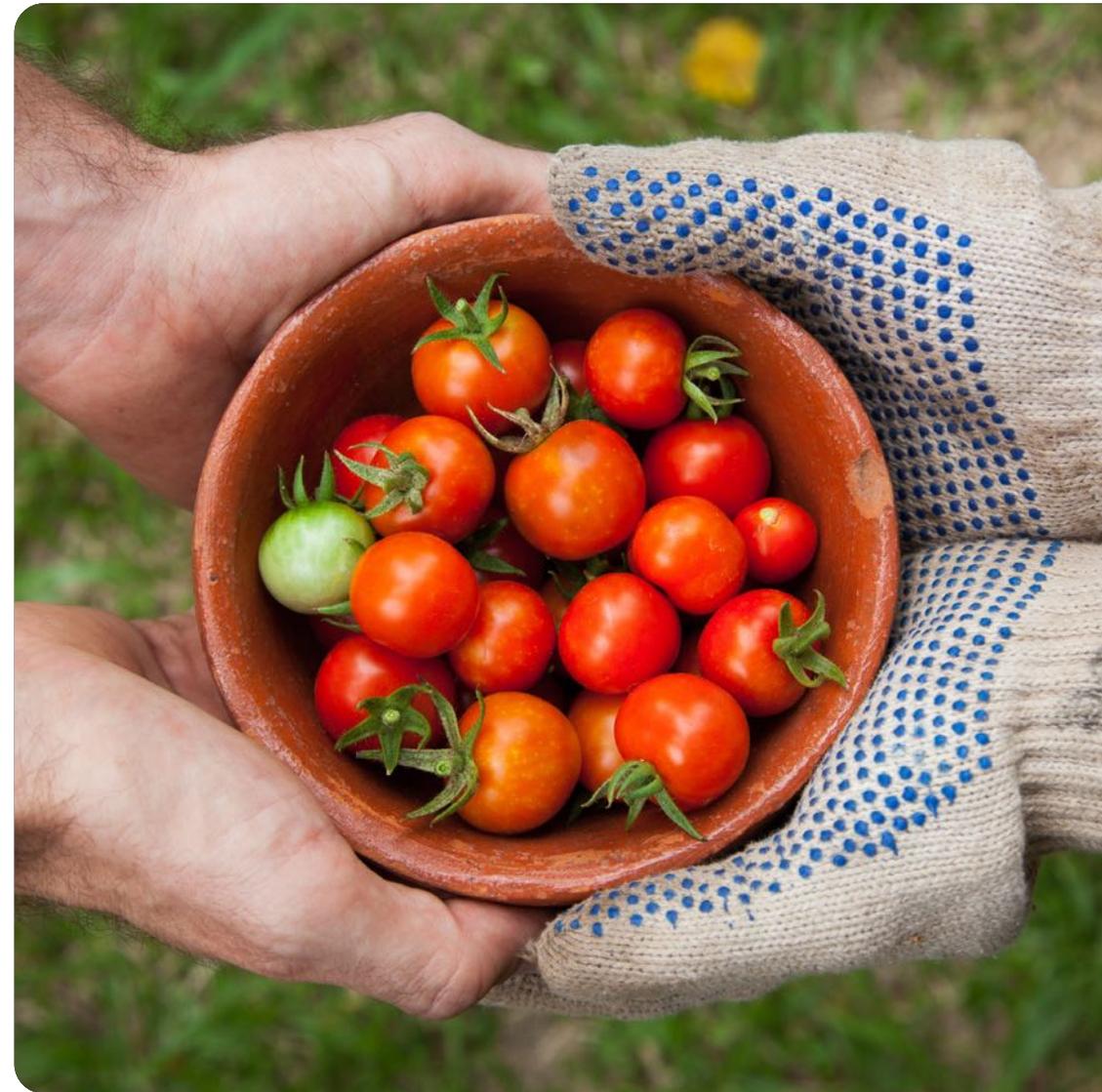
a transformation towards urban food resilience can be informed by the approaches provided above and scaled with proper and planned use of the four enablers.

The opportunities outlined in this paper offer a starting point for cities to consider how to adopt circular economy principles into their thinking about increasing the food resilience of their cities. As we move forward in supporting cities in transitioning towards resilient food systems, we will:

- ▶ Actively engage with cities to identify what specific food resilience issues cities are facing and the support they require in addressing them.
- ▶ Identify opportunities in the waste management system to incorporate circular principles to improve food resilience.
- ▶ Further assess the replicability of best practices on the nexus of food security, urban resilience and circularity and share them.

As next steps, we will undertake a comprehensive mapping to identify key stakeholders across the urban food value chain that are (i) interested in exploring appropriate opportunities to transition towards resilient food systems, and (ii) interested in co-developing scalable approaches to underpin a circular economy model in building urban food resilience.

While there are many challenges in our existing urban food systems, there is great potential to transform them with circular economy principles in order to create healthy and resilient communities globally.



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