ELLEN MACARTHUR FOUNDATION

CITIES AND CIRCULAR ECONOMY FOR FOOD

CITY ANALYSIS INSTRUCTIONS

ABOUT THE *CITIES AND CIRCULAR ECONOMY FOR FOOD* REPORT

The current food system has supported a fast-growing population and fuelled economic development and urbanisation. Yet, these productivity gains have come at a cost, and the model is no longer fit to meet future needs. Shifting to a circular economy for food presents an attractive model with huge economic, health, and environmental benefits across the food value chain and society more broadly.

The *Cities and Circular Economy for Food* report aims to highlight the often underappreciated role urban food actors can play in driving food system transformation, and to spark a global public-private effort to build a circular economy for food.

The report includes a global model for the benefits of the transition as well as a closer look at four focus cities – Brussels (Belgium), Guelph (Canada), Porto (Portugal), and São Paulo (Brazil) – with which the team collaborated to establish what the proposed model means at a local level, how it can be applied, and what the benefits would be.

CITY ANALYSIS GUIDE

This document acts as a guide for cities interested in analysing their food system to identify actions with clear benefits that can inspire and guide stakeholders in the transition towards a regenerative food system.

The guide is based on the methodology used by the Ellen MacArthur Foundation team in its analysis of four focus cities during the development of the *Cities and Circular Economy for Food* report. This guide presents a step-by-step approach cities can use to develop scenarios and estimate the resulting benefits. A complementary *City benefits tool* (xls file) is available for cities to download and use to calculate the positive impact.

Conducting analysis in a city consists of six main steps:

1. **Understand the city archetype and surrounding region:** Provide an overview of the city, demographics, economy, and local food production.
2. **Assess urban and peri-urban food production:** An in-depth study of the types of local food production, quantities, and methods of production employed locally.
3. **Assess urban food consumption:** Quantities of food consumed, traditions, and latest trends.
4. **Determine urban organic waste and food by-product streams:** Including an overview of food waste, prevention, and redistribution options as well as organic waste flows and the potential to transform them into valuable inputs for agriculture and the wider bioeconomy.
5. **Develop circular economy for food scenarios:** A shared vision that builds on the city's assets and activities to accelerate the transition.
6. **Estimate the benefits of circular economy scenarios:** Estimate the quantifiable economic, health, and environmental benefits that could be achieved by realising the scenarios.

STEP 1. UNDERSTAND THE CITY ARCHETYPE AND SURROUNDING REGION

Aim

To understand the context of the city, including its geography, existing assets, income level, and major economic drivers.

Suggested approach

Consult publicly available databases and statistics for data demographics and economics. Data collection should focus on data points included in Figure 1, which will help determine the city archetype. Other important factors, such as the city's geography, can be included in this section.

FIGURE 1. DATA REQUIRED TO DETERMINE ARCHETYPE
City population
Peri-urban population
Commuters
City density
Peri-urban area GDP
City GDP
Major economic drivers and activities conducted in city (e.g. industry, agriculture)
Major economic drivers and activities conducted in the peri-urban area

For the purpose of selecting the focus cities for the *Cities and Circular Economy for Food* report, the team assessed the city archetypes of the potential focus cities to ensure a diverse range of archetypes were analysed. City archetypes can be determined using the following definitions:

FIGURE 2. CITY ARCHETYPES

A. Developing urban centres	B. Developing mega-hub	C. Stable community	D. Growing community	E. Urban powerhouse
Low-income	Low-income	High-income	High-income	High-income
Small population	Large population	Small population	Small population	Large population
High population growth	Med-high population growth	Low population growth	Med-high population growth	Low population growth

Income:

Low < 12,000 USD/capita/year
High ≥ 12,000 USD/capita/year

Population size:

Small < 5 million inhabitants
Large ≥ 5 million inhabitants

Population growth:

Low < 0.5%
Med-High = 0.5% to < 1.5%
High ≥ 1.5%

INCORPORATING OTHER ASPECTS

Although the city archetype focuses on demographic and economic aspects, it is just as important to understand other dimensions, such as governance, the geography, the climate of the surrounding areas, and the relationship between urban and peri-urban areas.

STEP 2. ASSESS URBAN AND PERI-URBAN FOOD PRODUCTION

Aim

To develop an inventory of all food types produced within the urban and peri-urban areas, the quantities of each, and production practices used, along with any food-processing activities and the by-products they generate.

Suggested approach

Through desk research and interviews with experts, determine the types and volumes of food produced in the urban and peri-urban area, the land area dedicated to farming, and the farming methods used. Determine these variables both at an urban and peri-urban area level. All the desired data may not be available, however, the more granular the data (e.g. segmentation by food types), the more accurate the estimation of benefits will be. Figure 3 shows suggested layout for the data.

It is important to not only include primary production in the analysis, but also urban and peri-urban food processing. Establishing the food-processing industry provides information that can later be used to explore potential symbiosis between industries (e.g. ways in which food by-products from one food-processing facility can be turned into inputs for another food industry or bioeconomy industry player to use). Figure 4 provides suggested data points to guide data collection for Step 2.

For the purposes of understanding the local food production and comparison with previous studies,[1] the peri-urban area has been defined as the 20 km surrounding the urban boundaries. However, given that food production data is aggregated at different scales, for practical purposes, different-sized areas can be used. The main issue to consider in the peri-urban area defined is that it comprises the logistics, transport, and social integration that should be part of a circular economy for food.

FIGURE 3. VOLUME, LAND AREA, AND METHODS FOR LOCAL FOOD PRODUCTION

Food type	Land area	Farming methods	Mass of food	Trends in production and methods
Vegetables				
Fruits				
Dairy				
...				

FIGURE 4. PROCESSED FOODS

Food type	Processing type	Mass of processed food produced	By-products	Trends in production, methods, and by-product utilisation
Vegetables				
Fruits				
Dairy				
...				

[1] Thebo, A. L., *et al.* (July 2017), *A global, spatially-explicit assessment of irrigated croplands influenced by urban wastewater flows*, Environmental Research Letters, Vol. 12; *Cities and Circular Economy for Food* analysis – for details see Technical Appendix

STEP 3. ASSESS URBAN FOOD CONSUMPTION

Aim

To determine the food types and quantities consumed annually within the city, where the food is sourced from, the distribution of points of purchase (e.g. large retailers, farmer's markets or restaurants), and the latest consumption trends.

Suggested approach

Establishing the origin of the food consumed in a city can be challenging. In order to obtain this information, we suggest conducting desk research for available literature, and interviews with city authorities, retailers, and experts in the topic. Even if food flows cannot be precisely tracked, exploring the sourcing, origin, and methods of production offers insights into the resilience of the local system, and how it is linked to economic, environmental, and societal costs as well as the benefits of shifting to a circular food system.

Determining the diet of the local population can also be challenging since most often these statistics will only be available at a national level, although these can be used when no more detailed data is available. In order to understand the latest trends in consumption, a literature review combined with interviews with retailers, nutritionists, chefs, and other experts will provide the required information (see Figure 5 for an example).

Finally, the main method for the distribution of foods should be established, in order to understand how the foods reach consumers, and which organisations most influence the sourcing of foods. As above, if this data is not readily accessible through desk research, then interviews with retailers, experts, and food authorities would provide the existing information. Figure 6 suggests a possible layout for this information.

FIGURE 5. LOCAL FOOD CONSUMPTION AND TRENDS

Food type	Mass per person	Expenditure (USD)	Trends
Vegetables			
Fruits			
Dairy products			
...			

FIGURE 6. POINTS OF DISTRIBUTION

Type	Proportion of food	Trends and notes
Large retailers		
Small retailers		
Restaurants and hospitality		
Farmer's markets		
School canteens		

STEP 4. DETERMINE URBAN ORGANIC WASTE AND FOOD BY-PRODUCT STREAMS

Aim

To map the sources of food and organic waste, the potential for redistribution and prevention of food waste, and the volume and potential applications for the organic waste produced in the city.

Suggested approach

Organic waste separation, treatment, and valorisation

Desk research, combined with interviews with city authorities, solid waste and sewage management organisations, and experts, will provide data on the types of organic waste produced (e.g. food waste, household waste, green waste), the treatment it receives, and current valorisation options. This information can be collected in a table such as Figure 7 for solid organic waste.

Information on whether the organic waste is separated at source, how it is treated, and how it is valorised can also be added in these tables. Adding additional metrics to the table, such as the value of products made from organic waste and the value in preventing food waste are helpful for estimating the benefits in Step 5.

FIGURE 7. SOLID ORGANIC WASTE FLOWS

Organic Waste Stream	Mass (t/y)	Targets	Collection scheme	Treatment type and outputs	Output product mass (t/y)
Residential					
Street markets					
Large generators					
...					
Total volume collected					

Information on food waste prevention efforts and targets

Desk research, combined with interviews with city authorities, food charities, waste management organisations, and experts may be necessary to gain the full picture of the amount of food that goes to waste and the proportion that is preventable. Figure 8 presents a suggested layout for this information.

FIGURE 8. FOOD WASTE PREVENTION EFFORTS

Type	Mass (t/y)	Targets	Prevention schemes	Prevented food waste (t/y)	Redistribution schemes	Redistributed food (t/y)
Households						
Private sector						

Sewage production and treatment

Data on sewage, which also contains valuable nutrients, can be collected in a table such as Figure 9.

FIGURE 9. SEWAGE PRODUCTION AND TREATMENT

Type	Mass (t/y)	Targets	Treatment type	Output products mass (t/y)
Captured by treatment system				
Not captured				

STEP 5. DEVELOP CIRCULAR ECONOMY FOR FOOD SCENARIOS[2]

Aim

Develop a shared vision for the application of circular economy principles at scale in the city, which builds on the city's existing assets and activities.

A circular economy for food in cities is built on three ambitions (see *Cities and Circular Economy for Food* report for further details):

1. Source food grown regeneratively, and locally where appropriate: Food comes from natural systems which are inherently regenerative. Replicating these natural practices will improve the overall health of local ecosystems, diversify the food supply to increase resilience, reduce packaging needs, and shorten supply chains. In a circular model, urban and peri-urban communities will strengthen their connections with food and the farmers who grow it.

2. Make the most of food: Cities play a crucial role in keeping food at its highest value and eliminating waste. They can become hubs for the redistribution of surplus foods and and transforming food by-products into organic fertilisers, biomaterials, medicines, and bioenergy for a thriving bioeconomy.

3. Design and market healthier food products: There are no healthy food choices in an unhealthy food system. We can change food design and marketing to reshape our preferences and habits. This will ensure that healthy products become easily accessible, while valuable nutrients circulate back to the soil safely.

Suggested approach

Developing a shared vision

Scenarios should be built by applying these ambitions to the specific city environment, and exploring what the circular economy means in practice for each place.

The scenarios should ideally be developed together with city authorities, retailers, experts, consumers, and producers, if possible, in order to ensure that the end result not only helps paint a picture of what a circular economy for food looks like in the city, but also serves as a shared vision, with which all stakeholders are aligned.

Examples of scenarios that capture the ambitions above are:

- What if all organic waste is separated at source and valorised?
- What if 50% of peri-urban farmland switches to regenerative forms of production?
- What if 50% of food waste is prevented and redistributed?

[2] Please note that the benefit factors employed correspond to global estimates of impacts and benefits. These factors are available in the *City benefits tool* (xls file) and background information is contained in the *Technical Appendix*. The definition of all technical terms employed in the document are available in the Glossary of the *Cities and Circular Economy for Food* report.

STEP 6. ESTIMATE THE BENEFITS OF CIRCULAR ECONOMY SCENARIOS

Aim

Estimate the benefits for the economy, society, and the environment that come with a transition to the circular economy, and in particular the realisation of the developed scenarios.

Suggested approach

The economic, health, and environmental benefits can be calculated using the *City benefits tool* (xls file included in *City Analysis Guide* download file). The table is available for cities to conduct quantitative analysis and estimate benefits. Instructions on how to use the benefit factors contained in the table are included in the *City benefits tool.*

The scenario improvement data is obtained by applying the scenarios to the current numbers. Please note that this model estimates the benefits using global averages. If local factors are available (e.g. reduction in carbon emissions due to the application of regenerative agriculture at the local level, local market value of one tonne of food purchased in stores), these should be used.

IMAGE CREDITS

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