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Brief

# Circular Cities – Urban metabolism and circular economy as a planning approach to building resilient cities and territories

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## Abstract

**FEEM Policy Brief**

After the adoption of the 4th Circular Economy Package by the European Commission, become very important that cities use the resources circularly. In the last century, urbanization and consumption model have built unlimited cities and societies. Without considering the finite resources, the paradigm of the linear economy (production-consumption-waste) has built unsustainable cities and societies. Urban Metabolism and Circular Economy are interesting approaches that can help planners and decision-makers to re-think and re-design future cities and their relations whit rural and peri-urban areas. Understanding how flows of materials and energy shaping urban space, society, and governance system is the first step to construct cities able to close the cycles and become sustainable and resilient also in face to the climate change challenge.

# 01 Introduction

The Circular Economy Package (adopted by the E.U. in 2015) has been completed after three years. In March 2019, the E.U. adopted a report on the implementation of the Circular Economy Action Plan and its specific 54 actions (E.C. 2015). This action plan promoted a systemic approach across entire value chains. It mainstreamed circular principles into plastic production and consumption, water management, food systems, and the management of other specific waste flows. It underline future challenges towards circular economy construction and towards a climate-neutral economy where pressures on natural resources and ecosystems are minimized. However, no relevance is given to cities as a collector of resource flows. Cities consume 75% of global resources and generate 50%-80% of the world's greenhouse gas emission and half of all global waste that affects locally and globally. At the same time, cities also offer real opportunities for improving resource efficiency and reducing environmental impacts. Actions taken at the municipal level have the potential to achieve more sustainable goals because closely linked with the territory and the city planning. In the last years, two main approaches have gained visibility to which several policies of resource efficiency, waste reduction, and zero land consumption are associated : the circular economy (C.E.) and urban metabolism (U.M.). Both are firmly centered on a change in paradigm from an unsustainable, wasteful linear model to one that is more circular, representing a closed-loop.

# 02 Circular Economy and Urban Metabolism approach

The circular economy (C.E.) is not a completely new approach, but it has had a revival after the E.U. adoption of the Circular Economy Package. In 2012, the EllenMacArthur Foundation introduced the concept of a C.E. and defined it as "an industrial economy that is restorative or regenerative by intention and design" (E.M.F., 2013). It means that CE is an economic model aimed at the efficient use of resources, minimizing/eliminate waste, promoting long-term value, closing the loops of products, and considering the environmental protection and socio-economic benefits. There are no wastes associated with C.E.; there are only secondary

raw materials ready for a new life process (fig. 1). A CE has the potential to lead to sustainable development while decoupling economic growth from the negative consequences of resource depletion and ecological degradation (Murray et al., 2017; Hofmann, 2019).

On the one hand, C.E. appears as a positive approach, able to address environmental and economic challenges. On the other hand, it shows criticisms and limits. One of these limits is given by C.E. open interpretation, that despite the growing interest and literature remains in its infancy, with several fundamental open questions (Ghisellini et al., 2016; Morseletto, 2020). In terms of scientific research, C.E. can appear vague and based on a fragmented collection of ideas extracted and combined from different fields, while in terms of empirical applications, limits are posed by spatial, temporal, governance, managerial aspects (Lucertini and Musco, 2020). C.E. is discussed primarily in the economic and production field, and it remains an economic issue. As a result, there is limited consideration of the spatial dimension and, thus, of the C.E. impacts on cities.

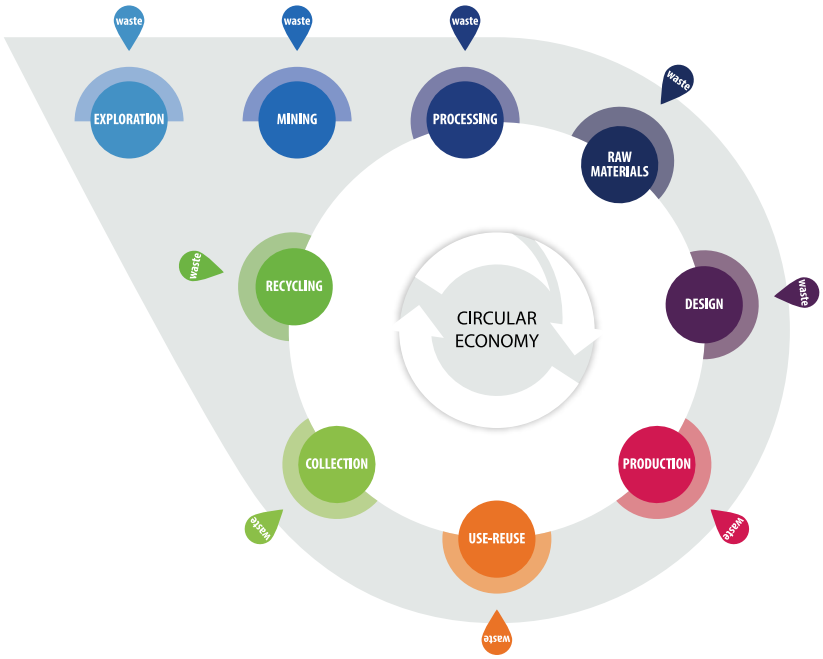


**Fig. 1.** *Circular Economy approach (Lucertini and Musco, 2020)*

Also, the urban metabolism (U.M.) approach, like C.E., is not really new. U.M. has re-emerged in the last ten years, but its origins date back to the 60s. U.M. concept is usually attributed to Abel Wolman, that studies for the first time the flows of material, energy, food, and waste to a hypothetical city. U.M. approach is based on a metaphor that conceptualizes cities as living organisms that need resource inputs and that produce waste as outputs. One of the most known definitions is “the total sum of the technical and socio-economic processes that

occur in cities, resulting in growth, production of energy, and elimination of waste" (Kennedy, 2007), where the considered flows are of natural and industrial materials, energy, people, and information (fig. 2).

U.M. approach has a theoretical conceptualization with a strong relation with urban planning and management (Thomson and Newman, 2018).

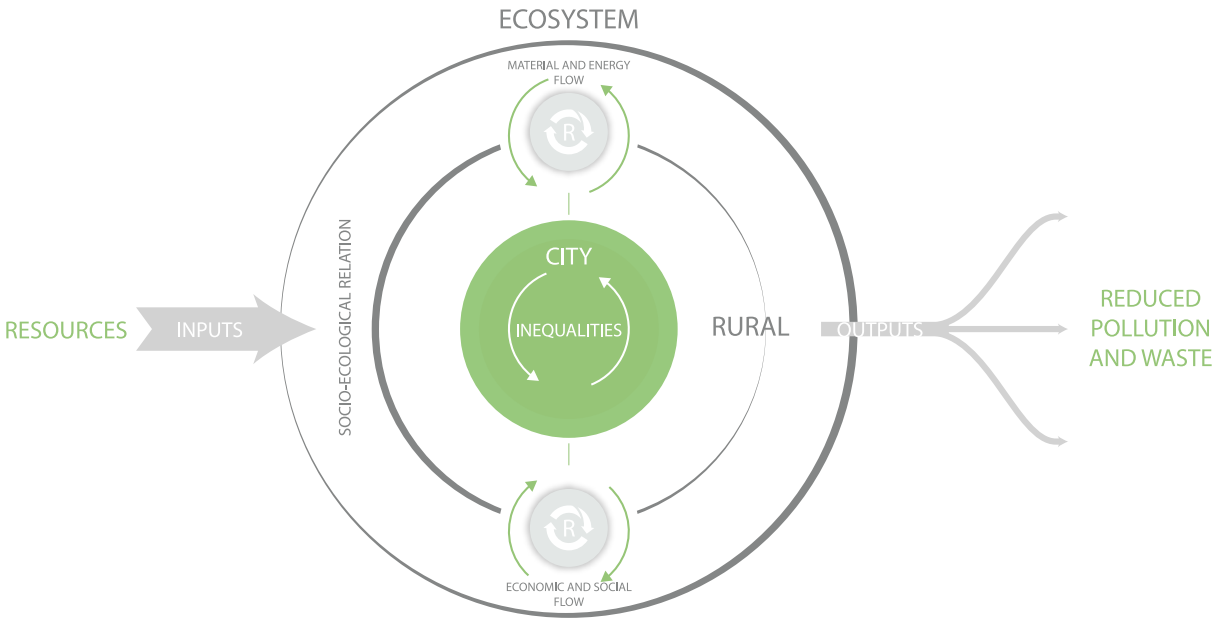


**Fig. 2.** *Urban Metabolism approach (Lucertini and Musco, 2020)*

Until now, it has been studied primarily using accountability methods. These studies aim to generate quantitative knowledge of urban flows. These quantitative methods could account for material or energy flows in cities and city-regions or could provide indicators to understand the changes in resource use considering the relations with the ecosystem and the environmental impacts. There are several examples of studies that try to measure the metabolism of cities (e.g., Niza et al. 2009; Zhang et al. 2013; Hoekman and von Blottnitz, 2017; Arora et al., 2019). Such studies contribute to increasing knowledge of how resource flows, and it has been identified at least three reasons why studying the material flows in cities: (i) to provide a baseline for future work; (ii) to identify the significant flows with regards to weight and value, and (iii) to address how best to tackle the issues arising with a reduction in the availability of these resources (Lee et al., 2016).

However, U.M. and urban planning should be even more connected and related to resource flows because they have a substantial impact on the physical structure and buildings of cities and the location of its services. Flows have a spatial and temporal dimension that in planning has to be considered, not just the economic one.

# Policy Conclusion

Considering the growing complexity of the urban system, traditional urban theories appear to be ineffective and inappropriate, while U.M. and C.E. are two approaches that arise as an excellent opportunity for urban planning. Resource flows, wastes, second raw materials have a physical impact on the cities, due to their spatial and temporal dimensions. U.M. and C.E. can benefit from each other if adopted simultaneously. In particular, C.E. activities can be intended as practical measures to achieve more sustainable urban metabolisms, able to connect economic activities with urban services and urban development. Moreover, several authors emphasized that the implementation of C.E. principles can greatly contribute to the achievement of sustainable development in the U.M. context (Cui, 2018; Voskamp et al., 2017).

C.E. and U.M. approaches could be useful to achieve sustainability within the cities, they must be considered within a supportive economic system—an economic system that champions new business models, technological innovation, and logistical and behavioural change.

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