

# CHALLENGES TO THE CIRCULAR CITY: CONCEPTUAL REMARKS ON INDUSTRY-RETAIL-URBAN SYMBIOSES

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**Abstract** - This article discusses critical integrative and symbiotic aspects of local circular economy policy. We start by a brief introduction to primary ontological layer of urban circularity known as urban metabolism, proceed to its connection with economic sectors, and as a final step address urban circularity as a local policy making issue. Our aim is to provide conceptual and theoretical views of the idea of circular city. Our discussion reveals that understanding the local level CE policy agenda and its challenges requires multi-level and multi- sectoral view of circular city. We argue that the idea of an industry-retail-urban symbiosis contains significant heuristic value in the making of a circular city, as it provides conceptual framework for understanding the multi- sector and multilayered nature of urban circularity.

**Keywords** - Circular City, Circular Economy, Urban Metabolism, Urban Governance, Tampere, Finland

## I. INTRODUCTION

Ecological concerns have increased tremendously within the last three decades due to climate change and a host of other issues, such as ozone layer depletion, air pollution, overpopulation, marine plastic pollution, loss of biodiversity, and deforestation. One of the generic approaches to mitigate human generated environmental problems revolves around circular economy, which aims at eliminating waste through reduce, reuse, recycle, and similar activities.

This paper clarifies critical conceptual aspects of the local circular economy (CE) policy, including the fundamental ontological layer of the circular city, its connection with organized economic activities, and lastly local policy making that aims at changing them in the pursuit of politically decided CE goals. Our aim is thus to build an integrative view of the layers and sectors associated with local CE.

Methodologically, this article presents a theoretical analysis of the connections between urban metabolism and the categories of organized human activity in the context of CE policy [1]. Our analysis utilizes a critical review of relevant literature [2]. Theoretical discussion relies on formal reasoning that is combined with heuristic approach to policy analysis [3, 4]. This paper represents a theoretically oriented part of the research agenda of the VATACO Project established jointly by the City of Helsinki and Tampere University for 2022-2025 funded by the academy of Finland.

## II. ENVIRONMENTAL IMPERATIVE

Cities are open subsystems of the materially closed ecosphere [5]. This is a premise that conditions urban life and points to one of the key premises of urban sustainability agenda.

Cities as dissipative structures are nexuses of flows of matter and energy [6]. The concept of urban metabolism refers to the very same idea. In such a model energy needed to power devices, maintain infrastructures, and provide heating, and materials used primarily in constructing buildings and infrastructures and creating products, are needed to build and maintain the support structures, utilities, and services to sustain urban functions [7].

The metabolism of social-ecological systems reflects the interaction of the economic process with the biosphere [8]. In the metabolic processes the catabolic part takes place in the primary production sectors of the economy, while the activities of the anabolic part take place in the remaining sectors of the economy, as illustrated in Figure 1 [9].

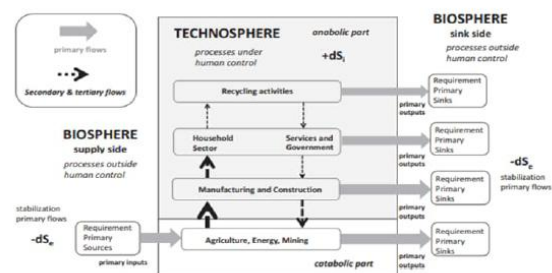


Figure 1. Biosphere, technosphere, and economic sectors.  
(Source: [9] p. 42.)

From the point of view of atmospheric environmental policy and governance, our challenge is ultimately to design the benign coordinated interaction between the economy and the atmospheric environment so that bilateral enhancement is possible [10].

## III. URBAN CIRCULAR ECONOMY

The idea of circular economy is seen as an antidote to take-make-waste pattern of the economy that depletes our natural resources. The understanding of

dissipative structure and urban metabolism is a theoretically grounded view of identifying such resource flows. Circular city discourse is built on such a fundamental layer of urban circularity [11].

The essence of a circular city revolves around the idea of eliminating waste. When taking the governance view into account, we may define circular city as “a city that practices CE principles to close resource loops, in partnership with the city’s stakeholders (citizens, community, business and knowledge stakeholders), to realize its vision of a future-proof city,” as formulated by Prendeville and others ([12], p. 187). This is a policy area in which city governments at times have to rely on persuasion rather than dictation in order to involve local manufacturers, distributors, retailers, consumers, and other stakeholders.

The primary focus in circular economy has been on businesses, as they affect circularity through industrial systems [13]. This encompasses a broad group of industries with varying relations with urban circularity. Especially manufacturing has a vital role in this discussion as manufacturing industries are heavy resource users and CO<sub>2</sub> emitters [14]. The other primal side of the urban metabolism is the material and carbon footprints of households [11].

Regarding household consumption, food, housing, and transport are hotspots of both material and carbon footprints. There is some evidence to claim that with consistent CE strategies and action plans cities may considerably mitigate their material and carbon footprints [15]. Regarding the role of city governments, Lakatos and others have claimed that cities play a focal role in facilitating the transition towards circularity especially through the closing of the loops, recirculation, technical innovation, policy elaboration, and citizens’ support [16].

#### **IV. ASPIRATIONAL VISION FOR MULTISECTOR SYMBIOSES**

CE policy is drastically different in different economic sectors and activity areas. Let us take a brief look at here examples of such areas, those of manufacturing, retailing, and housing.

The issues related to manufacturing have attracted a lot of attention in the CE discourse. While manufacturing companies have been instrumental in improving standard of living on a global scale, they are also linked to unsustainable production, logistics, and consumption patterns. Especially the production of such materials as cement, steel, plastics, and aluminum, account for the bulk of total emissions from industry. On the other hand, here are business sectors that diversify and specialize in CE-related businesses from waste management to a range of

relevant activities, including repair, maintenance, recycling, and the development of new materials. This has given impetus to aspirational views of industries’ ability to improve the efficiency of the use of resources, as depicted in the idea of inclusive and sustainable industrial development (ISID). This leads us to a broader view of production side of CE. It is not only about narrowly defined industrial production and the emergence of manufacturing model known as re-distributed manufacturing (RdM) [17], but a broader view of urban manufacturing [18] and the industrial transformation with critical connections to its societal context [19].

This development has its spatial dimension that has attracted attention in the promotion of CE. Just as industrial parks emerged several decades ago to facilitate industrial production and science parks to facilitate high-tech industries, eco-industrial parks (EIPs) emerged recently to speed up transition towards CE [20, 21, 22]. Such a transition requires a systemic change in the design of products, business models, and supply chains, as depicted in the idea of integrated industrial system known as industrial symbiosis [23]. Such a symbiotic approach lies at the heart of the formation of EIPs [24, 25, 26]. The most well-known example of such a symbiosis is arguably Kalundborg in Denmark [27]. The idea is that by sharing by-products – especially materials, energy, and water – manufacturers are able to bring about economic and environmental benefits [28]. On the other hand, in many EIPs such a symbiosis is not attained, and there are a lot of industrial parks in which the principles of CE do not play any role [29]. In short, EIPs are not an ultimate solution to environmental problems, but rather a meso-level environment that makes it possible for individual companies to improve their sustainability [30].

Sustainability has emerged in retailing with a general aim of reducing the negative impact of products on people and environment through the supply chain. There is a pressure from consumer side, for according to some reports over 90 % of consumers globally expect brands to support social and environmental issues [31]. Sustainable supply chain management (SSCM) has a close association with circular economy. It challenges the unidirectional flow of materials and products by paying attention to bidirectional or multidirectional flows amongst members of the supply chain. The aim is to “close the loop” by utilizing the idea of reverse supply chain, which enables the reverse flow of materials among channel members, thus creating a connecting with the 3R’s at the very core of the circular economy, i.e. with reducing, reusing, and recycling materials whenever feasible. Interestingly, retailers have a critical role in this setting due to their position as a linkage between the upstream and downstream actors in the supply chain [31]. Discussion that takes this

view further directs attention to the industry-retail symbiosis [32].

Urban settlements need housing and other facilities in order to make life in densely populated areas feasible, comfortable, and sustainable. The promotion of CE in such a context is important as cities are wasteful in terms of resource consumption. CE offers a conceptual framework for addressing such an issue through urban planning, construction, and directing residential lifestyle towards closedloop thinking. However, such regenerative and restorative urban systems are developing surprisingly lowly [33]. The meso-level context of the housing is a neighborhood level development, which can be used as an entry point for change as cities strive for CE transition [34]. One of the ultimate goals is to build a symbiotic urban neighborhood [35].

Previous discussion opens a hypothetically synergistic view of three realms of circularity that in the first instance extends conventional industrial symbiosis to industry-retail symbiosis, and further connects it through residential functions and consumptions to a wider urban setting, thus encompassing practically all essential urban functions [36, 37, 38]. Such a view can be called industry-retail-urban symbiosis that has a potential to provide a heuristic view of the symbioses at the intersections of major economic sectors, organized social activities, and urban functions.

## V. THE RELEVANCE OF LOCAL CE AGENDA

The circular economy is implemented through three circles [39, 40]. The first circle includes micro-level processes, which revolve around corporate-level initiatives such as sustainable manufacturing, waste minimization, and environmental management systems (EMS), and a range of consumer-oriented solutions, such as prosumption (production + consumption), community sharing, and repair cafés [41]. The second circle is about meso-level processes that operate at the inter-firm level, of which good examples are EIPs. The third circle is macro-level concept of circular economy, which operates at the level of holistic and complex social processes of a larger society. Cities as the loci of innovation, commerce, production, consumption, and power form geographical concentrations with a unique position in promoting circular economy. They serve as integrators of values within such a multi-sector and multi-layered setting. In the spatial CE policy this includes whole-of-city approach to CE policy, as illustrated by the eco-city concept [42, 43].

Local CE agenda implies that there may be a potential tension between global, macro-regional or national policies and local solutions that may rely on pragmatic mix of linear and circular economies. Even

in such a case local focus has its relevance. Local policy making is justified by such factors as the “stickiness” of local knowledge, urban scale, ability to engage stakeholders within the given area, adopting different governance models, facing urban problems that can be addressed locally, and availability of relevant benchmarks [44]. There are, thus, several factors that justify the locality-based approach to the promotion of CE.

Lakatos and others [16] have pointed out that there are several alternative definitions for circular cities, which increases ambiguities in local CE policies. The other important observation is that successful implementation of the CE agenda requires efforts at different institutional levels, which poses an obvious challenge to local governance. Furthermore, circular cities are based on fundamentals of circular economy [45], which means cities need to articulate its CE policies in a conceptually fuzzy field the way that resonates with the views of local stakeholders. Stakeholder involvement is, in any case, a key to the success of the implementation of local CE policies [16]. In spite of all good intentions, cities face persistent challenges in their strive to become fully sustainable. It seems that circular economy practices require both technological and managerial improvements in order to be effective [12, 46].

## VI. CONCLUSION

Understanding the local level CE policy agenda and its challenges requires an integrated multi-level and multi sector view of a circular city. The challenges of circular city research include the search for conceptual clarity, the availability of relevant data on urban metabolism, determining policy priorities in a conceptually fuzzy field, learning about the role of stakeholder engagement, and understanding the issues of the implementation of CE policy.

A particular issue addressed in this article worth a closer look is the industrial-retail-urban symbioses, which may be one of the preconditions for the breakthrough in the local CE policy. This is one of the areas we wish to shed light on in our future research through a series of small-scale empirical analyses and case studies that combine industrial, retail, and residential functions of a city.

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