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REVIEW NOTES – Economy, business and land use

Circular economy in urban areas: evidence from global cities

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Abstract
Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always following a rigorous scientific in-depth analysis. This section of the Journal, Review Notes, is the expression of a continuous updating of emerging topics concerning relationships among urban planning, mobility and environment, through a collection of short scientific papers. The Review Notes are made of four parts. Each section examines a specific aspect of the broader information storage within the main interests of TeMA Journal. In particular, the Economy, business and land use section aims at presenting recent advancements on relevant topics that underlie socio-economic relationships between firms and territories. The present note aims at addressing the issue of circular economy in urban contexts describing theoretical approaches and identifying best practices from cities across the world.

Keywords
Circular economy; Cities; Net zero; Waste reduction.

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1. Introduction

Circular economy is a rapidly emerging concept in the field of urban studies that seeks to create a more sustainable and efficient system for resource management (Guida & Caglioni, 2020; Petit-Boix & Leipold, 2018). It is a regenerative approach that aims to minimize waste, optimize resource use, and increase the longevity of products and materials. In this research note, we will provide an overview of circular economy in urban studies, its principles, and its potential applications. Circular economy is based on three core principles: designing out waste and pollution, keeping products and materials in use, and regenerating natural systems (Christensen, 2021). The first principle focuses on reducing waste and pollution by designing products and materials that can be easily reused or recycled. The second principle emphasizes the importance of extending the life of products and materials through repair, refurbishment, and remanufacturing. The third principle involves regenerating natural systems by restoring ecosystems, protecting biodiversity, and reducing carbon emissions (Pilogallo et al., 2019). Urban areas are particularly well-suited for the implementation of circular economy principles. Cities are centers of economic activity, and they generate significant amounts of waste and emissions (Tira, 2020). However, they also offer opportunities for collaboration and innovation that can drive circular economy solutions. For example, urban areas are home to large concentrations of consumers and businesses that can participate in circular economy networks, such as sharing platforms and product-service systems (Williams, 2019). They also offer a diverse range of waste streams, such as food waste and construction materials, that can be repurposed or recycled. Circular economy in urban studies has numerous potential applications (Wang et al., 2018). For example, circular economy principles can be applied to the design of buildings and infrastructure to reduce waste and energy consumption. Materials used in construction can be selected for their recyclability, and buildings can be designed to incorporate renewable energy sources and to maximize energy efficiency. In addition, circular economy principles can be applied to waste management systems to increase the recovery and recycling of materials. Innovative approaches to waste management, such as waste-to-energy technologies, can also help to reduce the amount of waste sent to landfills. Thus, circular economy is a promising approach for achieving more sustainable and efficient resource management in urban areas. It offers opportunities for collaboration and innovation that can help to reduce waste, optimize resource use, and regenerate natural systems. As cities continue to grow and face increasing environmental challenges, circular economy principles can play an important role in creating a more sustainable and resilient urban future (Pirlone & Spadaro, 2020).

2. Approaches to circular economy in cities

The circular economy in cities is a complex and multifaceted concept that draws on several theoretical frameworks (Corvellec et al., 2022). Some of the key theoretical frameworks that underpin the circular economy in cities include: Urban Metabolism (Kennedyt al., 2011), Industrial Ecology (Petit-Boix & Leipold, 2018), System Thinking (Bassi et al., 2021), Social-Ecological System (Folkeet al., 2005), Service Dominant Logic (Ekman et al., 2019). Urban metabolism is a framework that views cities as complex systems that consume resources and produce waste. The circular economy in cities aims to reduce the resource consumption and waste production of cities by creating closed-loop systems. Industrial ecology is a framework that views industrial systems as ecosystems that can learn from natural ecosystems. The circular economy in cities draws on this framework by promoting the use of waste as a resource, mimicking natural systems in which waste is used by other organisms in the ecosystem. Systems thinking is a framework that views systems as interconnected and interdependent. The circular economy in cities draws on this framework by promoting the creation of circular value chains, where waste from one business becomes a resource for another business. Social-ecological systems is a framework that views the interactions between social systems and ecological systems as interdependent. The circular economy in cities draws on this

framework by promoting the creation of circular systems that are socially and environmentally sustainable. Service-dominant logic is a framework that views economic systems as focused on the creation of value for customers through services rather than the production of goods. The circular economy in cities draws on this framework by promoting the creation of circular business models that focus on providing services rather than selling products. These theoretical frameworks provide a basis for understanding the circular economy in cities and its potential benefits for sustainability, economic development, and social well-being. They help to identify the challenges and opportunities associated with transitioning to a circular economy in cities and guide the development of strategies and policies that can promote this transition. In the following boxes we provide some practical applications of these approaches to different urban contexts. In particular, we describe circular economy strategies of Seoul, Ljubljana, and Rotterdam.

Seoul

Seoul, the capital city of South Korea, has implemented a range of circular economy initiatives aimed at reducing waste, promoting sustainable production and consumption, and creating a more resource-efficient city. Among other initiatives, the city of Seoul implemented:

- food waste recycling: Seoul has implemented a program to convert food waste into biogas, which is used to generate electricity and heat. The city has installed food waste collection systems in apartment buildings and other public facilities, and the collected waste is then transported to biogas plants for processing. This program has significantly reduced the amount of food waste sent to landfills and has helped to create a new source of renewable energy for the city;
- sharing economy platform: Seoul has launched a sharing economy platform called "ShareHub," which connects individuals and businesses to share resources and services. The platform includes a range of services, such as shared workspaces, tool libraries, and car sharing services. By encouraging resource sharing, the platform helps to reduce waste and promote a more sustainable and resource-efficient city;
- upcycling: Seoul has implemented a program to upcycle waste materials into new products. The program includes initiatives such as "upcycling villages," where local artisans create new products from waste materials such as plastics, textiles, and metal. The upcycling program helps to reduce waste and promote sustainable production practices;
- circular economy education: Seoul has implemented a range of educational programs to raise awareness of the circular economy and promote sustainable production and consumption practices. These programs include workshops, seminars, and other educational events aimed at businesses, students, and the general public.

Overall, Seoul's circular economy initiatives demonstrate the city's commitment to creating a more sustainable and resource-efficient urban environment. By implementing programs such as food waste recycling, sharing economy platforms, and upcycling initiatives, the city is reducing waste, promoting sustainable production and consumption, and creating a more resilient and sustainable city for its residents.

Ljubljana

Ljubljana, the capital city of Slovenia, is a leading example of circular economy principles being implemented on a city-wide scale. In 2017, Ljubljana was awarded the title of European Green Capital in recognition of its efforts to promote sustainability and implement circular economy principles. One of the key initiatives implemented by Ljubljana is its "Zero Waste" program, which aims to divert all waste from landfills by 2025. The program includes a range of measures to reduce waste generation, increase recycling, and promote composting. For example, the city has implemented a system of separate waste collection, with separate bins for organic waste, paper, plastic, metal, and glass. The city also provides residents with composting bins and organizes educational programs to promote composting. Ljubljana has also implemented a number of initiatives to promote sustainable consumption and production. The city has developed a circular economy strategy that includes measures to promote sustainable tourism, reduce resource consumption in construction, and support sustainable procurement practices. The city also supports a range of circular business models, including sharing and rental services. Another key initiative implemented by Ljubljana is the renovation of its historic city center. The renovation project, which was completed in 2018, included the implementation of energy-efficient lighting, the installation of green roofs and facades, and the use of sustainable building materials. The project also included the installation of a district heating and cooling system, which uses waste heat from a nearby waste-to-energy plant to provide heating and cooling to buildings in the city center. Overall, Ljubljana's circular economy initiatives demonstrate that it is possible to implement circular economy principles on a city-wide scale. The city's Zero Waste program, circular economy strategy, and sustainable building renovation project are just a few examples of the innovative initiatives that have been implemented. These initiatives have helped to reduce waste, promote sustainable consumption and production, and create a more resilient and sustainable city.

Rotterdam

Rotterdam is a city that has been at the forefront of the circular economy movement. The city has implemented various initiatives to promote a circular economy, such as:

- Rotterdam Circular: This is a platform for businesses, organizations, and citizens to collaborate and share knowledge and resources to promote a circular economy. The platform offers various services, including circular procurement advice, circular design support, and circular innovation.
- BlueCity: This is a business park that is dedicated to the circular economy. It is a hub for innovative businesses that focus on circular design, circular production, and circular business models. BlueCity aims to create a closed-loop system where waste from one company becomes the input for another company.
- Circular Buildings: Rotterdam is promoting the construction of circular buildings that are designed for disassembly, reuse, and recycling. The city has set a target to make all new buildings in Rotterdam circular by 2050.
- Circular Food: Rotterdam has launched several initiatives to promote a circular food system. For example, the city has set up urban agriculture projects, such as rooftop gardens, and it is promoting the use of food waste as a resource.
- Waste-to-energy: Rotterdam has several waste-to-energy plants that convert waste into energy. The city is also exploring the use of other waste-to-product technologies, such as chemical recycling and biorefining.
- The Circular Hub is an initiative in Rotterdam that aims to accelerate the transition to a circular economy by connecting businesses, entrepreneurs, and researchers. It is a physical space located in the city center where circular economy stakeholders can meet, network, and collaborate on circular projects. The Circular Hub was launched in 2019 by Rotterdam Partners, a not-for-profit organization that promotes the economic development of Rotterdam. The hub offers various services to its members, including access to funding, mentoring, and matchmaking events. One of the key objectives of the Circular Hub is to facilitate the creation of circular value chains. This involves connecting businesses that produce waste with businesses that can use that waste as a resource. By creating these circular value chains, the hub aims to reduce waste and create new economic opportunities. The Circular Hub also provides a platform for circular innovation. It hosts events and workshops to promote knowledge-sharing and collaboration between circular economy stakeholders. The hub has a circular innovation lab where entrepreneurs can experiment with circular business models and develop new circular products and services. In summary, the Circular Hub is an important initiative in Rotterdam's circular economy ecosystem. It plays a vital role in connecting circular economy stakeholders and promoting circular innovation and value creation.

3. Conclusion

Circular economy in cities is a growing body of literature and an increasingly relevant issue in practice. The abundance of theoretical approaches and the growing number of best practices offer new perspective on how to develop sustainable practices in cities aimed at achieving the net zero goal. To this aim, the joint work of urban stakeholders, i.e., administrations, firms and citizens is fundamental to create closed loops aimed at reducing wastes and optimizing the use of natural resources that could create sustainable urban environments.

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