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The Impact of Waste production on Sustainability and the Metabolism of a City

Voukkali Irene^{1,2}, Antonis A. Zorpas²

¹ Institute of Environmental Technology and Sustainable Development,
Department of Research - Development, Paralimni, Cyprus, voukkei@yahoo.gr

² Cyprus Open University, Faculty of Pure and Applied Sciences, Environmental
Conservation and Management, Laboratory of Chemical Engineering and
Engineering Sustainability P.O.Box 12794, 2252, Latsia, Nicosia, Cyprus; +357-
22411936, antonis.zorpas@ouc.ac.cy, antoniszorpas@yahoo.com

Introduction

- ▶ Today cities face challenges concerning growth and urban concentration, competitiveness, and residents' livelihoods
- ▶ The rapid expansion has been accompanied by increased energy flows of inputs and outputs such as fuel, food, waste and electricity that enter, exit and/or accumulate within the external of the city boundaries
- ▶ Cities allocate about 50% of world's population, and it is expected that this number will increase up to 80% in the upcoming years
- ▶ According World bank the world's urban population will be double from 2010 (2.6 billion) to 2050 (5.2 billion)

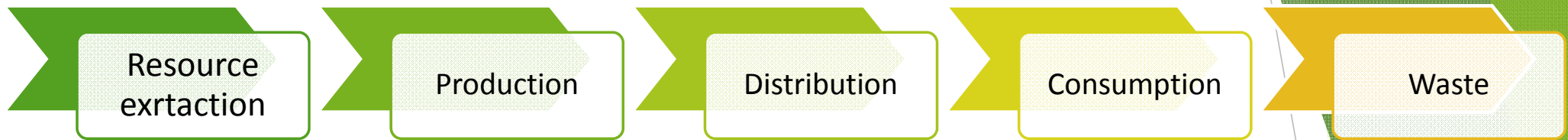
Waste generation

- ▶ The urban territory is responsible for **a high percentage of natural resources consumption and waste generation**
- ▶ According to the latest official Eurostat statistics, the total waste generation in the EU-27 was more than 2.62 billion tn.
- ▶ At the same time World Bank's report (2012) focuses on waste generation indicated that in all Regions we will have a continual waste amounts and the per capital waste production varies from **0.77 Kg/day for SAR** (South Asia Region) to **2.1 Kg/day for OECD** (Organisation for Economic Co-operation and Development, region)
- ▶ Furthermore annual increasing rate of **Municipal Solid Waste (MSW)** **is about 2 billion tn.**
- ▶ Besides the explosive growth in the weight and volume, the composition of the MSW is becoming more and **more complex**

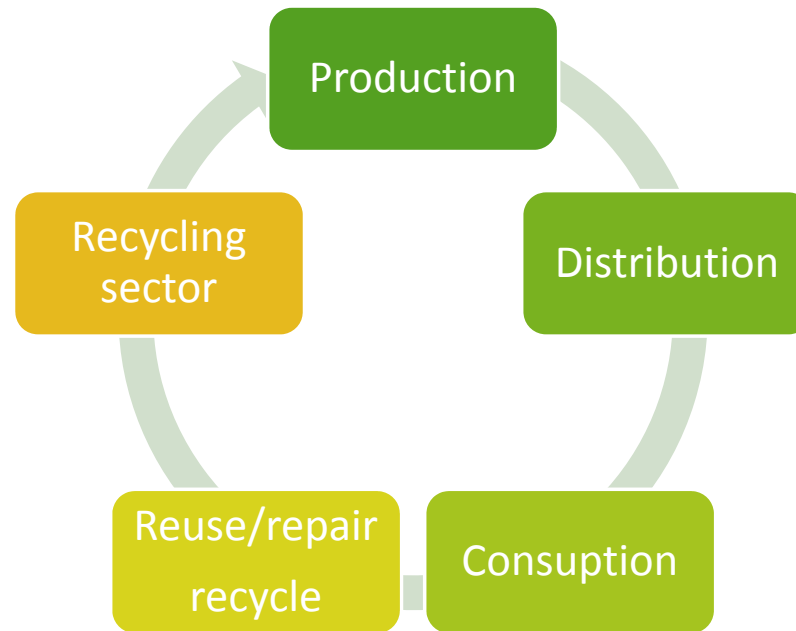
Sustainable urban metabolism as a framework for Circular economy

Over the last decade rising attention has been paid worldwide, with the aim to provide a **better alternative** to the dominant linear economic development model (*produce - use - throw*)

Circular economy is an opportunity for countries to improve waste management through the use of all sorts of materials contained in waste, and their introduction back into productive use in the economy



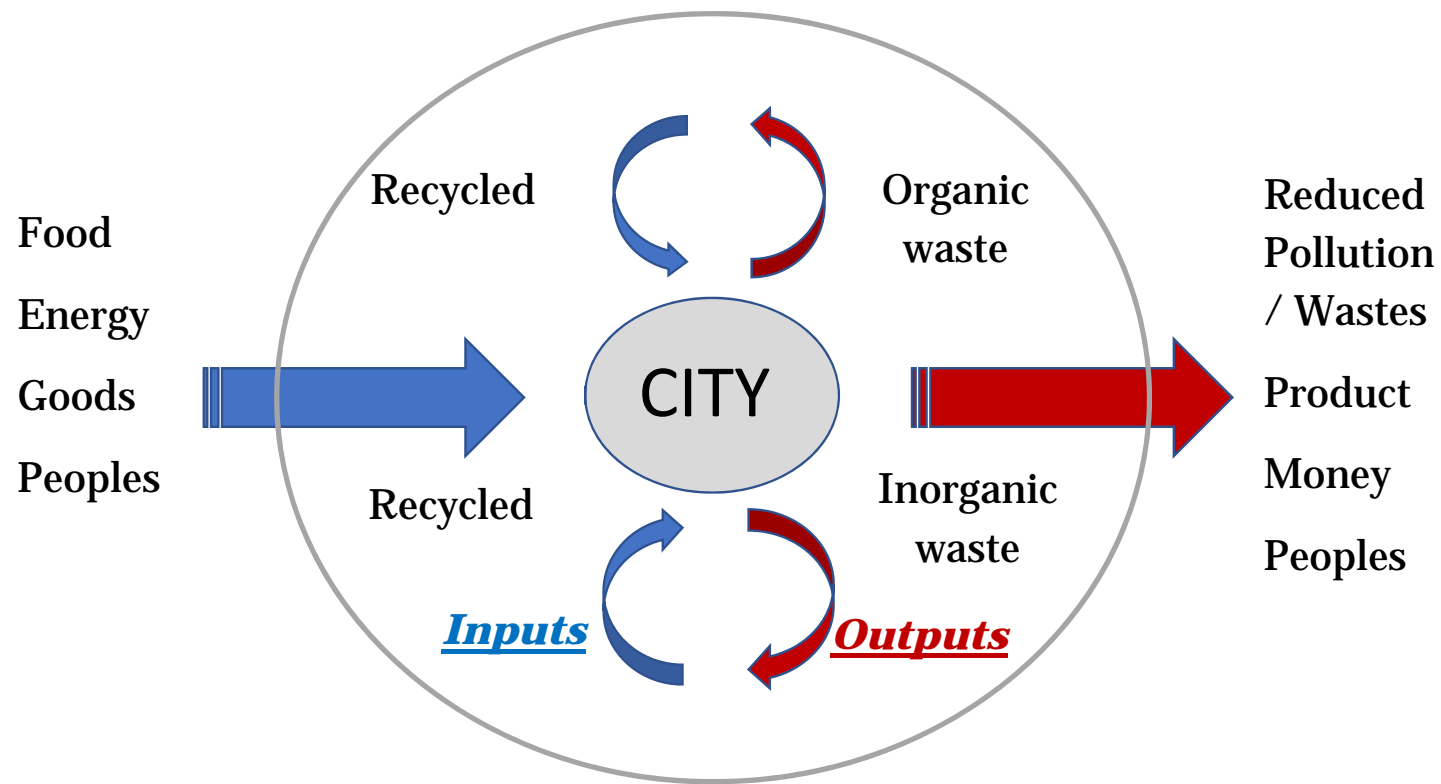
linear economic model Vs circular economy model



Sustainable urban metabolism as a framework for Circular economy

The concept of the urban metabolism, conceived by Wolman (1965), **is fundamental to developing sustainable cities and communities** and can be defined as “the sum total of the technical and socio-economic processes that occur in cities, resulting growth, production of energy, and elimination of waste”

Is a multi-disciplinary and integrated platform that examines material and energy flows in cities as complex systems as they are shaped by various social, economic and environmental forces



The concept of urban metabolism

Sustainable Waste management system

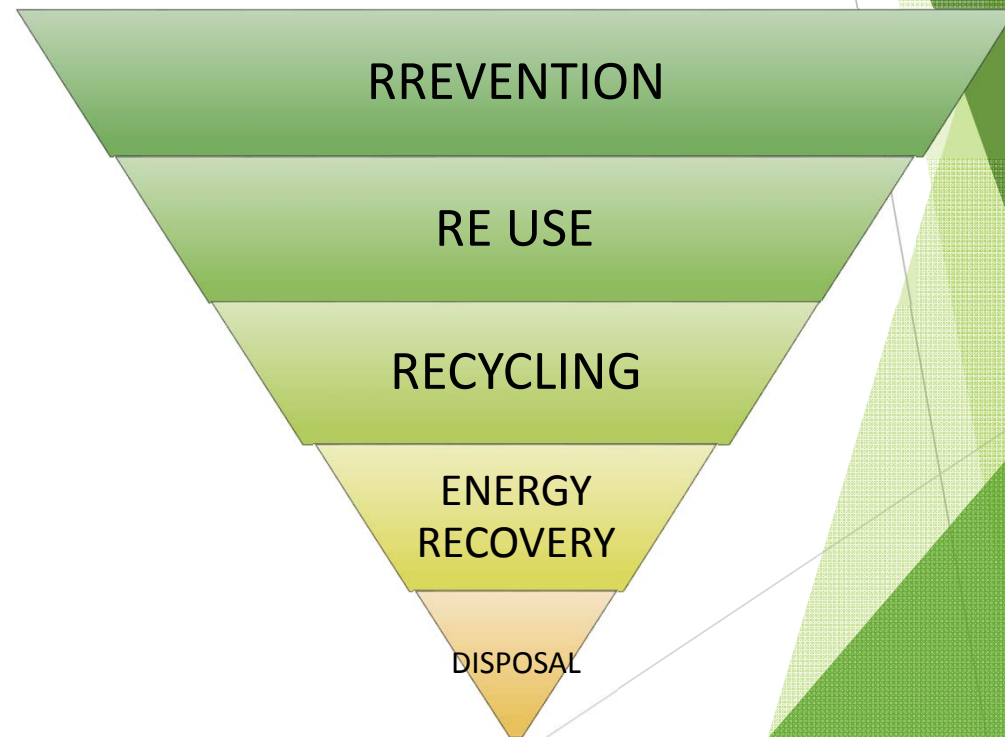
Waste management is one of the key subsystems of urban metabolism and is causing increasing concern due to emissions (leachate, methane, heavy metals) into soil, water and air, as well as social conflicts around disposal sites and loss of resources and energy.

Those impacts are enlarged by a) demographic changes, b) economic growth, and c) the increasing difficulty of technological solutions.

Sustainable Waste management system

Article 4 of the revised EU Waste Framework Directive (Directive 2008/98/EC) sets out five steps for dealing with waste, ranked according to the environmental impact.

The Waste Hierarchy gives priority to preventing the production of waste in the first place. When waste is produced, it gives priority to preparing it for re-use, recycling, other recovery and disposal, in descending order of environmental preference



Sustainable Waste management system

In line with the Waste Framework directive, CE mainly emerges in the literature through three main actions, the so called

3R's Principles: Reduction, Reuse and Recycle

CE provides a reliable framework towards improving the current business model towards preventive and regenerative eco-industrial development as well as increased wellbeing based on improved environmental integrity.

Sustainable Waste management

Effective and efficient MSW management has been widely accepted as an emergent factor

An integrated MSW management should take into consideration the goals of the **CIRCULAR ECONOMY (CE)** according to the framework of **SUSTAINABLE URBAN METABOLISM (UM)**.

Conclusion

Cities play a crucial role as instruments of the economy, as places of connectivity, creativity and innovations

Due to their density, cities compromise a huge potential for energy savings and a move towards a carbon-neutral economy

Cities are also places where problems such as unemployment, segregation and poverty are concentrated and moreover, the increase of energy flows of inputs and outputs such as fuel, food, waste and electricity

Conclusion

MSW is experiencing an immense increase in **both the amount and composition** throughout the world.

Municipalities have the challenge to provide an effective and efficient system to the inhabitants and also to face problems due to lack of organization, financial resources, complexity and system multi dimensionality

Conclusion

The study of urban metabolism and the use of it as a framework for circular economy consists a **crucial key** in the undertaking of the rapidly increased waste production. There is an urgent need to improve the understanding of cities and their metabolism, however, is hard-pressed not only by the social relevance of urban environments, but also by the availability of new strategies for city-scale interferences.

To apply this approach is need for a scientific understanding of cities that considers the built environments and the people who inhabit them.