# WASTE MANAGEMENT IN THE CONTEXT OF A CIRCULAR ECONOMY

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**Abstract:** The closed-loop economy involves improving the efficiency of waste management by increasing the amount of waste that is recovered and recycled, thereby minimising the amount of waste sent to landfill. This new economic model follows the principle of eliminating pollution at source, whatever its form.

**Keywords:** closed loop economy, circular economy, waste, benefits, principles

## Introduction

The circular economy, or circular economy, is a very valuable concept aiming at the rational use of resources and reducing the environmental impact of manufactured products, which - like materials and raw materials - should remain in the economy for as long as necessary, while the waste generated should be minimised as much as possible.

## 1. Closed loop economy

The closed-loop economy (circular economy) is a model that, instead of the traditional 'produce, use, throw away' approach, promotes 'reduce, reuse, recycle' strategies, allowing the economy to be fed by the continued use of resources. In the context of waste management and, the circular economy offers interesting perspectives.

The circular economy is a model that replaces the traditional linear structure of the economy with a more sustainable approach that focuses on reducing, reusing (after they have been processed ecologically) and recycling resources. In a circular economy, products and

materials are kept in the economy for as long as possible, while waste and resource consumption are kept as short as possible.

Here are the basic principles of the circular economy (1):

a) designing for the future - in the circular economy, products and materials are designed in such a way that they are sustainable, can be repaired, improved, and even reused to make new products. Aiming to eliminate waste from the design stage is a key element of this approach.
b) build resilience thro- ugh diversity - this principle applies not only to the biological cycle, but also to the technical cycle. The modern economy has to adapt easily to change, so there can be no single best form of action, there is a need for actors both large and small, operating locally, regionally and globally. A diverse system with many connections and operating at different scales will provide the best resistance to unexpected change.
c) circularity of products and materials - in a circular economy, the aim is to keep products, components and materials at the highest possible level of quality through practices such as reuse, repair, improvement and recycling.
d) sustainable and renewable resources - the circular economy relies on the use of renewable, safe energy sources and a biological cycle that ensures that biodegradable materials are safely returned to the environment.
e) systems thinking: think in 'systems' - the ability to see how an element interacts with the whole, and the whole with the element, and the elements with each other. however, the view of the economy should include a broader context, taking into account environmental and social impacts;
f) waste is food - again, this principle applies not only to the biological cycle, but also to the technical cycle. as far as the biological nutrients are concerned, it is important to plan for and make use of the capacity to reintroduce products and materials into the biosphere. as far as the technical cycle is concerned, it is also possible to improve the quality of the resources circulating in the economy, e.g. through upcycling

The full implementation of the above principles and their use in a circular economy can generate many benefits for any entity, whether it is a municipality or a private company. For example, benefits such as:

a) environmental benefits - the circular economy helps to reduce resource consumption, waste generation and greenhouse gas emissions. This can contribute to environmental protection and the fight against climate change.

b) economic benefits - the circular economy can bring economic benefits by tapering resource efficiency and stimulating innovation. In addition, resources can be kept in the economy for longer, which can contribute to economic stability.
c) social benefits - the circular economy can bring social benefits by means of the creation of jobs, increasing people's well-being and health and improving quality of life.

Looking at the above social, economic and environmental benefits, it is a reasonable impression that the circular economy is a model that prioritises sustainable, long-term and renewable resources, of course, in combination (without which they cannot exist on their own) with environmental, economic and social benefits.

Reducing waste generation is one of the key objectives of the circular economy. There are several strategies that can help achieve this (2):

a) green design - involves considering the environmental impact of a product at all stages of its life cycle, from design to disposal. An example might be to design products that are easy to repair orup, which extends their life and reduces the need to generate new products. In other words, it may be to use less harmful materials or production processes that reduce the generation of hazardous waste.
b) closing the material loop - Closing the material loop involves creating systems where waste is reintroduced into the production cycle instead of going to landfill. This can include strategies such as recycling, composting or energy recovery. In the case of waste, it can also mean cleaning up and reusing that waste in a safe way.
c) substitution of hazardous substances - another strategy is to replace hazardous substances with less harmful alternatives where possible. This may include, for example, the substitution of hazardous chemicals used in production processes, or the substitution of materials in products.
d) extended producer responsibility for manufactured materials/products - this approach involves assigning producers responsibility for the entire life cycle of their products, including the post-use stage. In the case of waste-generating products, this may force products to consider how to minimise the generation of this waste or how to better manage it at the end of product life.

These strategies can help to reduce the number of generating wastes, but they can also help to improve the postacification of specific policies, technologies and waste management

systems. In this context, the circular economy is a valuable tool to promote more sustainable hazardous waste management practices.

## 2. Recovery and recycling of hazardous waste in a closed loop economy

Waste can be recovered and recycled within the circular economy, taking into account available or innovative technologies and of course.

Waste recovery and recycling is an essential part of the circular economy. It is a process that involves the precise segregation, treatment and safe processing of waste for reuse. This can include techniques such as energy recovery, raw material reclamation or waste neutralisation. However, there are a number of challenges and limitations that affect how effective these processes can be.

In some cases, harmful waste can be treated to recover energy. On example, certain types of industrial waste can be incinerated in a controlled manner to generate heat or electricity. This is possible only in the case of wastes, which do not contain any substances that can be used during incineration.

In some cases, harmful waste can be treated to recover valuable raw materials. For example, some electronic waste contains precious metals that can be recovered and reused. However, this process requires specialised technology and can be costly (3).

Some harmful wastes can be treated to neutralise their harmfulness. This may involve, for example, converting chemical waste into less harmful substances that can be safely stored or used. Of course, there are various technologies that can support waste recovery and recycling. For example, the sorting technologies can help to segregate waste accurately, and the treatment technologies can help to recycle or neutralise waste safely.

Despite technological advances, there are many challenges and limitations. For example, not all harmful waste is recyclable or recoverable, and some processes can be costly. Also, legal and regulatory requirements can affect what options are available. Ultimately, effective management of hazardous waste requires an integrated approach that considers both the prevention of waste generation and appropriate recovery and recycling methods.

## 3. Waste as a valuable economic resource.

Waste is often seen as a problem to be solved, but from a circular economy perspective, it can also be a valuable resource. Here are some examples of how waste can be used as a resource (4):

- electronic waste is one of the fastest growing waste streams in the world. Many electronic components contain valuable metals, such as gold, silver, copper and platinum, which can be recovered and reused. However, the process requires specialised technology and can be expensive, but there are a growing number of companies that specialise in the safe recycling of e-waste.
- industrial waste generates harmful waste as a by-product of its activities.
- medical waste, such as needles or syringes, is often difficult to dispose of because of the risk of infection. However, there are technologies which can be used to optimise the utilisation of such waste and the recovery of energy from it.
- agricultural wastes can be potentially harmful to the environment if not properly managed. However, they can also be a valuable resource as a source of energy for methane fermentation.

Despite these challenges, proper management of the above waste can bring significant economic and environmental benefits.

A vision for the future of hazardous waste management in the circular economy may include the following aspects (5):

- development and improvement of recycling technology - as technology advances, it becomes possible to recover raw materials from hazardous waste more efficiently and economically. We can expect further developments and improvements in recycling technology, such as biological, chemical or physical methods, which will help to recover valuable raw materials from hazardous waste,
- an increase in the role of products - in the future, producers may have more responsibility for the whole life cycle of their products, including the waste management stage. This means that they will need to design their products with the whole life cycle in mind, minimise the generation

of hazardous waste and plan and implement strategies to manage it safely and efficiently,

- greater integration of the circular economy - in the circular economy, harmful waste is not just a problem to be solved, but also a resource to be used. If properly managed, harmful waste can be recycled and then reused or sold as secondary raw materials. In the future, it can be expected that more economic sectors will be integrated into the circular economy,
- evolution of regulations - as understanding of hazardous waste issues grows, it is likely that we will also see an evolution of regulations for its management. These regulations are likely to become more stringent and prevention-oriented to minimise the generation of hazardous waste and increase recycling and recovery,
- increase in public awareness - an increase in public awareness of the risks associated with hazardous waste and the benefits of managing it properly is likely to result in a greater emphasis on responsible management practices for this waste from both producers and consumers.

## Conclusion

The Closed Circuit Economy is a model that minimises the use of raw materials and the generation of waste, and has many practical benefits. It aims, of course, to reduce greenhouse gas emissions and energy use, thus creating closed loops in which the waste generated is used as a raw material in subsequent production phases. This, in turn, helps to create a sustainable, low-carbon and competitive economy, which not only serves our environment, but also reduces the cost of doing business and improves the quality of services provided.

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