

Textile packaging waste in the context of implementing the concept of circular economy

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ABSTRACT – REZUMAT

Textile packaging waste in the context of implementing the concept of circular economy

At European level, there are concrete measures regarding waste management in the circular economy, and these refer to: mandatory recycling rates for different categories of waste: plastics, glass, metals, paper and cardboard as well as biodegradable waste; the obligation to redesign the products in order to increase the proportion of raw materials resulting from recycling and to increase the degree of recycling of products, in order to consider them as secondary raw materials; promoting and stimulating the reuse of products; increasing the recycling rate of municipal waste by 2030 to a minimum of 65%; increasing the recycling rate of packaging waste by 2030 to a minimum of 75%; reduction of food wastage and implicitly of the resulted food waste by 50% by 2030.

The large amount of packaging waste determined the taking of legislative measures that defined the obligations of packaging producers/distributors, recycling objectives and the waste management hierarchy.

New targets for the recycling of packaging waste predict a growth to 65% in 2025 and 70% in 2030 [1].

Textile packaging waste is an important link in the integrated management of waste whose recovery contributes to the conservation and improvement of natural capital.

Keywords: circular economy, textile packaging, waste, requirements, mapping recovery options

Deșeurile de ambalaje textile în contextul implementării conceptului de economie circulară

La nivel european există măsuri concrete în ceea ce privește managementul deșeurilor în economia circulară, iar acestea se referă la: rate de reciclare obligatorii pentru diferite categorii de deșeuri: mase plastice, sticlă, metale, hârtie și carton, precum și deșeuri biodegradabile; obligativitatea reproiectării produselor pentru creșterea proporției materiilor prime rezultate din reciclare și pentru creșterea gradului de reciclare a produselor, cu scopul de a le considera drept materii prime secundare; promovarea și stimularea reutilizării produselor; creșterea ratei de reciclare a deșeurilor municipale până în anul 2030 la minim 65%; creșterea ratei de reciclare a deșeurilor de ambalaje până în anul 2030 la minim 75%; reducerea risipei alimentare și implicit a deșeurilor alimentare rezultate cu 50% până în anul 2030.

Cantitatea mare de deșeuri de ambalaje a determinat luarea de măsuri legislative care au definit obligațiile producătorilor/distribuitorilor de ambalaje, obiectivele de reciclare și ierarhia de gestionare a deșeurilor.

Noi obiective privind reciclarea deșeurilor de ambalaje prevăd o creștere de 65% până în 2025 și de 70% până în 2030. Deșeurile de ambalaje din materiale textile sunt o verigă importantă a managementului integrat al deșeurilor a căror valorificare contribuie la conservarea și îmbunătățirea capitalului natural.

Cuvinte-cheie: economie circulară, ambalaje din materiale textile, deșeuri, cerințe, mapare opțiuni de valorificare

INTRODUCTION

“Humanity’s 21st century challenge is to ensure that every person has the resources they need to meet their human rights, while collectively we live within the ecological means of this one planet”.

The circular economy, which is based on the phrase “produce-consume-reuse”, proposes a new way of rethinking the use of resources, so as not to affect the environment as so far, nor future generations of the Earth. Therefore, in recent years, a new concept has become popular internationally, in view of the fact that it presents an efficient alternative with improved performance compared to the linear economy [1].

The linear economy caterpillar turns into circular economy butterflies. Cradle-to-cradle thinking is what characterizes the circular economy.

The famous “butterfly chart” developed by the Ellen MacArthur Foundation encapsulates the principles of

a circular economy and the “meshes” that make it up (figure 1).

“Based on the principle of designing out waste from products and services, a circular economy is restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times”.

Basically, this chart is based on three main principles:

- conservation and improvement of natural capital by managing and balancing renewable source flows, where the general purpose is regeneration;
- resource optimization, where regeneration, distribution and optimization of products and materials in both technical and biological cycles, is the main target;
- promoting the implementation of the point of view of the system that aims to design all negative externalities.

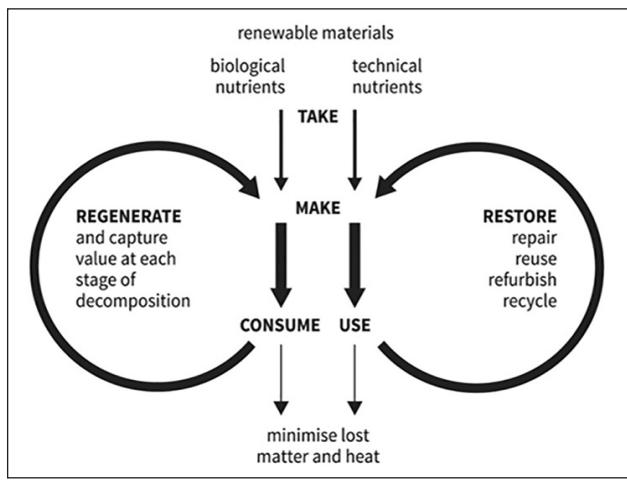


Fig. 1. Butterfly diagram – materials flows [2]

The secret of using organic nutrients endlessly is that we must ensure that they are not harvested faster than nature regenerates them and recover the multitude of valuable sources as they fall into life cycles and also the production design must be done in ways that render nature. In contrast, products made using technical nutrients, such as metals and synthetic fibres, do not naturally decompose, so they must be designed to be restored.

The inclusion of the social dimension increases the complexity of the diagram (figure 2) establishing a new golden rule of priorities, respectively [3]:

BioSphere > HumanSphere > TechnoSphere

By inserting the “Humansphere” area in the “Butterfly Diagram” you get a different but extremely positive image of “our role” in the future: the transition from the negative-Anthropocene epoch (negative-Anthropocene era) in which humans are the cause of ecosystem disorders, to a new positive-Anthropocene era in which humans reconstitute ecosystems (figure 2).

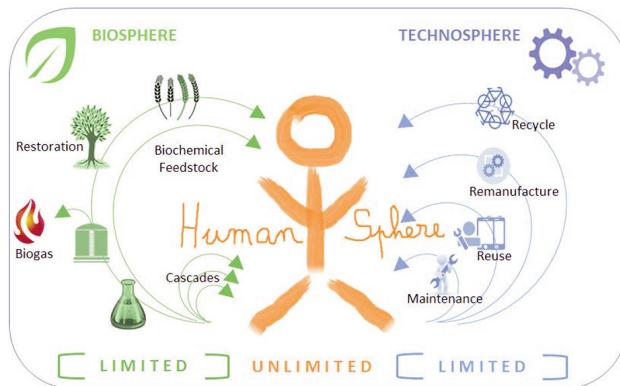


Fig. 2. Adapted butterfly diagram [4]

Humans-as-a-Service

In relations with the Biosphere, Humans are incorporated as a critical component of nature's regeneration, ensuring the preservation of diversity, regeneration and renewal of biological cycles.

Humans = Nature

Humans-as-a-Service

In their relationship with the Technosphere, humans represent the endless energy needed to maintain the stock of materials used for the longest possible period in the economy.

Humans = Power

The Humansphere and its business models are about “integration” [4].

Humans have to play their key roles at two levels:

- Humans are embedded into natural cycles with the aim of re-building our ecosystem;
- Humans are embedded into techno-cycles with the aim of maintaining the value of our techno-system.

The consequences of the new type of economy include minimizing the consumption of natural resources, reducing carbon emissions and optimizing costs regardless of their nature, developing opportunities in the business environment and creating jobs [5].

This economy that produces zero waste is a circuit in which, from the design phase, everything is designed in such a way that what enters a product or process, falls into two categories: either it is a biodegradable component, or it is a component with 100% recycling potential [6].

Waste recycling is essential in this circular process because it ensures the link between the initial and final point of the process, by transforming waste materials into raw materials for other production processes.

OPTIONS FOR RECOVERY OF WASTE FROM TEXTILE PACKAGING

The national legislation in the field establishes that the principles regarding the management of packaging and packaging waste are valid for all packaging placed on the market, regardless of the material from which they were made and how they are used in economic, commercial or household activities.

Aspects related to manufacturing, composition of the packaging and the reusable or recoverable nature of the packaging are essential requirements for packaging materials (table 1).

At the CE level, options mapping for the circular economy 3.0 concept includes four types of essential loops of different lengths: long length R7-9 (with well-organized places), medium length R4-6 (with new business models) and short length R0-3 (with a key role for consumers and non-profit activities) (figure 3) [8].

The 9Rs for packaging waste management can be generically grouped into three main areas that involve the use of a smart design, materials from sustainable sources, and activities to close the life cycle (figure 4).

The concept of integrated textile waste management is based on two key questions, respectively:

- a) What is the most environmentally beneficial option for textile waste management?

SPECIFIC REQUIREMENTS FOR PACKAGING [7]	
Specific essential requirements for the manufacture and composition of the packaging	<ul style="list-style-type: none"> – the packaging shall be so manufactured as to limit its volume and weight to the minimum necessary to ensure the required level of safety, hygiene and acceptability for both the packaged product and the consumer; – the packaging will be designed, manufactured and marketed in a way that allows its reuse or recovery, including recycling, and minimizes the negative impact on the environment; – the packaging shall be manufactured with the aim of minimizing the content of toxic substances and materials and other hazardous substances in the packaging material and its elements, substances that can be found in the emissions, ash or leachate resulting from the processes of disposal of packaging waste.
Specific essential requirements concerning the reusability of a package	<ul style="list-style-type: none"> – the physical properties and characteristics of the packaging must allow several rotations under the expected normal conditions of use; – the reused packaging must be prepared, as appropriate, to meet the health and safety requirements; – packaging that can no longer be reused must become recoverable packaging waste.
Specific essential requirements for the recoverability of packaging	<ul style="list-style-type: none"> – the packaging must be manufactured in such a way as to allow, when it becomes packaging waste, a certain percentage of the weight of the materials used to be recycled. Setting this percentage may differ depending on the type of material used in the manufacture of the package; – the packaging must be manufactured in such a way as to allow, when it becomes packaging waste, that the packaging waste treated for energy recovery has a minimum calorific value that allows the optimization of energy recovery; – the packaging must be manufactured in such a way that, when it becomes packaging waste, the packaging waste treated for composting is sufficiently biodegradable; – the biodegradable packaging must be manufactured in such a way as to allow, when it becomes packaging waste, a physical, chemical, thermal or biological decomposition, so that most of the material is transformed into carbon dioxide, biomass and water.

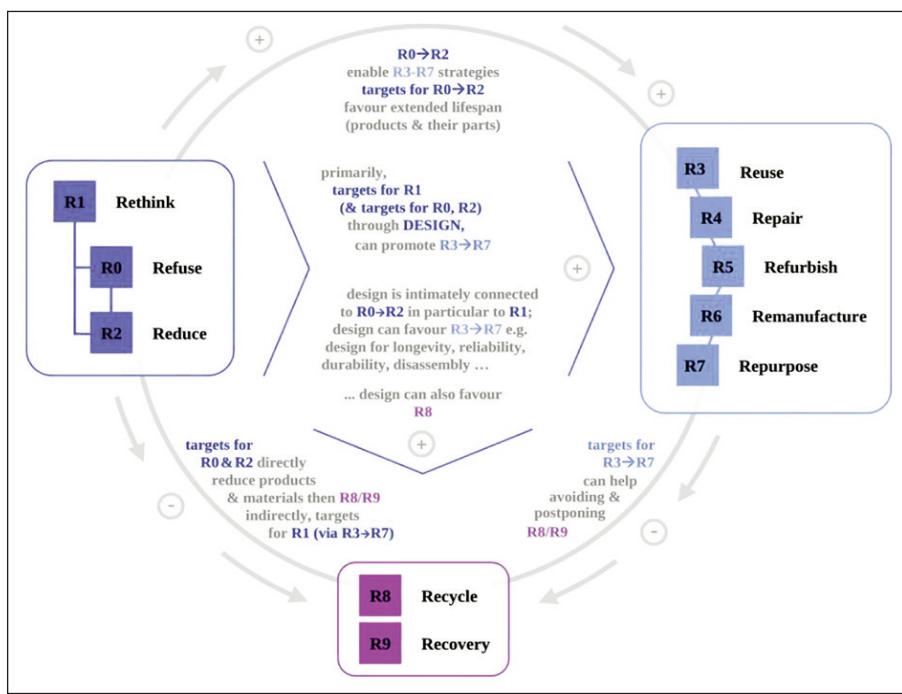


Fig. 3. Correlations among targets [8]

With the objectives of maximizing the value of resources and minimizing waste and its impact on the environment, packaging waste made of textile materials that are not contaminated with foreign substances or food waste, after the application of prevention and minimization measures, can be recovered by recycling technologies by going through the following steps (figure 5).

DISCUSSION

At the European level there are concrete measures regarding the waste management in the circular economy and these refer to: mandatory recycling rates for different categories of waste, mandatory redesign

b) Which social indicators are the most relevant and important in assessing the social impact on textile waste management?

In the case of textile packaging, the most commonly used are woven or non-woven textile structures made of natural fibres (cotton, organic cotton, jute, hemp, wool) or chemical fibres/yarns (polypropylene, HDPE).

of products, promotion and stimulation of product reuse, increase the recycling rate of municipal waste by 2030 to a minimum of 65%, increase the recycling rate of packaging waste by 2030 to a minimum of 75%, the reduction of food wastage and implicitly of the resulted food waste by 50% by 2030.

Textile packaging waste is a potential source of raw materials under the conditions of:



Fig. 4. Concept 9R in packaging waste management [9]

- implementation of a closed loop value chain;
- observance of the principles specific to the packaging waste management activity;
- compliance with the essential requirements regarding the manufacture and composition and the reusable and recoverable character of the packaging;
- modelling the causes and effects of waste production based on the ability to look at packaging products on the cycles of design, production, consumption, use and disposal, including interactions with sustainability;
- printing science and innovation of a more open, collaborative and international character – open innovation, open science, openness to the world;
- investments to deal with the technologies of the future;
- conducting social awareness and education activities = sustainable consumer.

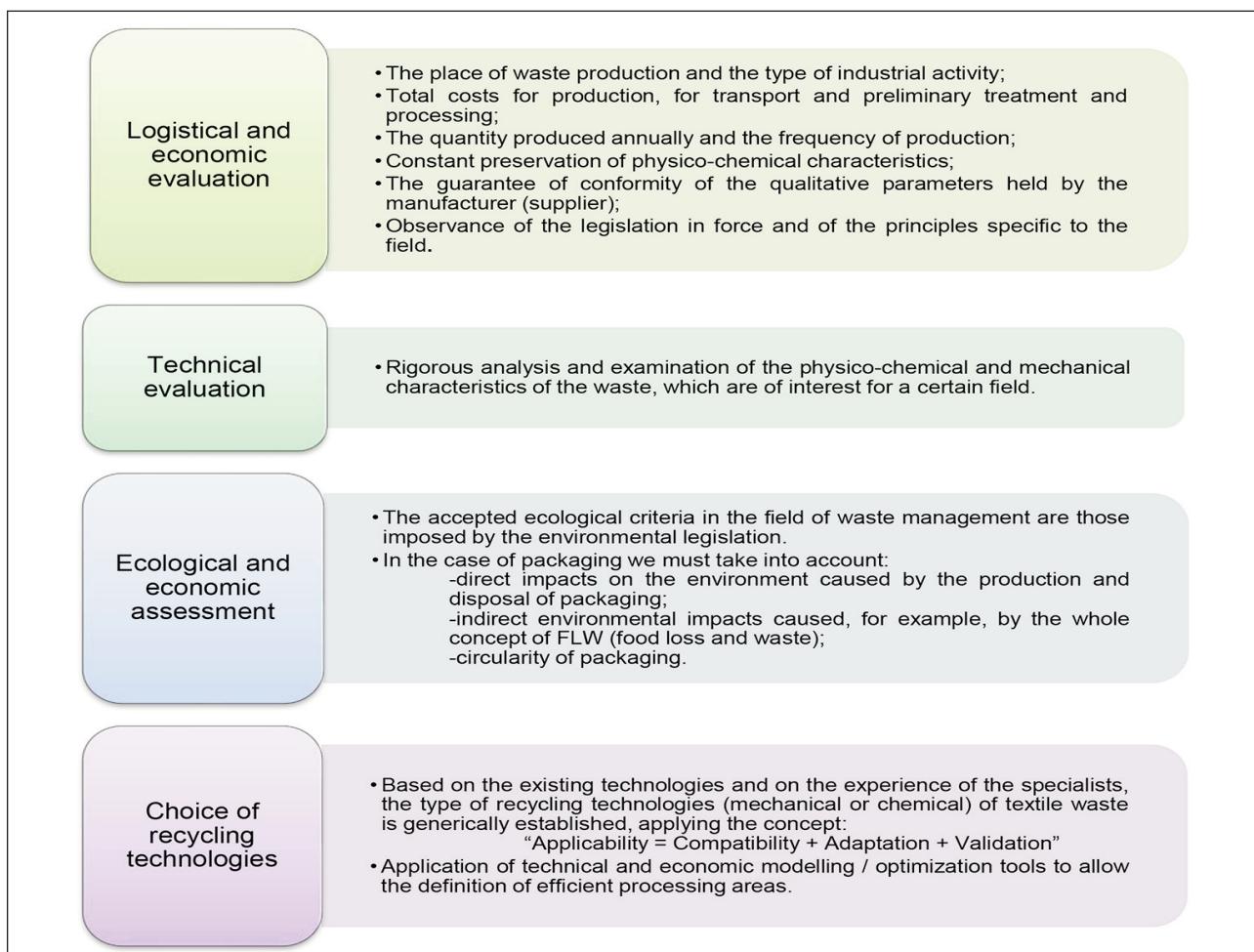


Fig. 5. Matrix for processing packaging waste from textile materials – stages

CONCLUSIONS

– The society of the future will be more and more oriented towards the individual and his needs, which will be more and more complex and varied, in the context in which diversity, equal opportunities, creativity, transparency and flexibility will represent the most important values of the future society.

– The consumer society, along with the global population growth trend, the intensification of the urbanization process, the development and dissemination of information and communication technology, the continuous increase of the living standard, the reduction of the product life cycle have contributed to the increase of volume and diversification of waste flows.

– In the conditions of sharp decline in natural resources, rapid deterioration of air, water, soil quality and damage to natural ecosystems, international concerns about waste management have become dynamic in identifying the best solutions and technologies. In this context, waste management has become a fundamental issue of future socio-economic developments, representing an essential element of a circular economy.

– Implementing the integrated management of packaging waste has a permanent component, that of capitalizing on the results of scientific and technological research and continuing activities in the field of future technologies to underpin the construction of a Romanian model of the circular economy.

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