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WASTE MANAGEMENT SYSTEM IN ROMANIA – STATUS AND DEVELOPMENT FOR BIOECONOMY

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Abstract
The waste management strategies released and applied in EU countries endeavor to achieve the improvement of natural resources use and efficiency towards reducing the air, water and soil pollution due to improper waste disposal or treatment.
This paper is a blueprint on waste generation and waste management Policies, Laws and strategies existing in Romania compared to EU countries. According to Directive 2008/98/EC Waste, is defined as "any substance or object which the holder discards or intends or is required to discard". One of the main principles of waste management strategies is to be able to process the waste generated towards reaching as up as possible the Waste Management Hierarchy.
From the circular economy concept point of view, the incorrect treatment of waste is representing an important loss of resources, both in raw materials and energy and therefore recycling and reuse should reach a superior level every year.

Keywords*: bioeconomy,circular economy, Romania, waste management*

Introduction

The general options for waste management and the re-circulation of solid waste and waste streams is a challenging issue, due to the ambitious targets for increasing recycling of waste.
Sustainable waste management systems in the context of resources efficiency is a key subject included in a broader topic of sustainable consumption and production in Europe. This topic is one of the 10 priorities highlighted in the Sustainable Development Indicators (SDI), of great concert for the economic and social development in European Union (Gavrilescu & Teodosiu 2016).
In this context, the EU Member States are obliged to ensure, by 2020, the recycling of at least 50% of the municipal waste and 70% of the waste from construction. (Parliament and European Council, 2008). The strategy was recently revised setting even more ambitious targets, namely: 55 % to be achieved by 2025, 60 % by 2030 and 65 % by 2035.
The European Union waste management approach is based on the principles of prevention, recycling and re-use, as well as the improvement of methods and technologies for final disposal and monitoring.

In the same time, the worldwide rate of waste generation is increasing fast and based on current prognosis it seems to be un-manageable to locate proper landfill sites (Singh et al 2017).
According to Directive 2008/98/EC Waste, is defined as "any substance or object which the holder discards or intends or is required to discard". The waste management strategies released and applied in EU countries endeavor to achieve the improvement of natural resources use and efficiency towards reducing the air, water and soil pollution due to improper waste disposal or treatment.
From the circular economy concept point of view, the incorrect treatment of waste is representing an important loss of resources (Filho et al 2016), both in raw materials and energy and therefore recycling and reuse should reach a superior level every year.
For example, waste electrical and electronic equipment (WEEE) presents the most rapidly increasing waste stream, with an annual growth rate of 4%). The estimated amount for 2017 was about 72 million metric tons in the year 2017 (Balde et al 2015, Patahak et al 2017). Unfortunately, as the technology advancement did not provide some practical solutions yet, the WEEE growth was not succeeded by the same trend in their collection, recycling (Patahak et al 2017), or recovery of valuable materials (Butu et al 2017).

Materials and Methods

The paper uses the bibliographical method to present an overview of waste management policies in Romania compared to other EU states. Official statistical data were withdrawn from Eurostat and Waste atlas.

Results and Discussion

European Legislative framework

Waste management strategies and the proposed targets to be achieved are set at the EU level, comprising minimum set of requirements by categories of waste. The priorities envisaged by the EU waste management legislative framework include the disposal of waste, the energy recovery, recycling, reuse, and waste prevention (Stoeva & Alriksson 2017).
The most relevant pieces of the EU legislative framework on waste include the following:

- Directive 2008/98/EC on waste (Waste Framework Directive)
- Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste.
- Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste.
- Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste

Figure 1. The waste hierarchy as stated by Directive 2008/98/EC on waste

Other directives regarding waste management, by waste category are as follows:

Sewage sludge

Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture

End of life vehicles

Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles

Packaging and Packaging waste

European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste

Waste electrical and electronic equipment

Directive 2012/19/UE of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE)

Batteries and accumulators and waste batteries and accumulators

Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC.

Following the adoption of the circular economy action plan in 2015 and the creation of a stakeholder platform in 2017, in 2017, the European Parliament adopted its position on the review of the four key waste directives with more ambitious targets and provisions compared to the Commission's proposals issued in 2016.

Therefore, in January 2018 was adopted a new package of measures, including several connected initiatives, such as:

- the strategy on plastics,
- model to address the interactions and linkages between chemicals legislation, products and waste,
- the updated report on critical raw materials,
- the framework for monitoring progress towards bioeconomy EIR

Romanian Legislative framework

The EU Directive on waste management was transposed in Romanian Legislation by Law 211 from November 2011 regarding waste regime, with subsequent amendments. The superior authorithy in charge is Ministry of Environment.

The National Environmental Protection Agency (Agentia Nationala pentru Protectia Mediului - ANPM) is the central public administration specialized institution with competence in the implementation of environmental protection policies and legislation. It is responsible with data gathering and reporting to Ministry of Environment and European Agencies for Environmental protection.

The National Environmental Guard (Garda Nationala de Mediu - GNM) controls activities with an impact on the environment, and applies sanctions for contravention provided by environmental legislation.

National Plan for waste management (Planul național de gestionare a deșeurilor – pngd), was released in 2018, and aproved by government decision 942/20.12.2017. PNGD includes also the National Plan for Prevention of waste.

Other regulatation on waste management, transposing the EU Directives are

Transport and storage of waste

Decision 788/2007 regarding meadures for application of European Parliamnet regulation and of European Council no 1013/2006 regarding shipment of waste with corresponding additions and modifications.

Decision 1061/2008 regarding shipment of hazardous and non-hazardous waste on Romanian teritory.

Landfill waste

Decision 349/2005 regarding landfill waste ensure that European requirements on landfill waste, in terms of building operation, monitoring, closure and post-closing follow-up of new deposits, as well as those existing (Brasoveanu 2012).

Decision 210/2007 was released for amending and supplementing certain acts transposing the acquis communautaire in the field of environmental protection, as amended and supplemented

Incineration of waste

Law 278/2013 regarding industrial emmisions with subsequent amendments, includes the guidelines previously set by Decision 128/ 2002 regarding incineraion of waste.

Sewage sludge

Order 344/708 from 2004 for the approval of technical norms regarding environmental protection with a special highlight on soils when sewage sludge is used in agriculture

Order 27/2007 was released for amending and supplementing certain acts transposing the acquis communautaire in the field of environmental protection, as amended and supplemented

End of life vehicles

Law no. 212/2015 on the management of new vehicles and end-of-life vehicles sets out measures to prevent the generation of waste from end-of-life vehicles, re-use,

recycling and other forms of recovery of end-of-life vehicles and their components to reduce waste disposal as well as environmental improvement of the activity of economic operators involved in the life cycle of vehicles, in particular of economic operators directly involved in the treatment of end-of-life vehicles.

Packaging and Packaging waste

Law 249/2015 regarding the management for packaging and Packaging waste, repealed the Decision 621/ 2005 that initially transposed the EU directive packaging and Packaging waste**.** This law regulates the management of packaging and packaging waste in order to prevent or reduce the environmental impact. It lays down measures aimed, as a matter of priority, on the prevention of the production of packaging waste and, as additional fundamental principles, the re-use of packaging, recycling and other forms of recovery of packaging waste and, consequently, the reduction of the final disposal of such wastes.

Waste electrical and electronic equipment

Emergency Ordinanc. 5/2015 regarding WEEE (in romanian deșeurile de echipamente electrice și electronice - DEEE)

This Emergency Ordinance sets out measures to protect the environment and public health by preventing or reducing the negative effects of generating and managing waste electrical and electronic equipment, referred to as WEEE (DEEE), by reducing the overall impacts of resource use and improving the efficiency of the use of these resources,

Batteries and accumulators and waste batteries and accumulators

Decision 1132/2008 aims to establish the requirements for the placing on the market of batteries and accumulators and specific rules on the collection, treatment, recycling and disposal of waste batteries and accumulators to complement harmonized national legislation on waste and to promote a high level of collection and recycling of waste batteries and accumulators and regulating the ban on the placing on the market of batteries and accumulators containing dangerous substances.

This Decision seeks to improve the environmental performance of batteries and accumulators and the activities of all economic operators involved in the life cycle of batteries and accumulators, namely manufacturers, distributors and end-users, and in particular operators directly involved in the treatment operations and waste recycling of batteries and accumulators.

Wastes from extractive industries

Decision 856/2008 establishes the legal framework for guidelines, measures and procedures and to prevent or reduce, as far as possible, any adverse effects on the environment, in particular water, air, soil, fauna, flora and landscapes, as well as any health hazards to the population , resulting from waste management in the extractive industries.

Waste generation and recycling in Romania vs European Countries

Annually, in the EU countries, is produced an average of aproximately 480 kg of waste per capita. More detailed, according to official data, the amount of municipal

waste generated in EU countries, in 2017, ranges between 250kg per capita up to almost 800 kg per capita.
The EU Member State with a collection rate of 100 % of waste is Germany, although it has a large rate of production of waste, 50.5 million tonnes per year and almost 620 kg per capita. However, Germany also has the second highest recycling rate of 47%.
Romania produces 5.8 million tonnes of waste per year, averaging 272 kilograms per year per capita and with a collection rate of only 82.3% (Figure 2).

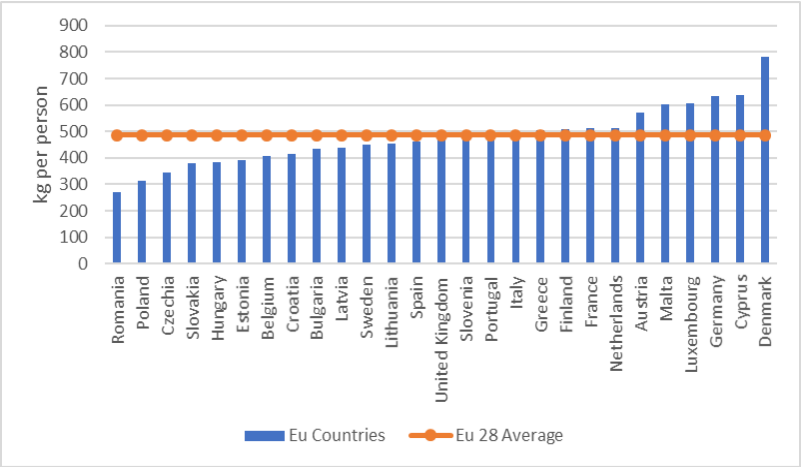

Figure 2. Muncipal waste generation in EU countries vs average EU 28
*Eurostat data

In Romania is recyled only around 3% of generated waste, while Slovenia is the EU Member State with the highest recycling rate of 55%, plus a 100% collection rate (Figure 3). However, Slovenia produces aproximately 853.000 tonnes of waste per year, with almost 470 kg per capita which is almost equal to european average of 487 kg per capita.

Therefore, there are member States who manage to achieve high recycling rates while there are other countries that apply landfill processes, and Romania is one of them.

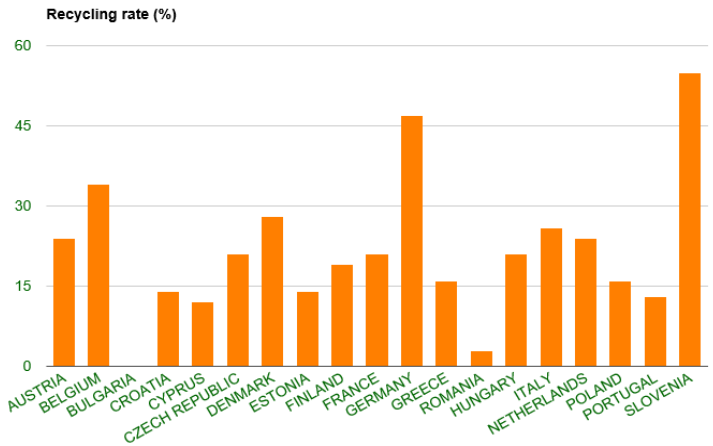

Figure 3. Waste recycling rate in Europe

The environmental stress calculated for eastern European countries is presented in figure 4. This indicator shows the concentration of Municipal solid waste (MSW) by including the country's land area.

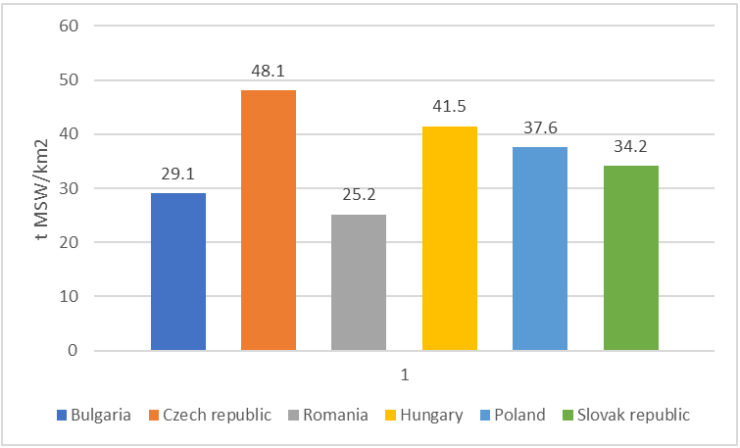

Figure 4. Waste environmnetal stress in Eastern European Countries
*data source http://www.atlas.d-waste.com/

Conclusions

The proper waste management and its transformation into a resource in Romania is fully supported by the implementation of EU legislation this area. However, the circular economy is still weakly developed in Romania. First of all, it is necessary to

increase awareness on selective collecting of waste, and to reach the targets of regulatory framework in force.

Acknowledgements

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*Directive 2008/98/EC

*http://www.atlas.d-waste.com

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