Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 17, Issue 2, 2017
PRINT ISSN 2284-7995, E-ISSN 2285-3952

ECO-INNOVATION PARK PROMOTING THE GREEN ECONOMY IN ROMANIA

Dumitru Florin FRONE[1], Simona FRONE[2]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania, Email: ffrone@hotmail.com
[2]Institute of National Economy, Romanian Academy, 13, Calea 13 Septembrie 050711 Bucharest, Romania, Email: frone.simona@gmail.com

Corresponding author: frone.simona@gmail.com

Abstract

In the efforts to develop a sustainable, low carbon, resource efficient and competitive economy and ultimately the green economy in the European Union, circular economy is an important conceptual and practical approach with essential contribution. Latest developments in eco-innovation in Romania are those dedicated to implementing the circular economy, as a way to increase the waste recycling and the resource productivity (one of the lowest in the European Union). In this respect, the main objective of the paper is a theoretical and methodological grounding and analysis of some concepts, trends and issues required for the implementation of the green economy in the EU and Romania, as well as for the sustainable regional economic development. The role of creating and developing eco-industrial parks, namely eco-innovation parks EInvP is not limited on their potential of increasing the resource efficiency but also to implementing and making work the new modern synergic and circular business models. In the paper we shall refer to some successful and pioneering circular economy enterprises or industrial eco-systems working in Romania, as good practices and pilot projects. The conclusions and recommendations refer to the importance of spatial eco-innovation represented by the industrial symbiosis as a high form of circular economy.
Key words**:** *green economy; circular economy; eco-innovation park; industrial symbiosis; synergy*

INTRODUCTION

The theory of green growth presents an alternative to the conventional economic paradigm of resource exploitation and is built around a concept of growth that integrates the sustainable use of natural resources, including greater energy and resource efficiency and improved natural capital as the drivers of growth.

Decoupling growth from resource use and unlocking new sources of sustainable growth needs therefore coherence and integration in the policies that shape our economy and our lifestyles. A revamping of the economy to become resource-efficient is a necessary, but still not sufficient condition to achieve transition towards the green economy.

As may be also followed in the paper, the green economy requires step changes in resource efficiency, investment in clean technologies, the development of alternative products, services and materials, and the ability to obtain value from the unavoidable waste (UNEP, 2012) [20].

There is explained in more detail the meaning and the features of eco-innovation for the circular economy and of the industrial symbiosis, focusing on the concept of waste and resource recycling.

In this respect, the main objective of the paper is a theoretical and methodological grounding and analysis of some concepts, trends and issues required for the implementation of the green economy in the EU and Romania, as well as for the sustainable regional economic development. This is possible with the implementation of the industrial synergy within eco-innovation parks, a concept to be analysed and exemplified in the paper.

In this paper, with the theoretical and empirical approaches employed there is argued more on the need to acknowledge and better understand the concept and aim of the circular economy (a form of the green economy) designed to close the loop in product life cycles by keeping as many resources in the economy as possible, thereby reducing waste and promoting sustainability.

In this context, the paper presents a short

analysis of the implementation of a pilot eco-innovation park as application of industrial ecosystems principles to regional development in Suceava County (ECOREG), in order to put into evidence the fact that it is an important vector promoting the green economy in Romania.

MATERIALS AND METHODS

The methodology used below is based on:
•Clarification and definition of the main methodological and operational concepts;
• Description of economic and environmental drivers in the process of eco-innovation;
• Analysis and synthesis of the characteristics and mechanisms of industrial synergy within the eco-innovation park, both for the theoretical model as well as for the case study;
•Analysis and synthesis of the strategic objectives for a circular economy in the European Union;
• Adjacent calculations, with tables and graphics, for a dynamic comparative analysis of the trends of main eco-innovation indicators.

RESULTS AND DISCUSSIONS

Theoretical and methodological background

The new paradigms of production and consumption call more and more for a higher resource-efficiency, a concept that underpins all the valuable ideal concepts of economy and development: sustainable development, the green economy and the circular economy, as well as the strategies dedicated to their objectives (Frone S., Constantinescu A., 2015) [9].

From the purposes of our paper here, important concepts (to be analysed further on) are the green industry and the circular economy. The green industry is considered a rapidly expanding and diverse sector that covers all types of services and technologies that help to reduce negative environmental impacts and resource consumption.

Still synergic ally related to a resource-efficient economy, but even more demanding is the concept and model of the circular economy**.** The strategic approach "Towards a Circular Economy" (COM(2014) 398) promotes a fundamental transition in the EU, away from a linear economy, for resources to be not simply extracted, used and thrown away, but put back in the loop so they can stay in use for longer. This approach also sets out measures driving a more efficient use of resources and waste minimization.

As suggested in (Frone D.F., Frone S., 2015) [8] the global resource nexus model is very suggestive for a green (circular) economy model and especially for our topic, since the importance of the sustainable management of natural resources and of their increased resource-recovery and efficiency is better acknowledged.

A form feature of the green economy, circular economy proposes the re-use of resources used in products whose shelf life has come to an end or which have lost their usefulness, to construct new objects of the same quality or even better. The circular economy model may be the ideal solution for relaunching sustainably the European economy which has suffered in recent years (2008-2012).

The principles of a circular economy support ideas and mechanisms for increased competitiveness and economic growth in the European Union, by: creating new business and jobs opportunities; transforming and revamping the processes of consumption for better efficiency; the correct management of resources.

Therefore, the European Commission has launched in December 2015 the ambitious **Closing the loop – An EU action plan for the circular economy (**COM/2015/0614 final) [3]as a package of measures to develop the circular economy. It is believed that by stimulating sustainable activity in key sectors and new business opportunities, the plan will help to unlock the growth and jobs potential of the circular economy.

Nevertheless, although the action plan focusses on “action at EU level with high added value”, implementing the circular economy will still require “long-term involvement at all levels, from Member States, regions and cities, to businesses and

citizens". Member States (including Romania) are invited to play their full part in EU action, integrating and complementing it with national action.

Although the main principle of the circular economy at EU and global level, recycling is no more taken as a simple action of diverting some materials form landfill. It is more and more important to know exactly what kind of recycling is achieved, to judge if it is the best recycling solution (Frone Simona, 2017) [12].

Thus, the green economy goals of recycling are:

- to prevent wasting potentially useful materials;
- to reduce consumption of fresh raw materials;
- to reduce energy usage;
- to reduce air pollution and water pollution;
- to lower greenhouse gas emissions as compared to virgin production.

As will be exemplified further on, there are interesting industrial synergy facilities of recycling the waste materials or the by-products. In this respect, the circular economy requires an innovative approach to production and consumption that offers the savvy entrepreneur significant opportunities (EC Panorama, 2016) [4].

In the paper will be argued that the Eco-Innovation Parks and the industrial symbiosis within provide such an innovative approach to production and consumption that really increases the business, innovation and development opportunities for all the green-aware enterprises and authorities in a region.

The EC action plan for the circular economy **(**COM/2015/0614 final) actually states that „it is important to promote innovative industrial processes. For example, industrial symbiosis allows waste or by-products of one industry to become inputs for another. In its revised proposals on waste, the Commission proposes elements to facilitate this practice, and will engage with Member States to help ensure a common understanding of the rules".

Eco-innovation issues and trends

With global resource scarcity and environmental degradation presenting growing challenges for business, along with related market and regulatory pressures, companies are facing a need to think more strategically about the sustainability of their business.

According to the definition of the Competitiveness and Innovation Framework Programme of the European Union, eco-innovation is "any form of innovation aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment or achieving a more efficient and responsible use of natural resources, including energy" (EC COM, 2006) [2].

Eco-innovation is any innovation that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle. Eco-innovation can help transform the green challenges into new market opportunities, since it is the development and application of a business model, shaped by a new business strategy, which incorporates sustainability throughout all business operations based on life cycle thinking and in cooperation with partners across the value chain (UNEP, 2014) [19].

The majority of the eco-innovation studies have focused on incremental innovations such as green products and eco-efficiency improvements. Systemic and transformative change is also reflected lately in the growing number of case studies analysing innovative solutions based on new systemic thinking like "cradle to cradle" and "industrial symbiosis".

„Industrial symbiosis differs from more commonplace efforts to 'green' industry in that it fosters cooperation between firms as opposed to focusing on action at the level of the individual firm. By cooperating businesses can improve their combined environmental performance by measures that will also increase profit margins" (Gibbs, 2008) [14].

After a more detailed conceptual analysis of the spatial (regional) eco-innovation happening in the Eco-Innovation Parks and involving cooperation in industrial synergies, such an industrial symbiosis case-study will be also analysed further in this paper (in the next section).

The eco-innovation scoreboard Eco-IS with its composite Eco-innovation index demonstrates the eco-innovation performance

of a country compared with the EU average and with the EU top performers. The graph in Figure 1 was based on the EU 28 Eco-IS for the year 2013, while in Figure 2 the graph was based on the EU 28 Eco-IS for the year 2015.

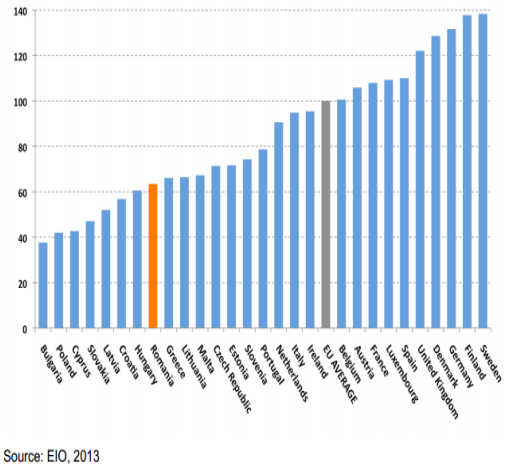

Fig..1 EU28 Eco-innovation scoreboard 2013 composite index

In this context, according to the latest EIO Country Profile (EIO, 2015) [7], Romania ranks 18th in the Eco-Innovation Scoreboard (Eco-IS), obtaining a score of 87.1. This indicates it is still below the overall EU-28 average score by 13% (2015, see Figure 2). However, dealing with the most recent issues and trends it is encouraging that our country has advanced three positions since 2013, from the previous rank of 21 (in Figure 1) to the current rank.

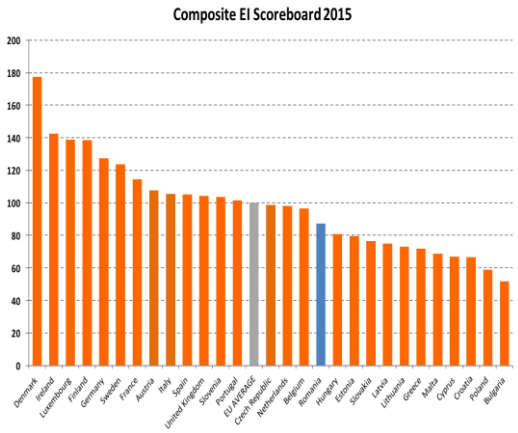

Fig.2. EU28 Eco-innovation scoreboard 2015 composite index

While some issues of poor or inefficient resource management and low propensity to invest and cooperate for sustainable production and consumption were signalled in a previous paper (Frone Simona, 2016) [11], it is important to point out that the last EIO Country Profile report on Romania (EIO, 2015) [6] specifically raises the issues of barriers and drivers to circular economy and the targeted eco-innovation in Romania.

Another important aspect was that the Romanian SMEs were less likely to adopt measures to improve their resource efficiency in comparison to the EU average and had a low propensity to collaborate. These are important challenges for a systemic transformation agenda in the European Union such as the circular and green economy.

Also in this respect, according to the most recent report (EIO, 2015) [7] Romania's eco-innovation system can be broadly characterised in terms of push and pull factors acting in opposition. It may be stated that there is still:

-low level of investment in basic infrastructure and framework conditions for recycling, waste management and resource efficiency;

-low input into R&D from the public and private sectors.

However, confirming the findings that eco-innovation activities are on the rise trend in Romania (EIO, 2013) [6], there are islands of eco-innovation at the grass-roots level that have gradually accumulated. These have the potential to reach critical mass, and possibly have positive spill over effects on further fields of economic activities in time, but they generally need larger-scale investment and support to have a significant impact.

The EU Cohesion funding is an important source of public investment in Romania, fostering eco-innovation and green reforms. The Environment Sectoral OP 2007-2013 funded the majority of the environmental infrastructure investments. For example, by the end of 2015, it supported projects related to diminishing GHG emissions in the energy sector by investing €237 million in energy production from non-polluting sources; provided €2.2 billion to projects related to modernising water and wastewater treatment facilities; and €500 million to projects in the

waste management sector.

Indeed, as a conclusion of previous research, Romania's ability to provide efficient infrastructure and environmental services, both nationally and locally, is an important factor in stimulating and supporting sustainable economic development (Frone Simona, Frone D.F., 2012) [13].

From the viewpoint of the green economy, we resume in the paper research on the importance of investment in infrastructure, eventually for fostering the regional scale eco-innovation able to provide for eco-innovation parks and industrial ecosystems promoting the circular and green economy.

Eco-innovation park promoting the green economy in Romania

The term eco-innovation park is used to define both, eco-industrial parks and eco-innovative areas combining residential and industrial activities. Eco-innovation parks (EInvP) are optimized from an environmental point of view (e.g., piloting installations and processes that incorporate environmental technologies and services) and are open for continuous improvement (e.g., collaboration with institutions of research and development

The main conclusion of the approach in (Frone Simona, 2015) [10] was based on a regression model showing that in the 16 European countries of the analysed sample there is a positive correlation between the number of existing eco-innovation parks (EInvP) and the national level of resource productivity (as macroeconomic indicator of the resource-efficiency). Also important is the key feature of the eco-innovation park in which material flow exchanges (or industrial symbioses) generally also encompass other eco-criteria, in particular energy efficiency, waste and water management, so leading to an almost exponential growth in the local resource-efficiency, for all the clustered companies

Another aspect is that the role of creating and developing eco-industrial parks, namely eco-innovation parks EInvP is not limited on their potential on increasing the resource efficiency (Frone Simona, 2017) [12], but also to implementing and making work the new modern synergic and circular business models.

To foster eco-innovation in eco-industrial parks, several tools have been developed to store and analyse data on material and energy flows. Most tools focus on supporting the identification of potential networking and industrial symbiosis.

An "Industrial symbiosis engages diverse organisations in a network to foster eco-innovation and long-term culture change. Creating and sharing knowledge through the network yields mutually profitable transactions for novel sourcing of required inputs and value-added destinations for non-product outputs, as well as improved business and technical processes"(Lombardi & Laybourn, 2012) [16].

The theory of Industrial Ecology (IE) enabled transformation of traditional industrial activity in a more comprehensive model by which regional economies can be assembled in an industrial ecosystem composition, so the residues of some companies can be used as inputs for others. In addition, industrial ecosystems can be organized around product or material supply chains and/or in defined geographical areas.

As a case study, we shall analyse here the main features, objectives and outcomes of the pilot Romanian EInvP named Application of Industrial Ecosystems Principles to Regional Development (ECOREG) in Suceava County, according to the official reporting (nisp-ecoreg.ro). ECOREG was a pilot project aimed at testing the applicability of Industrial Symbiosis in Romania. This entails the reuse of resources and by-products used in one production cycle into another, thus creating mutually beneficial partnerships between companies in various sectors.

The objectives of the project correspond to the local, regional and national sustainable development requirements, since there are: environmental, economic and social objectives. The environmental objectives were actually the most important: a reduction in raw material consumption, energy, utilities, by 2-5 %for all units through implementing innovative tools and instruments; reduction of waste generation and pollutant emissions by 5-20% for all units; the conversion of

wastes/by-products into resources (secondary materials); the significant reduction of environmental impact at the level of industrial units.

ECOREG is modelled on NISP, the world's only national industrial symbiosis programme (UK) which demonstrated that industrial symbiosis has the potential to significantly reduce industrial and commercial waste and comprehensively lessen the adverse environmental impacts of business. The ECOREG project used actual business opportunity as the mechanism for encouraging resource efficiency and its holistic approach is actively dealing with all resources including water, energy, materials, logistics, assets and expertise.

The ECOREG project was implemented with financial support of the European Union, in the period 1st February 2009 – 1st October 2011, in the Suceava County, Romania. The total project budget was of 880 700 Euro. ECOREG was funded by the European Commission through the LIFE+ programme as part of its package to help businesses to improve resource efficiency and reduce waste.

The most important feature of the ECOREG is ***the industrial symbiosis as eco-innovation implemented at a regional scal***e. It is supported by the numerous industrial synergies (200) identified in the area, out of which 114 actually implemented (nisp-ecoreg.ro).

We analyse such an industrial synergy in the following case study, namely the one identified and implemented between:

(i)SC RITMIC SRL**,** a SME based in Ilisesti, 18 km E from Suceava, dealing, among others, with collecting wooden waste (sawdust, chops, branches, etc.), conditioning it and selling it as bio-fuel (wooden briquettes) and

(ii)SC IASIMOLD SRL, another SME located near the Moldovita Commune, Suceava County, some 100 km W from Suceava, in a beautiful landscape. The company exploits wood and completes the first stages in processing timber, producing large quantities of sawdust and wooden waste, a heavily polluted material with no economic value.

The synergy created works like that: the sawdust and wooden debris produced by SC IASIMOLD SRL are collected by S.C. RITMIC SRL's trucks, transported and directed to the wooden debris processing unit of SC RITMIC SRL in Ilisesti. The sawdust and wooden debris are turned into briquettes and sold at a price of 400 RON/ton (95 Euros/ton) at the facility gate; the same briquettes are sold in supermarkets at a price of 850 RON/ton (200 Euros/ton).

The life cycle analysis of the final product should be done in order to certify the circular economy system created:

-Raw material for the briquettes comes from an insidious waste that currently pollutes the forests' outskirts and river valleys in the Suceava County as well as in other Romanian Counties.

-The processing technology is environmentally friendly, uses biomass (wooden chips) as energy source and the only waste produced is the (benign) carbon dioxide that comes from the biomass burnt.

-No additives (adhesives, binders) are used in the technology that could add some inorganic or organic load to the final product and increase its environmental impact;

-During their life time the briquettes do not produce any environmental hazard and their combustion produces benign carbon dioxide and small quantities of ash that can be used as fertilizer.

There are important economic, environmental and social benefits of this industrial synergy identified and exploited in the ECOREG EInvP of Suceava, as we shall highlight below:

(i)The economic benefits are significant, since SC RITMIC SRL obtains the raw material it needs to sustain its business at a bargain price (cost of transportation and of manipulation has the major share in cost breakdown); SC LIAMOLD SRL gets rid of the wooden debris from production space;

(ii)The environmental benefits of this industrial symbiosis are even more interesting, especially considering the saved virgin forests in the area, as well as the biomass energy potential and the avoided CO_2 emissions (Table 1).

Table 1. Estimated environmental benefits of the industrial synergy SC IASIMOLD SRL - S.C. RITMIC SRL

Characteristics	Value	U.M.
Volume of biomass involved in synergy	380	m^3
Virgin forest resources saved	0.437	Ha
Methane gas saved by the biomass produced	35,625	m^3
Total harmful CO_2 emissions avoided	25.5892	Tons
Persistent Organic Pollutants (POPs) emissions avoided	100.32	micrograms

Source: Own selection and computation from ***Adding Value to Wooden Waste (5), ECOREG Project Case Study No 5, 2010 [1]

(iii)The social benefits are also notable since the synergy keeps the actual jobs in both organizations and contributes to their social role. For customers, the synergy adds important quantities of renewable biomass fuel to the market, at a convenient price, saving households money.

(iv)Last but not least, the sustainability of this industrial synergy is high, since as the price of oil and gas will increase, biomass becomes the alternative at hand. Still, forest management in Romania does not fully comply with international and EU rules for sustainability, since large quantities of wood are cut illegally, jeopardizing the virgin forest natural heritage of Romania (Platon V. et al., 2016) [17]. In the next years, the cost of raw wood could raise, once sustainable forest management policies are implemented.

(v)An important feature is the replication potential of this industrial ecosystem synergy between these SMEs in the Suceava county, also in other regions of Romania. The project description mentions that: "the synergy is a good and straightforward solution for improving the energy of small communities and limited geographic areas. It may be replicated in small communities across 28% area of Romania covered by forests."

The synergy presented and analysed above, between the SC IASIMOLD SRL and S.C. RITMIC SRL is only one of the many industrial synergies working in the ECOREG project. ECOREG may be considered an actual eco-innovation park, since it is a spatial, regional application of eco-innovation with rich environmental, economic and social benefits for all the companies and organisations involved, as well as for the people and natural environment in that area of Suceava County.

In an overall outlook, the ECOREG project has led to the following main quantitative outcomes (nisp-ecoreg.ro):

-over 200 economic and social units from various fields and industrial sectors have been included in a regional symbiotic network;

-568 resources flows and 200 synergies were identified; 114 synergies were completed, involving 13 waste categories;

-The quantity of waste involved in the synergies was of over 530.000 t of waste, out of which: 30,000 t of construction and demolition waste; over 500,000 t wood waste; 232 t of animal and food waste; 25 t plastic waste; 20 t waste electrical and electronic equipment.

-A surface of over 2,500 ha of forest was preserved, following the replacement of wood raw materials with other types of wastes;

The reduction in GHG emissions with more than 130,000 t of CO_2, following the replacement of virgin materials with alternative resources.

CONCLUSIONS

For the green and circular economy, eco-innovation is based on centralizing knowledge on material and energy flows as an efficient tool to foster a transition from a linear industrial system to a closed-loop system mimicking biological ecosystems.

After having previously claimed that eco-innovation and eco-innovation parks are the vectors of transition to a green economy and their importance (Frone Simona, 2015) [10], in this paper there are analysed and highlighted some of the objectives, features and principles of the circular economy as they are implemented through industrial synergies in these very eco-innovation parks.

The eco-innovation and especially the regional eco-innovation of an industrial symbiosis will bring increased

competitiveness and better management of resources over their whole life cycle, for all the economic entities and partnerships which are part of the industrial ecosystem. The conclusions of this research paper reiterate that planning, implementing and development of eco-industrial and eco-innovation parks is mostly needed in Romania, in view of a sustainable economic development and a path of green growth.

It was only after Romania's accession to the European Union and with the Cohesion funding support, that adoption of the environmental acquis and of the know-how and good practice of the EU member states, as well as of the Strategy 2020 has enabled the implementation of ECOREG, a pilot project of industrial symbiosis in the Suceava County.

As the main case-study of circular economy, we have shortly analysed this Romanian project as a pilot eco-innovation park enabling the promotion of a circular economy system and a green growth in the N-E region. The official European web-site for the project description has concluded that ECOREG project „demonstrated major environmental benefits, as a result of developing a sustainable approach to waste and resource management. This will help Romania to recycle more of its waste, in line with EU policy. ECOREG recycled 530,000 t of waste, which would otherwise have gone to landfill, using less than €500,000 (€0.88/t)".

An important recommendation for our objective of promoting the green economy and increasing resource efficiency by industrial symbiosis is applying material flow analysis on planned activities leading to the identification of solutions to foster resource efficiency prior to the settlement of the EInvPs' tenants.

The policies and strategic approaches to implement the green economy by fostering eco-innovation in developing eco-industrial (eco-innovation) parks in Romania will make the subject of future research.

REFERENCES

[1]Adding Value to Wooden Waste (5), ECOREG Project Case Study No 5, 2010EU Council (2006): Renewed EU Sustainable Development Strategy, Council of the European Union, Brussels, 9 June 2006, 10117/06

[2]EC COM, 2006, Decision No1639/2006/EC of the European Parliament and of the Council of 24 October 2006 establishing a Competitiveness and Innovation Framework Programme (2007 to 2013)

[3]EC COM, 2015, (614 final): Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, Closing the loop - An EU action plan for the Circular Economy, European Commission, Brussels

[4]EC Panorama, 2016, Panorama, No.58 Autumn 2016, European Commission

[5]EC SWD, 2014, (211), Commission Staff Working Document, Analysis of an EU target for Resource Productivity Accompanying the document, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Towards a circular economy: a zero waste program for Europe {COM(2014) 398}

[6]EIO, 2013, Country Profile Romania 2013, Eco-Innovation Observatory, Brussels, 2013

[7]EIO, 2016, Country Profile Romania 2014-2015, Eco-Innovation Observatory, Brussels, 2016

[8]Frone, D.F., Frone Simona, 2015, Resource-efficiency objectives and issues for a green economy, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol. 15, Issue 3, 2015

[9]Frone, S., Constantinescu, A., 2015, Objectives and trebds of a resource-efficient economy in European Unuion and in Romania, Annals of the „Constantin Brâncuşi" University of Târgu Jiu, Economy Series, Special Issue/2015 - Information society and sustainable development

[10]Frone Simona, 2015, The Eco-Innovation Parks: Vectors Of Transition to A Green Economy, Annals of the „Constantin Brâncuşi" University of Târgu Jiu, Economy Series Special Issue ECO-TREND 2015

[11]Frone Simona, 2016, On the role of eco-innovation for a Green Economic Growth, in Internal Auditing & Risk Management no.42 (2) 201

[12]Frone Simona, 2017, The Role of Eco-Innovation for Promoting a Green Economy, LAP LAMBERT Academic Publishing, Saarbrucken

[13]Frone Simona, Frone, D.F., 2012, Water Infrastructure and Socio-Economic Development Issues, in Recent Researches in Environmental & Geological Sciences, Energy, Environmental and Structural Engineering Series 4, WSEAS Press p.470-4756

[14]Gibbs, D., 2008, Industrial Symbiosis and Eco-Industrial Development: An Introduction. Geography Compass, 2: 1138–1154. doi:10.1111/j.1749-8198.2008.00123.x

[15]http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3254, ECOREG - Application of industrial ecosystems

principles to regional development ECOREG LIFE07 ENV/RO/000690
[16]Lombardi, D. R., Laybourn, P., 2012, Redefining Industrial Symbiosis. Journal of Industrial Ecology, 16: 28–37. doi: 10.1111/j.1530-9290.2011.00444.x
[17]Platon, V., Frone, S., Constantinescu, A., 2016, Challenges and innovations on the sustainable forest management in Romania; virgin forests as heritage, at the international project conference MIS ECT 2617 ALECTOR "Caring and Sharing. The Heritage Environment as an Agent for Change" 31st May-2nd of June 2016, Istanbul
[18]UNDP, 2008, Government of Romania, Ministry of Environment and Sustainable Development, United Nations Development Program, National Sustainable Development Strategy Romania 2013-2020-2030, Bucharest, 2008
[19]UNEP 2014, The Business Case for Eco-innovation, United Nations Environment Programme, 2014
UNEP, 2012, The Business Case for the Green Economy. Sustainable Return on Investment, United Nations Environment Programme, 2012