**Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development**
**Vol. 18, Issue 2, 2018**
**PRINT ISSN 2284-7995, E-ISSN 2285-3952**

# ECO-INNOVATION PARKS FOR A GREEN DEVELOPMENT IN SMALL AND MEDIUM SIZED ENTERPRISES

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

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, 011464, 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***: ffrone@hotmail.com

***Abstract***

*An important issue to be tackled is that the Romanian Small and Medium-sized Enterprises (SMEs) are less likely to adopt measures to improve their resource efficiency in comparison to the EU average and have a low propensity to collaborate for a systemic transformation agenda such as the circular and green economy. The main research objective of this paper is to stress eventually the strategic role of eco-innovation in developing eco-industrial parks as a community of manufacturing and service enterprises seeking enhanced environmental and economic performance through collaboration in managing environmental and resource issues including energy, water, and materials. The methodological approach will be based mostly on some own recently published theoretical and empirical research findings, referring to a case-study as well. The main results and conclusions outline the urge to identify, design and plan the possibilities of industrial symbiosis between several enterprises within an eco-industrial park as a way for promoting green development in the SME-s as well as at the local, regional and macroeconomic scale.*

***Key words*****:** *resource efficiency*, *eco-innovation, green economy, SME, eco-innovation park (EInvP),*

## INTRODUCTION

Eco-innovation and implementing a green development becomes a must for sustainable economic growth, based on increased resource efficiency and a circular economy.
The green economy means a sustainable management of environmental resources, in our biosphere as a closed system with finite resources and a limited capacity for self-regulation and self-renewal. [10]
The main objective of the paper is to ground and stress the strategic role of developing eco-innovation parks as circular industrial ecosystems for a community of manufacturing and service small and medium enterprises seeking enhanced environmental and economic performance through collaboration in managing environmental and resource issues including energy, water, and materials.
The Small and Medium Enterprises (SMEs) which represent the majority of European Businesses have become more and more important at the scale of the EU, both economically and environmentally.
This is not due to their individual environmental impact (too low), but to the cumulated impact of the SME, quite significant and important to be considered for a green development outlook.
Consequently, the Green Action Plan for SMEs (2014) may help these companies benefit from the opportunities of the green economy, since it describes in detail how the partnerships of the European Commission with Member States and regions can turn environmental challenges into business opportunities for SMEs. [5]
Previous cited papers have emphasized some synergic features of the eco-innovation parks (EInvP) and their important economic, ecologic and social advantages for the restructuring and turning of the economy and industry into a resource-efficient path. This is meant to bring increased competitiveness and a better whole life cycle management of resources, for all the economic entities involving SMEs partnerships in the industrial ecosystem. In this context, although environmental policies can create challenges

for SMEs, they also provide business opportunities, as we shall highlight in the paper.

European SMEs can generate employment and economic growth and may also boost their productivity and competitiveness by raising the resource efficiency, adopting circular economy solutions and entering on green markets.

The paper analyses the efforts and policies to increase resource-efficiency in the European Union SMEs, focusing on the potential and outcomes of working in symbiotic clusters or eco-industrial parks for efficient resource recovery and recycling, as well as for a sustainable economic growth and a green development at the micro and mezzo scale.

## MATERIALS AND METHODS

In this paper, with the theoretical and empirical approaches employed there is argued again on the urge for a green development of the SME by using, recovering and redirecting resources for reuse and by keeping resources in productive use in the economy for longer.

The methodology used below is based on:

•Clarification and definition of the main methodological and operational concepts (in the section of theoretical and methodological background);

•Description of economic and environmental drivers in the resource efficiency, using figures and tables (in the section Issues and trends of green development in the European Union SMEs);

•Analysis and synthesis of the characteristics and mechanisms of a green development within the eco-innovation park, from the ECOREG case study (in the section Eco-Innovation Parks for a Green Development in Small and Medium Sized Enterprises);

•Adjacent calculations in tables for a comparative analysis of the trends of some eco-innovation indicators of SMEs, most of them resulting from case-studies or from previous research outcomes in the section Eco-Innovation Parks for a Green Development in Small and Medium Sized Enterprises).

## RESULTS AND DISCUSSIONS

### Theoretical and methodological background

The principles of a green economy support ideas and mechanisms for increased competitiveness and economic growth in the European Union, by taking into consideration the potential of the increased environmental awareness and resource efficiency for creating new business and jobs opportunities as well as a sustainable management of resources.

The green economy is a model that "secures growth and development, safeguards human health and well-being, provides decent jobs, reduces inequalities and invests in, and preserves biodiversity, including the ecosystem services it provides (natural capital), for its intrinsic value and for its essential contribution to human well-being and economic prosperity". [6]

There should be also acknowledged more on the meaning of resource-efficiency. More theoretical analysis is detailed in previous research, since resource efficiency is a main concept in all the ideal forms of economy and development, such as the sustainable development, the green economy and the circular economy, as well as for the strategies dedicated to their objectives. [4]

Also resource-efficient economy is very close to advanced concepts such as the green economy or the circular economy; both promote great resource-efficiency gains through a systemic transformation in the way resources flow through the economy and society, arguing that there are business and job opportunities to build by revolutionising recycling and re-use. [8]

In this conceptual framework, it was launched the Green Action Plan by the European Commission, in order to foster the re-industrialisation of Europe as advocated by the and supported by the European Council, by enhancing SMEs competitiveness and supporting green business developments across all European regions, since significant differences in resource efficiency exist between sectors and between European countries. [5]

Indeed, as shown in [11], there are quite important differences between the EU member states as concerning the national level of resource-productivity, but our regression analysis based on the data-base of the eco-innovation parks in Europe, as well as on a Romanian regional case-study have shown indubitable evidence on the role of these most advanced EIP, namely the eco-innovation parks (EInvP) in promoting local, regional and national sustainable economic development and transition to a green economy. [9, 10]

The eco-innovation has an ability to maintain a balance between ecosystem services and the intrinsic economic circuits, adjusting also, by geared technical means, both the renewing of resources according to the assimilative capacity of the environment and the transactions that include ecosystem services into the economic cycle.

Also, another significant concept for green development is the industrial symbiosis implemented in the industrial ecology, since alignment of ecology to industry as a key area for economic development, suggests its reorientation towards a sustainable use of resources.

In this paper the focus is more on the role and potential of the SMEs in finding the best ways for their green development, meaning a sustainable economic growth of their business while considering the entire regional and national economic prospects and environmental resources.

The main green economy goals of recycling are to:

-prevent wasting potentially useful materials;
-reduce consumption of fresh raw materials;
-reduce energy usage;
-reduce air pollution and water pollution;
lower greenhouse gas emissions as compared to virgin production. [10]

**Issues and trends of green development in the European Union SMEs**

The preventing or correcting of environmental damage is a social challenge for transition to a low carbon economy, but also an economic and business opportunity for most enterprises.

Since technological innovation could become the cornerstone of minimizing pollution and at the same time, the key to global sustainable economic development, it supports the eco-innovation which is a concept embedding more than technology. [1]

Eco-innovation is considered to be the introduction of any new or significantly improved product, process, organisational change or marketing solution that either reduces the consumption of natural resources and/or the release of pollution across the entire life-cycle. [13]

However, eco-innovation' like any other types of innovation, needs a fertile ecosystem to flourish and green innovators depend on support to develop their ideas and on access to finance to implement them. [4]

The green entrepreneurship is enabled in the presence in the proximity of factors like consulting and academic institutions, skilled labour and cross-sectoral cooperation. These conditions are appropriate for the creation of eco-innovative clusters that we also refer as eco-innovation parks (EInvP).

As stated in [5], the Green Action Plan for the European Union builds on the Eco-Innovation Action Plan (EcoAP), which provides directions for eco-innovation policy and funding under the umbrella of the Europe 2020 strategy. Some instruments of the EcoAP are relevant for SMEs: the European Innovation Scoreboard Eco-IS, the Eco-innovation Observatory, the European Forum on Eco-innovation, European Innovation Partnerships and financing instruments for eco-innovation under Horizon 2020. The actions featured in the Green Action Plan and the EcoAP are, therefore, complementary and generate important synergies.

In this framework, the Eco-Innovation Index shows how well individual Member States perform in different dimensions of eco-innovation compared to the EU average and presents their strengths and weaknesses. The Eco-IS and the Eco-Innovation Index complements other measurement approaches of innovativeness of EU countries and aim to promote a holistic view on economic, environmental and social performance. [2]

For instance, as presented in previous research according to the latest EIO Country Profile, 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%. [9]

Why is eco-innovation for resource efficiency improvements also important for SMEs?

Eco-innovation can have a twofold positive impact on resource efficiency:

(i)it can increase the generated economic value, while at the same time

(ii)it will decrease pressures on the natural environment.

Hence, according to legal experts, 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. [3]

An important aspect related to eco-innovation activities meant for the resource-efficiency enhancing signalled previously 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. [12]

Also in this respect, 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. [13]

In Green Action Plan for SMEs it was stated that generally European SMEs are aware that being resource efficient is important since 75% of SMEs have observed an increase in their materials costs in the past five years. About 93% of SMEs in the EU are taking at least one action to be more resource efficient which, in most cases, is a low-cost action. [5]

It is therefore important to underline that the specific resource efficiency actions taken by companies mainly are the following:

(a)Minimising waste;

(b)Recycle by reusing waste within the company;

(c)Design products that are easier to maintain, repair and reuse;

(d)Sell scrap material to other companies. [2]

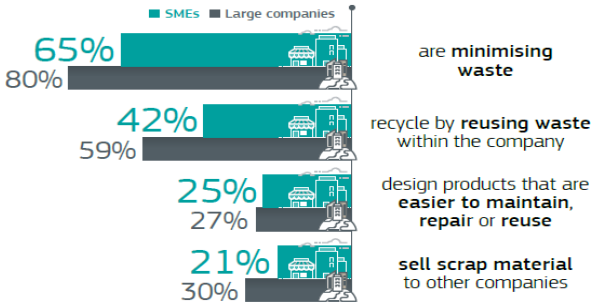


Fig. 1. Share of companies taking actions to become more resource efficient

Source: SMEs and the Circular economy. Facts from the Eurobarometer, 2017 [2]

Although significant shares of SMEs are undertaking these actions in order to become resource efficient, they are still less likely to do so than large companies (Fig.1).

However, only 42% of SMEs that implement measures to improve resource efficiency have seen a reduction of their production costs [5].

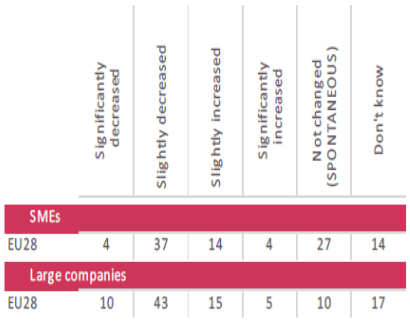


Fig. 2. Impact of the undertaken resource efficiency actions had on the production costs over the past two years (% - EU)

Source: SMEs and the Circular economy. Facts from the Eurobarometer, 2017

Besides, as observable in Fig. 2, according to a recent report large companies are more likely than SMEs to say production costs have decreased (53% vs. 41%) as a result of resource efficiency actions. [2]

SMEs are more likely to say there has been no change (27% vs. 10%).This indicates the necessity to provide more guidance to SMEs on the cost-effectiveness of resource efficiency investments.

Thus a partial conclusion is that SMEs need some conditions for increased resource-efficiency:

-a favourable business environment, for development and financing green ideas as well as

-close cooperation and clustering for efficient spatial eco-innovation and facilitated resource recycling and recovery.

**Eco-Innovation Parks for a Green Development in Small and Medium Sized Enterprises**

Some previous papers have focused on the eco-innovation trend of industrial ecology meant to enable transformation of traditional model of industrial activity in a more comprehensive model by which regional economies can be assembled in an industrial ecosystem composition, and so the residues of some companies can be used as input for others. [13]

There was also evidence on the role of eco-innovation parks (EInvP) as vectors of transition to a green economy. [11]

Here we aim to analyse more the role of the eco-innovation parks as industrial ecosystems, by grouping several SME-s in a certain area in order to let them share some technological eco-innovation facilities, as well as to put them in a relation of industrial synergy, leading to waste recovery and recycling as a resource, eventually improving the resource efficiency and productivity at the microeconomic as well as the sectoral and regional scale.

Some negative issues but also positive findings about the green economy prospects of the Romanian companies analysed include the following: companies show weak environmental awareness and weak levels of transparency and communication on environmental issues; in terms of cost assessment, companies do not measure or do not want to declare the costs and benefits obtained through their environmental management practices; many companies do not monitor their resource use systematically, which is why they are not able to take measures to improve their environmental performance; there is a perception that investment in a more sophisticated environmental monitoring system would outweigh the benefits from reduced costs; there is an increase in companies' use of renewable energy sources, since 9.3% of the surveyed companies predominantly use renewable energy sources, while for 18.5% of the companies, less than 50% of their energy use comes from renewables; unfortunately, the majority of the surveyed companies (57%) did not use recycled resources as production materials at all, while for another 16.3%, recycled resources make up less than 2.5% of their production materials. [13]

These facts showed there are still large opportunities for a green development, mainly of the circular economy in Romania.

This is why we stress again on the necessity and opportunity to for the small and medium size enterprises to group or cluster in some kind of Eco-Innovation Park, taking advantage of all the premises involved, especially those of an industrial ecosystem aimed for promoting a circular economy.

In another paper, the term eco-innovation park (EInvP) is introduced and used to define both eco-industrial parks and eco-innovative areas combining residential and industrial activities. 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). [11]

In this section, there is a reconsideration and resuming of our previous findings on the case-study of the ECOREG (a pilot EInvP in the Romanian Suceava County) aiming to provide evidence for the actual dimension and realization of green and complex environmental, economic and social benefits provided by the EInvP for the SMEs involved. Industrial ecosystems can be organized around product or material supply chains and/or in defined geographical areas. [13]

Significant for the current research is the key feature of the eco-innovation park in which material flow exchanges (or industrial symbioses) generally encompass other eco-criteria, in particular resource and energy efficiency, by the waste and water

management improvements through a shared, regional eco-innovation, for all the clustered companies. This inner circular mechanism closing-the-loop of resource use in a company or in a region (such as in the EInvP) deserves further attention due to the outstanding green economic growth impact (Fig 3).

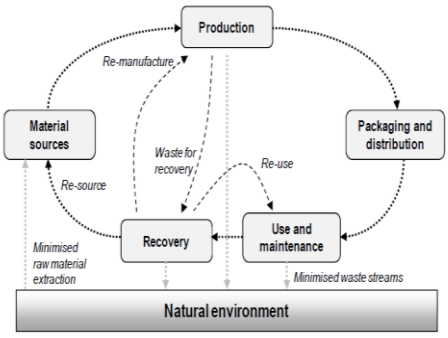


Fig.3. Features of a closed-loop green production system
Source: Figure 1 in [15]

The eco-industrial parks (EInvP) have this tremendous potential of increasing the resource efficiency by implementing and making work the new modern synergic and circular business models, with industrial symbiosis.
We have disclosed and analysed [9, 10] from the Romanian ECOREG EInvP of Suceava, several industrial synergies such as:
(1) The agri-food industrial synergy identified and implemented between the SC PRODINCOM Company – Suceava, a slaughterhouse and meat processing SME in the Suceava County, and a cluster of agri-food companies that generate animal waste and had problems with the management of this waste; PRODINCOM itself; other small meat producers (there are more than 130 SMEs having this object of activity registered in the Suceava County, having from 10 to 2,000 animals).
There were important environmental issues leading to this industrial synergy, since the SMEs partners of the industrial synergy share the problem of their animal waste (carcasses, expired animal or dairy products, waste generated by the slaughterhouse, etc.). The animal waste is a constant problem for all farms and meat processing in the Suceava County as there are no incinerating facilities available at a reasonable distance. As described, the eco-innovation solution identified by the ECOREG team was the installation of an *organic waste incinerator* at PRODINCOM that could help the company and other similar businesses to get rid of their animal waste. [10]

Table 1. Main environmental, economic and social benefits of the PRODINCOM cluster animal waste industrial synergy

| | **Type** | **Value and characteristics** |
|---|---|---|
| 1. | Economic Benefits | 150-200 lei /ton for waste transport to a different incinerator, saved; 1000 lei/ton for incinerating the waste at other location, saved Cost of LPG* saved =15,000 Lei/an |
| 2. | Environmental Benefits | No waste to landfill 15 tons CO2 less emitted from LPG replaced |
| 3. | Social Benefits | 3 new jobs |

Source: Table 1, pg.3 in (A Pattern of Cooperation for Better Animal Waste Management, 2011) LPG = Liquefied Petroleum Gas

As may be observed from the analysis (Table 1), the economic, environmental and social benefits of the ECOREG industrial synergy for animal waste at PRODCOM are very important.
(2)Another impressive industrial synergy involving SMEs within the ECOREG is the one in the wood sector, between: 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 SC IASIMOLD SRL, another SME located near the Moldovita Commune, Suceava County.
A closing loop (circular) system created may be analysed considering that:
-raw material for the briquettes comes from an insidious waste that currently pollutes the forests' and river valleys in the Suceava 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.

The economic benefits are significant, since SC RITMIC SRL obtains the raw material it needs to sustain its business at a bargain price; SC LIAMOLD SRL gets rid of the wooden debris from production space.

Table 2. 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 | 255,892 | 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

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. [13]

## CONCLUSIONS

For the green economic development, involving also 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.

The symbiotic economy maximizes resource and cost savings by prolonging the time that resources, products and components are used. The efficiently use of resources, both by reducing waste and by recycling waste into new goods and services demands eco-innovation, new intermediaries and brokerage services.

SMEs and entrepreneurs need a supportive environment to enter in new industrial relationships enabling them to move towards a circular economy that would enable increased resource efficiency and economic benefits. This is why, in this paper there are analysed and highlighted again some of the features, principles and trends of eco-innovation and eco-innovation parks for green development in SMEs. In a green market economy, the interest of economic operators to establish a synergy is still firstly financial, each industrial manager aiming to increase resource efficiency of its business and find a market for its wastes and/or by-products.

The ECOREG eco-innovation park project was therefore promoted in the Suceava County of Romania, by highlighting the potential economic benefits of joining the programme in order to boost the interest of industry. As our case study and according to the official reporting (nisp-ecoreg.ro) ECOREG was a pilot project aimed at testing the applicability of Industrial Symbiosis in Romania. This entailed 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 most important feature of the ECOREG is *the industrial symbiosis as eco-innovation implemented at the regional scal*e. [13]

The resumed examples of agri-food and wood industrial synergies between SMEs implemented by the EInvP ECOREG are only two within the total of 114 synergies implemented in the area of the project (Suceava County, Romania). The industrial synergies presented are fully sustainable and need only the input from the involved SMEs as parties. The replication potential is high, since clusters of SMEs in the animal product business and in the wood sector exist and may still appear all across Romania, as both sectors are quite traditional for rural development in Romanian history and culture.

Nevertheless, from the viewpoint of the SMEs, there were quite many challenges and threats in gathering and constructing a functional industrial ecosystem within the ECOREG project [14]. There should be mentioned at least: a reluctance from the SMEs concerning the opportunities created through a IS network at local level; the lack of

interest for the industrial synergy concept at all levels.

Still, these challenges for a green and circular economy are acknowledged in the Green Action Plan for SMEs, so the European Commission will facilitate their cross-sectoral collaboration through some actions [5]: the action on 'Cluster facilitated projects for new industrial value chains' under Horizon 2020; the European Cluster Observatory providing regions with cross-sectoral clustering trends identification.

## REFERENCES

[1]Constantinescu, A., Frone, S., 2014: The role of technological innovation in sustainable economic development, Scientific Papers International Conference on Knowledge Society, in Journal of Knowledge Management, Economics and Information Technology 2014,Vol.4 Issue 1.1;

[2]EC COM, 2017, Flash Eurobarometer 456 Report, SMEs, resource efficiency and green markets, September 2017

[3]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)

[4]EC COM, 2014, 14 final Communication from the Commission to the European Parliament, the Council, The European Economic and Social Committee and the Committee of the Regions For an European Industrial Renaissance {SWD(2014) 14 final}

[5]EC COM, 2014, 440 final: Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, Green Action Plan for SMEs, Enabling SMEs to turn environmental challenges into business opportunities, European Commission,{SWD(2014) 213 final}

[6]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

[7]European Parliament and the Council of the European Union, Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet', Official Journal of the European Union, 28.12.2013

[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, D.F., Frone Simona, 2017a., Eco-Innovation Park Promoting the Green Economy in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol. 17, Issue 2, 2017

[10]Frone, D.F., Frone Simona, 2017b., Circular Economy in Romania: an Industrial Synergy in the Agri-Food Sector, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol. 17, Issue 2, 2017

[11]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

[12]Frone Simona, 2016, On the Role of Eco-Innovation for a Green Economic Growth, in Internal Auditing & Risk Management no.42 (2) 201

[13]Frone Simona, 2017, Eco-innovation promoting the circular economy in Romania, Romanian Journal of Economics, Issue 1 Vol. 44, 2017

[14]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

[15]OECD, 2009, Sustainable manufacturing and Eco-Innovation: Framework, Practices and Measurement-Synthesis Report, 2009.