ANALYSIS OF THE ECO-INDUSTRY SECTOR – REDUCTION OF HARMFUL EMISSIONS FROM THE PERSPECTIVE OF THE EUROPEAN UNION

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Abstract

Since environmental issues have worsened during the last decades due to excessive use of natural resources, air/water pollution and industrial waste, it has become evident that there is an increasing global demand for eco-industries and the services they entail. Within the European Union, the new member states represent a market with an important growth potential, which will be able to generate in the future important scale economies if appropriately integrated. During the last years, the EU eco-industry has obtained good results on export markets as compared to the other international manufacturers. In the future, new opportunities will emerge through the development of markets from transitioning countries, as well as due to the expansion of emerging sub-sectors such as renewable energy.

In respect of the member states, the study conducted based on the efficiency of eco-industries – reduction of harmful emissions indicates the will of these countries to allocate a higher GDP amount, as well as to regulate and comply with the European field legislation.

Key words: eco-industry, sustainable development, greenhouse gas emissions, European industrial policy.

JEL Classification: C10; F15; L39; L72; Q57.

1. Introduction:

In this paper we rely on the approach of Ernst Young (2006) for an eco-industry assessment, with the following activity groups: air pollution control, wastewater treatment, solid waste management and recycling, the remedy and cleaning of surface and underground waters, noise and vibration control, material recycling, renewable energy production, environment monitoring, sustainable buildings, private environment management, water supply.

The global eco-industry market can be divided into two large segments:

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- the market in developing countries, where the demands for water supply and waste water treatment are strong points of the industry, representing around 1% of the Gross Domestic Product.

- the market in developed countries, where much more sophisticated products and services are delivered.

Official data indicate that the “new” eco-industries are photovoltaic energy and other environment equipment which present higher commercial potential for all EU member states than more traditional eco-industries such as hydropower, waste and water pollution management.

Here are some of the successful initiatives of European institutions to support these companies:

- to establish collaboration relations with various local suppliers

- to grant financial support for the execution of feasibility studies

- to sponsor demonstrations of external environment projects in order to popularize the techniques used by European specialists

- the programs of the EU Commission to promote exports

- indirect benefits obtained from the development support given to Member States and EU (in order to promote the improvement of environmental performances in developing countries) by stimulating the demand for economic goods and services.

2. Dynamic SWOT analysis of the European eco-industry during recent years

To sketch a better overview of the European eco-industry, in this paper we have set to perform a SWOT analysis of the European eco-industry.

Table 1- SWOT analysis of the European eco-industry

STRENGTHS	***WEAKNESSES***
- **relevance of eco-industry** – in the environment policy, eco-industry has a major role in fighting climate change - **consumer awareness** – citizens become increasingly aware of the impact of their actions and their behaviour on the environment - **technologic progress** – European manufacturers are able to provide increasingly advanced technologic goods and services	**- the environmental policy –** for certain fields, there is a certain lack of awareness of the evolution of external markets **- a distinct implementation level** – of European directives in various member states; within certain sectors as well, there are different regulations in the member states - the **capital –** it is difficult to obtain, particularly by small and medium-sized enterprises

- **European eco-solutions** – focus on the customers' needs and requests - **existence of strong values –** in respect of the environmental policy. The position of the European leader in the field of climate change represents a strong impetus for the promotion of greener manufacturing methods - **European eco-industry** – it evaluates depending on each situation, being a dynamic industry, sensitive to the changes of the economic environment	- the **labour market –** the lack of specialized labour market; specializing and training staff take time - the **demand in certain sectors –** it is mainly governed by the principle of "obtaining a minimum level to achieve the requested results" - **most sectors of eco-industry** still do not enjoy the benefits of scale economies because of the different stages of implementation of European directives and the lack of harmonization thereof in the member states, which prevents the achievement of real benefits and a full operation of the domestic market
OPPORTUNITIES	**THREATS**
- **policy making** – the harmonization of implementation methods at national level and the removal of regulations which may represent trade barriers between member states - **increase of the global demand –** it will be achieved with the integration of policies connected to climate change - **willingness to catch up –** EU member states which are economically developed provide opportunities and new business ideas to newer members - **technology and innovation –** European eco-industrial companies allocate a large amount of their turnover to research and development, which makes it possible to develop innovative products and services, thus turning the sector into a more competitive one - **continuing to hold the leading position** – in some aspects such as climate change and environment protection, which will increase the sector credibility and will provide many perspectives to investors - **new models to approach a business in the field –** this will increase the efficiency	- **labour force training –** an appropriate transfer of knowledge and a focus on the development of skills are crucial in order to be one step ahead non-Eu state - **fierce international competition –** which will most likely grow as BRIC economies (Brazil, Russia, India, China) display consistent growth rates - **lack of political involvement –** in approaching aspects of transversal politics can have adverse effects within the sector (domestic market and public or private partnerships - PPP) -**lack of global regulations –** in respect of green labelling, verification schemes, trading standards and regulations -**long-term technological changes on other markets –** may lead to the moral wear and tear of certain eco-industrial processes. For instance, the introduction of electric cars may have an adverse impact on companies manufacturing filters; the processes of full pollution prevention may reduce the need for certain specific air cleaning technologies

of costs across the industry and services through the integration of eco-solutions, for instance in the field of renewable energy and pollution control, all these leading to increased global competitivity (for example, access to green market - IT software, hybrid cars, energy recovery)	- **lack of an authentic domestic market –** the existence of domestic regulations which are significantly different - **implementation of technical environment solutions –** which are efficient cost-wise, particularly when imposed through regulations - **price increases –** there is the risk that investments in new technologies might become less attractive - **the prolonged COVID19 pandemic –** it leads to the reduction of private funds allocated to sustainable research and development

Source: Authors' adaptation after Ecoris Research and Consulting, 2009[30]

The current pandemic crisis is highly likely to leave certain long-term effects on certain eco-industry sectors from the perspective of a decreased manufacturing capacity and strategies on the competitive European market.

Following the SWOT analysis, in this paper we advance a series of suggestions or improvements of economic activity, as well as initiatives which can be implemented in the eco-industry sector.

First, the Sustainable Consumption and Production - SCP and Sustainable Industrial Policy-SIP Action Plan provide a legal framework for the improvement of environment performance, including in the energy field, which relies on three pillars:

- better products and intelligent consumption;

- an eco-efficient leaner;

- global markets for products complying with the principles of sustainable development.

The first pillar refers to a series of European initiatives such as the eco-design directive, the eco-labelling scheme and public procurements.

The second pillar focuses on production eco-efficiency in the meaning of resource efficiency and eco-innovation. This part includes the formulation of an authentic industrial policy and heightened focus on small- and medium-sized enterprises.

The third pillar involves the promotion of a sector approach to climate change in international negotiations as part of the international field treaty after 2012, the promotion of a sustainable industrial policy as part of the wider framework of United Nations programs

[30] Ecoris Research and Consulting,2009

and the promotion of international trade favourable to compliance with environmental principles.

3. Methodology used in the analysis of the eco-industry efficiency – greenhouse effect emission reduction binomial

The research methodology contains a vast analysis of data collected from the Internet web page of the European Commission, with individual analysis of all indicators under investigation in all 27-EU for a ten-year period (2011-2021). In our research, we made use of two indicators to measure the eco-industry efficiency in respect of greenhouse gas emissions reduction, namely:

a.**greenhouse gas emissions** – as can be noted from the theory presented above in this paper, greenhouse gas emissions represent an important objective for the decarbonization of the European economy.

b. **emission reduction following the achieved investment effort –** this indicator measures the efficiency in eco-technologies in Europe and the extent to which it generates a reduction of harmful emissions.

Based on the statistical data from the United Nations Framework Convention on Climate Change (UNFCC)[31], with the use of the Eviews software we analysed the accuracy of the estimated parameters:

$\beta = -284.7820$ and $\alpha = 581377.2$.

Table 2. Checking the estimated parameters for the factor greenhouse gas emissions

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	**581377.2**	653420.4	0.889744	**0.4144**
X	**-284.7820**	326.2207	-0.872974	**0.4226**
R-squared	0.132258	Mean dependent var		10958.71
Adjusted R-squared	-0.041290	S.D. dependent var		1691.627
S.E. of regression	1726.198	Akaike info criterion		17.98019
Sum squared resid	14898794	Schwarz criterion		17.96473
Log likelihood	-60.93065	F-statistic		0.762083

[31] www.unfccc.int

Durbin-Watson stat	1.300454	Prob(F-statistic)	0.422613

Source: Calculated by the authors with Eview econometric software

In the table processed in Eviews, one can notice that the relatively high P-values of $t_{calculat}$ (0.4144 and 0.4226) both for the curve and for the beginning of the trend line, raise questions on the accuracy of the used model.

Assuming that the reason for this uncertainty is the use of an insufficient number of statistical data, in what follows we will try to determine the trend curve by using a higher number of records, namely for a ten-year period (2011-2021), the data being provided by Eurostat.

First, we notice that the square average deviation has the value 1726.198, which is considerably higher as compared to the average value of resource productivity, namely 10958.71

Using the t- student test, we start off from a series of formulated hypotheses:

H_0: $\beta = 0$

H_1: $\beta \neq 0$

If the null H_0 hypothesis is correct, there is no linear connection between the value of resource productivity and year.

This is the value for a calculated t = 0.889744

The very high P-values calculated of t (0.4144 and 0.4226), both for the curve and for the beginning of the trend line, raise questions on the accuracy of used model. We assume that the reason for this uncertainty is the insufficient number of statistical data.

The critical region is calculated t >t

$$t_{calculat} > t_{\frac{\alpha}{2},n-2} = t_{\frac{0.05}{2},12-2} = t_{0,025,10} = 2.593092681\,.$$
$$t_{calculat} < -t_{\frac{\alpha}{2},n-2} = -t_{\frac{0.05}{2},13-2} = -t_{0,025,11} = -2.593092681$$

First, we notice that the average square deviation has the value 1726.198, which is considerably higher than the value of the greenhouse gas emissions, namely 10958.71.

In the equations above, α represents the relevance threshold (we choose it as 0.05), while n is the number of observations (12, in our case).

In order to detect $t_{\frac{\alpha}{2},n-2}$ we used the Excel equation *tinv()*.

Since the value of the statistical test calculated t (-0,872974) with a p-value of 0,4226 (probability), there ensues that there is an obvious linear connection (because the probability is lower than 5%, we reject the null hypothesis, which means that the year has a significant influence on resource productivity).

In order to test α , we have:

H0: $\alpha = 0$

H1: $\alpha \neq 0$

We have calculated t = (-0,872974)

The critical region is $t_{calculat} < -t_{\frac{\alpha}{2},n-2} = -t_{\frac{0.05}{2},13-2} = -t_{0,025,11} = -2.593092681$ or $t_{calculat} > t_{\frac{\alpha}{2},n-2} = t_{\frac{0.05}{2},12-2} = t_{0,025,10} = 2.593092681$

Since the value of the statistical test calculated t = (-0,872974), with a p-value of 0.4226 (probability), there ensues that we reject the null hypothesis according to which $\alpha = 0$, at a 5% relevance threshold.

As we already have the values of α and β we can estimate the values of the resource productivity values for the entire period considered in this scenario, according to the table below.

The purpose of this verification is to confirm whether the eco-technology investment effort has a determining role in diminishing the volume of greenhouse gas emissions. If the European Union manages to reach its objectives related to energy and climate change, this will determine an increase in the life quality for European citizens and the entire ecosystem, thus ensuring for itself the position of world leader.

In order to be competitive on the global market, European providers will have to develop new goods and services which comply with future requirements. In this line, the Commission recommendations include the following:

- to continue the development of European programs for information and communication in the technological field;

- to adopt manufacturing processes which consider environmental costs and resource management as efficient solutions to environmental issues;

- to strengthen the collaboration among eco-industry providers and end users;

- to promote accredited manufacturing technological schemes meant to increase the quality of provided equipment.

Starting from the hypothesis that greenhouse gas emissions have a linearly descending trend, we can check, for Table 3, the estimated parameters for gas emissions.

Table 3. Checking the estimated parameters for the factor greenhouse gas emissions

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-21109.28	28618.36	-0.737613	0.4939
X	10.75622	14.28774	0.752829	0.4855
R-squared	0.101810	Mean dependent var		435.4266
Adjusted R-squared	-0.077828	S.D. dependent var		72.82288
S.E. of regression	75.60362	Akaike info criterion		11.72384
Sum squared resid	28579.54	Schwarz criterion		11.70839
Log likelihood	-39.03345	F-statistic		0.566751
Durbin-Watson stat	1.256452	Prob(F-statistic)		0.485466

Source: Calculated by the authors with Eviews econometric software

The fairly high P-values of $t_{calculat}$ (0.4939 and 0.4855), both for the curve and for the beginning of the trend line, raise some questions on the accuracy of the used model.

Assuming that the reason of this uncertainty is the use of an insufficient number of statistical data, in what follows we will try to determine the trend curve using a higher number of records for the period 2011-2021.

We determine the new values $\alpha = 43787.39$ and $\beta = -21.63952$.

Hereinafter we will try to analyse the accuracy of the newly estimated parameters for Table 4 using the Eviews software.

Table 4. Parameters of greenhouse gas emissions

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	43787.39	16398.78	2.670161	0.0235
X	-21.63952	8.197329	-2.639825	0.0247
R-squared	0.410679	Mean dependent var		497.5419
Adjusted R-squared	0.351747	S.D. dependent var		121.7497

S.E. of regression	98.02580	Akaike info criterion	12.15935
Sum squared resid	96090.57	Schwarz criterion	12.24017
Log likelihood	-70.95610	F-statistic	6.968677
Durbin-Watson stat	0.600204	Prob(F-statistic)	0.024741

Source: Calculated by the authors with Eviews econometric software

First, we note that the square average deviation has the value 98.02580, which is considerably lower than the average value of human resources productivity, namely 497.5419.

By applying the t-student test, we consider the following hypotheses:

H_0: $\beta = 0$

H_1: $\beta \neq 0$

If the null hypothesis H_0 is true, there is no linear connection between resource productivity and year.

There is $t_{calculat} = -2.639825$.

The critical region is $t_{calculat} < -t_{\frac{\alpha}{2},n-2} = -t_{\frac{0.05}{2},12-2} = -t_{0,025,10} = -2.633766915$ or $t_{calculat} > t_{\frac{\alpha}{2},n-2} = t_{\frac{0.05}{2},12-2} = t_{0,025,10} = 2.633766915$.

In the equations above, α represents the significance threshold (which we select as 0.05), while n is the number of observations (12, in our particular case).

In order to identify $t_{\frac{\alpha}{2},n-2}$ we used the Excel function *tinv()*.

Since the value of the statistical test $t_{calculat} = -2.639825$ with p-value of 0.0000 (probability), there ensues that there is an obvious linear connection (since the probability is lower than 5%, we reject the null hypothesis, which means that the year has a significant influence on resource productivity).

In order to test α, there is:

H_0: $\alpha = 0$

H_1: $\alpha \neq 0$

and $t_{calculat} = 2.670161$

The critical region is $t_{calculat} < -t_{\frac{\alpha}{2},n-2} = -t_{\frac{0.05}{2},12-2} = -t_{0,025,10} = -2.633766915$ or $t_{calculat} > t_{\frac{\alpha}{2},n-2} = t_{\frac{0.05}{2},12-2} = t_{0,025,10} = 2.633766915$

Since the value of the statistical test $t_{calculat} = 2.670161$ with p- probability value, there ensues that we reject the null hypothesis according to which $\alpha = 0$, at a significance threshold of 5%.

Since we have the values of α and β , we can estimate the values of the factor reduction of harmful emissions following the investment effort for the entire duration considered in this scenario.

4. Conclusions

Following the results of the research, the authors consider that European providers of eco-industries should focus on a series of measures, such as: to fully grasp the demands of the export markets, to develop long-term relationships with certain key clients based on mutual advantages, to get involved in the development of trading partnerships on strategic emerging markets by closing alliances or mergers, to focus on the provision of goods and services with higher value added and to grant service and assistance, to closely collaborate with other exporters.

As a result of our research, we proposed ten viable policies that EU may implement in order to preserve its position of global leader in eco-industry, which are specified below:

- to improve the statistic monitoring of the sector, as the current quantity data have a limited character in ensuring sustainable consumption, production and industrial policy;

- to harmonize the application of various directives standards and certification procedures on the domestic market;

- to introduce performance criteria across the European Union, as well as technical standards for the reduction of the administrative burden;

- to create qualified labour force through professional training programs and the flow of highly qualified workers from outside the European Union;

- to ensure legal access to information among eco-industry, clients and providers;

- to stimulate and support eco-innovation and research and development through the promotion of C&D research and development, ETAP and the PC7 research program;

- to develop financial support systems for C&D and innovation in eco-industry;

- to harmonize and promote eco-friendly public procurements;

- to create globally open markets.

The authors are of the opinion that for the following decades, the sector of investments in eco-technologies will continue to grow as a result of subsidies and fiscal stimulants, continuing to be a viable source of competitive edge on the European market.

The European Union will continue to be concerned with the reduction of carbon emissions meant to diminish pollution and ensure a clean environment to its citizens.

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