

## Contribution of Environmental Voluntary Schemes to Sustainable Development in the European Union

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### Abstract

*Establishment of voluntary approaches in the OECD and EU represented one of the most striking environmental developments of the 1990s. The EU Eco-Management and Audit Scheme (EMAS, 1993) is a management instrument to improve environmental performance of organisations. The EU Ecolabel (1992) is a part of the EU sustainable consumption and production policy, which is also one of ten themes in the EU Sustainable Development Strategy. Usage of these voluntary schemes can affect the Resource productivity, which is a headline indicator in this theme, and ultimately lead to sustainable development. However, the positive effects in the EU countries take place with time lags after their introduction. The longer lags are typical of the EMAS. The aim of this Paper is to assess the usage of the voluntary instruments in the EU countries and to evaluate their contribution to sustainable development on the basis of examining their relations to resource productivity.*

**Keywords:** *sustainable development, the EU Eco-Management and Audit Scheme (EMAS), the EU Ecolabel, the EU Sustainable Development Strategy, resource productivity*

**JEL Classification:** Q51, Q56

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### Introduction

According to the most frequently quoted definition from the Report of the World Commission on Environment and Development (WCED) Our Common Future, also known as the Brundtland Report, sustainable development (SD) is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UN, 1987). SD stresses the

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long-term compatibility of the economic, social and environmental dimensions of human well-being, while acknowledging their possible competition in the short-term. Thereby, short-term competition between goals pertaining to the economic, environmental and social dimensions is one of the important causes of the large gap in the implementation of SD policies (OECD, 2001). SD is recently a major concern in many developed countries and it results in stricter regulation taking into account the impact of the products during their whole life cycle (Houe and Grabot, 2009), i.e. extraction, manufacturing and packaging, distribution, use and finally the “end of life” stage, when the product is disposed of or recycled. So, it is important to encourage decoupling between the economic and environmental variables to improve the resource productivity (RP) to advance towards the SD. One of the investigated voluntary schemes, i.e. the EU Ecolabel, was established to improve the environmental quality of a product all along its lifecycle, i.e. to identify products and services that have a reduced environmental impact throughout their life cycle (EC, 2014a). Thus the above mentioned philosophy under the SD also constitutes the basis of this voluntary scheme. The second one, i.e. EU Eco-Management and Audit Scheme (EMAS) is a management tool which aims to increase the environmental performance of organisations. The aim of this Paper is to assess the usage of the voluntary schemes in the EU countries and to evaluate their contribution to sustainable development on the basis of examining their relations to resource productivity.

## **1. Background of Environmental Voluntary Instruments and the EU Sustainable Development Indicators**

This section presents the basic knowledge for the analysis of voluntary instruments in the EU. It consists of short history of the voluntary instruments, more detailed introductions of two examined EU voluntary instruments and the EU Sustainable Development Indicators (SDIs) which are significantly associated with this topic and also the main sources of data.

### **1.1. Development and Classification of Voluntary Approaches**

In the 1970s and 1980s most developed countries created a lot of new regulations aimed at tackling environmental degradation. The approach taken in that time was typically one of “command and control,” which specified in law the standards to be met. It can show excessive rigidity, costliness and thus negatively affect relations between the private and public sectors (Lyon and Maxwell, 1999; Dawson and Segerson, 2003). One of the most striking environmental

developments of the 1990s goes beyond this type of environmental regulation. Many OECD countries have moved towards deploying more co-operative approaches with the private sector, particularly through establishment of voluntary approaches (Lyon and Maxwell, 1999). They increase flexibility and reduce administrative cost both for the private sector and government. Main types of voluntary approaches in OECD countries are the following ones (Börkey, Glachant and Lévêque, 1999). *Public voluntary programmes* involve commitments devised by the public bodies such as environmental agencies in which individual firms are invited to participate. Participation is left to individual companies. The examples are the US programme 33/50 Program for Reducing Toxic Chemical Emissions and the EMAS implemented in the EU since 1993 (see the next section). *Negotiated agreements* are commitments for environmental protection developed through bargaining between a public authority and industry. They typically contain a target and a timetable for reaching that target. Some examples are the French agreement on the treatment of end-of-life vehicles or the Swedish agreement of produce responsibility for packaging. *Unilateral commitments* are initiated by the private sector without any involvement of a public authority. Examples include the Chemical Manufacturers Association's "Responsible Care" program for reducing chemical hazards or the German Industry and Trade Association's plan to reduce carbon dioxide emissions (Lyon and Maxwell, 1999).

One group of the instruments, which is contained in the above indicated groups, are the environmental management systems (EMS). They represent frameworks for integrating corporate environmental protection policies, programs, and practices. Many companies that adopt an EMS follow industry standards, such as "Responsible Care" in the chemicals sector, or international guidelines such as ISO 14001<sup>1</sup> or the EU EMAS (Morrow and Rondinelli, 2002).

This survey is completed with the different types of information provision programs. A label indicating that the labeled brand is more environmentally friendly than unlabelled brands of the given consumer product is often used as a simple way to present complex environmental information to consumers. Examples include the EU Ecolabel (the EU's Ecoflower), the German Blue Angel, and the Nordic Swan (Bjørner, Hansen and Russell, 2004). Ecolabeling policies may promote environmental objectives without production site command and control methods and they can be a way of meeting global environmental objectives (Teisl, Roe and Hicks, 2002). Generally, the labels referring to the low environmental impact of products belong to three major types (Gallastegui, 2002).

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<sup>1</sup> The International Standards Organization (ISO) promulgated its standard for EMSs (ISO 14001) in 1996 (Stuart, 2000).

*Type I labels*, also called eco-labels, refer to the environmental quality of a product all along its lifecycle. These voluntary labels are the result of third party certification programmes. *Type II labels* are self-declarations of the manufacturers, importers or distributors and refer to specific attributes of the products (e.g. “CFC free” products). *Type III labels* use pre-set indices and give quantified information on products based on independent verification. They are still rarely used in the environmental field.

## **1.2. More Detailed Literature Review**

Voluntary instruments and measuring of sustainability/SD have been examined by many authors. Besides the above mentioned, it is important to refer to the work of Kuhn (1999), which investigated if a public eco-label mitigates adverse selection, where an ecologically superior (green) product variant is underprovided. One of the conclusions is that an ecolabel may help to promote the establishment of a green industry by resolving the informational asymmetry at least partially and, thereby, overcoming the problem of adverse selection (Kuhn, 1999). Aspects of Environmental labeling and consumers’ choice are investigated by Bjørner, Hansen and Russell (2004), Teisl, Roe and Hicks (2002), or Banerjee and Solomon (2003) who examined Eco-labeling to promote energy efficiency and sustainability. Bratt et al. (2011) investigate what gaps there may be in the current criteria development processes in relation to a strategic sustainability perspective. A framework for strategic sustainable development is applied for the assessment of two eco-labelling programmes. Houe and Grabot (2009) came to the conclusions that SD is a major challenge for our society, but its full integration in our behaviours cannot be obtained quickly if it is only considered as a new source of constraints for companies. They guess that, with the emergence of real customer awareness on environmental issues, the eco-friendliness of a product may become a competitive advantage, making consistent two conflicting issues, namely SD and law of the market. In this sense eco-labels should play the role of certification standards, which can be trusted by the customers.

Concerning EMAS, Clark (1999) indicates that many multinational companies are adopting EMS to satisfy customer pressures and to ensure that their suppliers are operating in environmentally and socially responsible ways. The several empirical analyses and case studies that have been done on corporate EMS provide insights into results primarily for large multinational corporations in the United States and Europe. Morrow and Rondinelli (2002) compare these findings with those of five in-depth case studies of smaller domestic energy and gas companies in Germany. Most of the case studies and surveys show that it is

difficult to attribute environmental improvements directly to the adoption and certification of EMS. Stuart (2000) claims that EMS can be an effective tool for communicating the value of an environmental program to a wide variety of audiences. However, implementing an EMS is not a simple process because a complete EMS is likely to affect every aspect of an organization's operations. To complete the survey it is appropriate to mention the study of Melnyk, Sroufe and Calantone (2003) which assesses the relative effects of having a formal but uncertified EMS compared to having a formal, certified system. Their results demonstrate that firms in possession of a formal EMS perceive impacts well beyond pollution abatement and see a critical positive impact on many dimensions of operations performance. Regarding the sustainability measurement the work of Singh et al. (2009) provides an overview of various sustainability indices applied in policy practice.

### **1.3. The EU Eco-Management and Audit Scheme and the EU Ecolabel**

The EU EMAS is a management instrument developed by the European Commission for companies and other organisations to evaluate, report, and improve their environmental performance. EMAS was introduced in 1993 and evolved over time. It is a voluntary tool available for any kind of organisation aiming to improve its environmental and financial performance and communicate its environmental achievements to stakeholders and society in general. It spans all economic and service sectors (EC, 2014b). The EU Ecolabel scheme belongs to the *Type I labels* (see section 1.1) and it is a voluntary label administered by the European Commission. It is part of the sustainable consumption and production policy of the EU, which aims at reducing the negative impact of consumption and production on the environment, health, climate and natural resources (the European Parliament and the Council of the EU, 2010). So the EU Ecolabel is awarded to products and services with reduced environmental impacts in comparison to similar ones on the market (EC, 2014a).

The legislative basis of the voluntary schemes in the EU is composed of the relevant pieces of the EU (EC) secondary law, concretely the Regulations and additional Decisions, which have been amended several times according to the developing and changing requirements. The EN ISO 14001: 2004 EMS requirements are an integral part of EMAS III (Annex II of EMAS III Regulation). However, EMAS considers additional elements to support organisations in continually and significantly improving their environmental performance (EC, 2014b). While EMAS and ISO 14001 share the same objective, EMAS goes beyond some ISO requirements. A comparison with statistics on ISO 14001 shows that the popularity of EMAS is still relatively low (Eurostat, 2014c).

#### 1.4. The EU Sustainable Development Indicators

The EU Sustainable Development Strategy (EU SDS) was launched in June 2001. In June 2006 an ambitious and comprehensive renewed SDS for an enlarged EU was adopted according to the previous review of the EU SDS (EC, 2014c). The SDIs are used to monitor the EU SDS in a report published by Eurostat every two years and they are presented in ten themes. Of more than 100 indicators, twelve ones have been identified as headline indicators. They provide an overall picture of whether the EU has achieved progress towards sustainable development in terms of the objectives and targets defined in this strategy (Eurostat, 2014b). At the lower level there are the operational indicators which are related to the operational objectives of the EU SDS and the lead indicators in their subthemes. At the even lower level there are explanatory indicators which are related to actions described in the SDS or to other issues which are useful for analysing progress towards the objectives of the SDS (Eurostat, 2013).

For the analysis carried out in this Paper one of the themes is particularly relevant, i.e. Sustainable Consumption and Production (SCP), where the EU SDS sets out the objective of promoting sustainable consumption and production patterns (Eurostat, 2014c). Headline indicator of this theme is the Resource Productivity (RP) which is defined as the ratio between gross domestic product (GDP) and domestic material consumption (DMC). The DMC indicator is based on the Economy-wide Material Flow Accounts. DMC measures the total amount of materials directly used by an economy and it is defined as the annual quantity of raw materials extracted from the domestic territory of the focal economy, plus all physical imports minus all physical exports. The RP is so called “decoupling indicator” which provides some insights into the SDS objective to decouple economic growth from natural resource use (Eurostat, 2014c). In general, these indicators measure the decoupling of environmental pressure from economic growth over a given period (OECD, 2003). Decoupling takes place when the growth rate of the economic driving force, e.g. GDP, exceeds the growth rate of the environmental pressure over a given period (OECD, 2002).

Three operational objectives and targets of SCP theme are: Resource Use and Waste, Consumption Patterns and Production Patterns. The third objective is associated with the usage of voluntary schemes. Namely, the operational indicators related to these objectives are the Organisations and sites with EMAS registration and one of the explanatory indicators are the Ecolabel licenses (Eurostat, 2014c).

## 2. Data and Methodology

In the analysis of this Paper data available on Eurostat (2014a, b, c) are used. Concretely, general, economic statistics and SDIs data in Theme 2 of the EU SDS: *Sustainable consumption and production* (which were described in the section 1.4) are applied in the analysis. Data for indicators referring to the application of two investigated voluntary instruments in the EU are available in 27 EU countries. It means that Croatia which entered EU in 2014 is excluded from the large part of the analysis. As a method for investigation of mutual relations of variables the panel data analysis, particularly panel EGLS (cross-section weights) was applied. Regarding the effects specification the model with fixed effects in the cross-section dimension was used to account for individual effects. Regarding GLS weights, cross section weights were selected, which is a feasible GLS specification assuming the presence of cross-section heteroskedasticity. Generally, the following model was applied:

$$\Delta RP = C_1 + C_2 \times \Delta EL + C_3 \times \Delta EMAS + C_4 \times dGDPpc + [CX = F] \quad (1)$$

After the application of the above presented general model, the time lags were incorporated in the model as well.

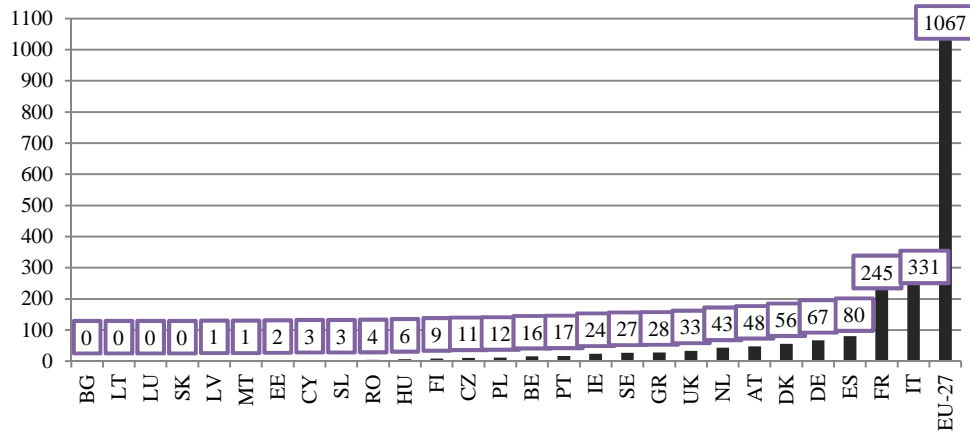
## 3. Analysis of Sustainable Development in the EU Using the Relationship between Voluntary Schemes and Resource Productivity

In the first part of the analytical section the development of EMAS registrations and Ecolabel licenses in the EU and its countries is monitored. The second part is devoted to the analysis of the Resource Productivity indicators development in the EU and its countries. The third part is focused on the relations of the examined voluntary schemes to Resource Productivity (RP) using the panel regression in order to examine their impacts on SD in the EU.

### 3.1. Analysis of Ecolabel Licenses and EMAS Registrations in the EU

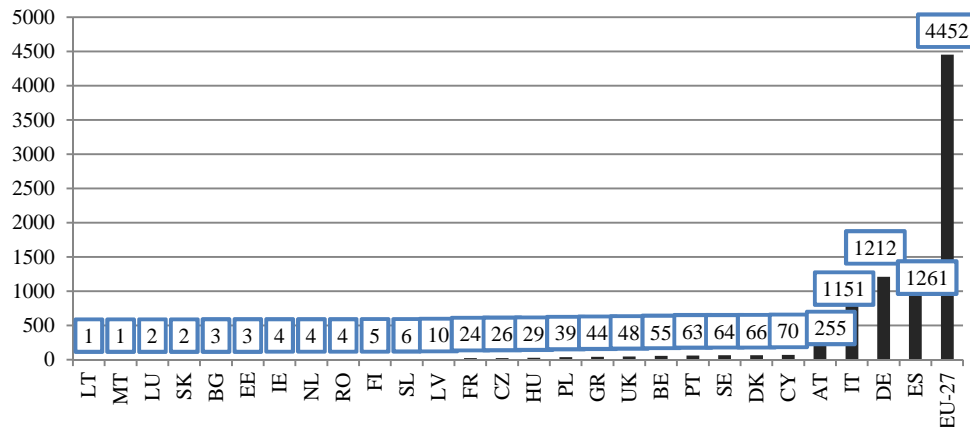
The analysis is initiated with monitoring of the two voluntary schemes development in the EU and its countries. The indicator depicted in Figure 1 is defined as the number of Ecolabel or “EU Flower” licences in the EU countries (Eurostat, 2014c). It can be seen that France, Italy and Spain dominate in the number of licenses among the EU countries whereas the lowest numbers are typical of most of the new Member States and Luxembourg.

Figure 1  
Ecolabel Licenses in 27 EU Countries, Number, 2010



Source: Eurostat (2014c).

Figure 2  
Organisations with EMAS Registration, Number, 2012

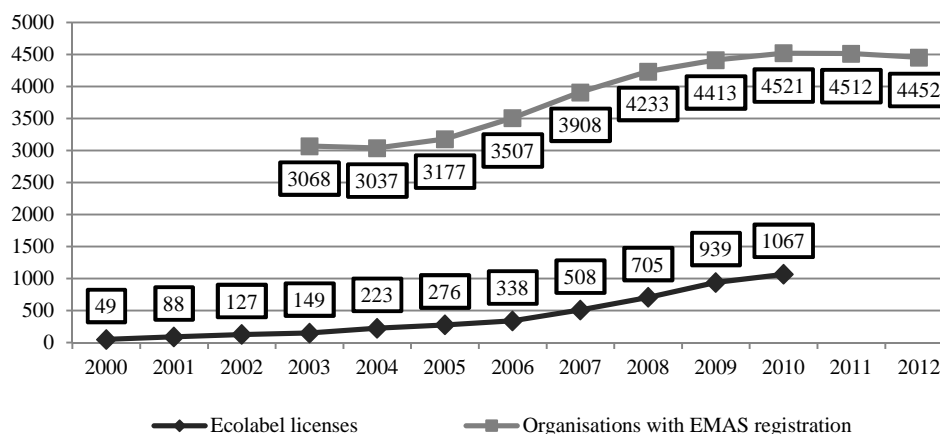


Source: Eurostat (2014c).

The indicator depicted in Figure 2 is defined as the number of EMAS-registered organisations (Eurostat, 2014c). Spain, Germany and Italy achieved the highest numbers of EMAS registrations whereas more new Member States and Luxembourg showed the lowest numbers of these registrations similarly to the number of the Ecolabel licenses. Regarding the number of EMAS registrations, the economy of Cyprus with the fifth highest number among the EU countries represents an exception. The number of registrations in this country was zero until 2007, four in 2008, five in years 2009 – 2011 and increased to seventy in 2012.



Figure 3  
**Ecolabel Licenses (2000 – 2010) and Organisations with EMAS Registration (2003 – 2012) in EU-27, Numbers**



Source: Eurostat (2014c).

Development of both of the instruments in EU-27 is indicated in Figure 3. Even if the numbers of Ecolabel licenses in comparison to the numbers of Organisations with EMAS registrations are relatively lower, their number significantly increased in per cent in period 2000 – 2010, i.e. by 2 077.551% (by 1 018 licences in absolute figures). On the contrary the number of Organisations with EMAS registrations increased less significantly in relative figures, i.e. by 45.111% but more significantly in absolute figures, i.e. by 1 384 registrations. Development of Ecolabel licenses and Organisations with EMAS registrations in EU-27 in monitored periods (see Figure 3) seems to have been quite positive. The number of Ecolabel licenses was growing in the whole period of 2001 – 2010 in which data were available. The greatest increase in absolute figures occurred in 2009, whereas the lowest one in 2003. The most significant percentage increase was typical of 2001. Regarding the EMAS registrations, there was a negative change in three years of monitored period of 2004 – 2012, namely in 2004, 2011 and 2012 whereas the drop in 2012 was the highest both in absolute as well as in percentage terms. The highest increases in EMAS registrations were typical of years 2007 and 2006 both in absolute and relative terms. Moreover in 2008 and 2009 the numbers of both instruments also increased significantly, especially in absolute figures. In most recent years the development seems not to be positive especially by EMAS, where the numbers of registrations decreased in 2011 and 2012. By Ecolabel licenses, however, the trend in recent period cannot be adequately assessed because of lack of data after 2010.

To sum up, the numbers of instruments were predominantly growing, the great increases of the number of instruments in 2009 can be associated with more conscious behaviour of organisations due to the economic crisis. However, this awareness can have a downward trend in most recent period, especially by EMAS registrations. Because these two instruments have different character, i.e. the first one is related to products and the second one to organisations, it is not possible to compare the numbers directly. It can only be said, that the increase in the number of both instruments leads to more sustainable production and consumption and eventually to sustainable development.

Table 1

**Annual Changes of Ecolabel Licenses (2001 – 2010) and Organisations with EMAS Registration (2004 – 2012) in EU-27, Numbers**

VS/year		01	02	03	04	05	06	07	08	09	10	11	12
Ecolabel licenses	abs.	39	39	22	74	53	62	170	197	234	128		
	%	79.6	44.3	17.3	49.7	23.8	22.5	50.3	38.8	33.2	13.6		
Organisations with EMAS registration	abs.				-31	140	330	401	325	180	108	-9	-60
	%				-1.01	4.6	10.4	11.4	8.3	4.3	2.4	-0.2	-1.3

Source: Eurostat (2014c); own elaboration.

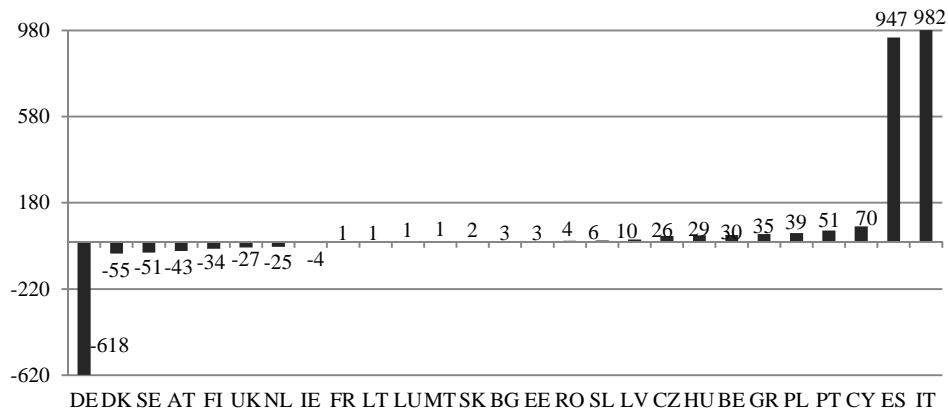
In Figure 4 the development of the number of Organisations with EMAS registration in the EU countries in period 2003 – 2012 can be seen. In some EU countries the number of Organisations with EMAS registration decreased, especially in Germany, Denmark, Sweden and Austria. In Germany this number dropped in every year of the monitored period with exception of 2010 (23 new registrations). The largest increase in the number of Organisations in period 2003 – 2012 was typical of Italy and Spain (more than 900) and they were followed by Cyprus and Portugal (more than 50). The countries responsible for the drop of EMAS registrations in three years of monitored period (see Table 1) are especially Germany (-189) and Austria (-44) in 2004, Germany (-56) in 2011 and Germany (-134) in 2012. It can be said that the more positive development of the EMAS registrations numbers has been typical of the Southern and the new Member States compared to the most advanced EU economies including the Northern States.

Regarding the Ecolabel licenses we can see in Figure 5 that the number of Ecolabel licenses did not decrease until 2010 in any of the EU country. However there are still countries with zero number of the license such as Bulgaria, Luxembourg, Latvia and Slovakia. Whereas in the first two countries the number was zero during the whole period in which data were available (see notes below Figure 5), in Latvia and Slovakia the numbers were also positive. However, these numbers were very small, i.e. 3 licenses in Latvia in 2007 – 2009 and 1 license

in 2008 and two licenses in 2009 in Slovakia. It is questionable to what extent this phenomenon is correlated with the economic crisis assuming that in 2010 their number is again zero.

Figure 4

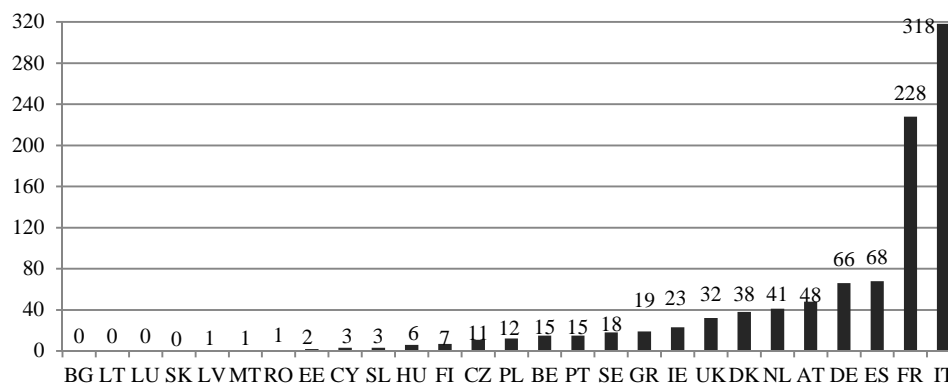
**Changes of Organisations with EMAS Registration (2003 – 2012), Numbers**



Source: Eurostat (2014c); own elaboration.

Figure 5

**Changes of Ecolabel Licenses until 2010, Numbers**



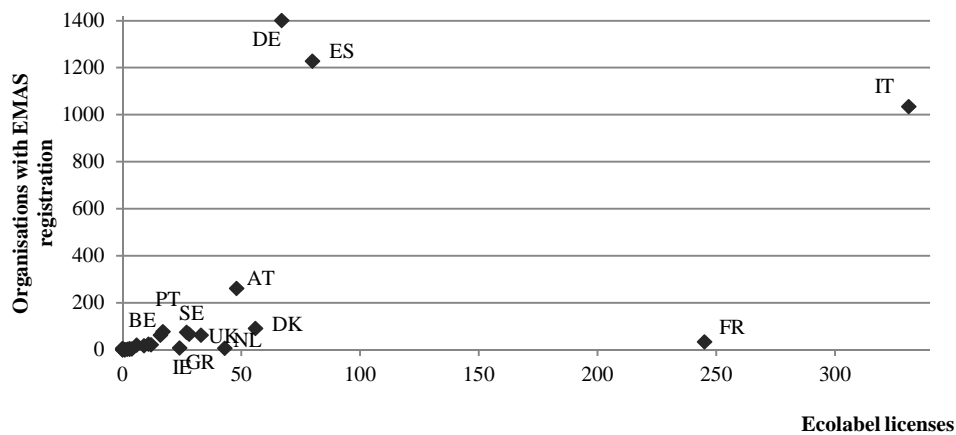
Note: The first year to which the changes are compared differs among the EU countries depending on the first year in which EU Ecolabel licenses are monitored (or introduced) in particular country. In 15 older Member States data have been available since 2001, in 9 new Member States since 2004, in Malta since 2005, in Bulgaria and Romania since 2008.

Source: Eurostat (2014c); own elaboration.

There are also other countries, especially the new member states, with the low numbers of the Ecolabel licenses in 2010 (see Figure 1). Four countries with the largest increase of the number of licenses until 2010, i.e. Italy, France, Spain

and Germany (Figure 5) are also the countries with their highest number in 2010 (Figure 1). In comparison to the development of EMAS registrations that of Ecolabel licenses seems to be different. The eight advanced countries with the decrease of EMAS registrations (see Figure 4) showed increase in Ecolabel licenses in the monitored period 2001 – 2010. The lack of analysis is that data are not available after 2010.

Figure 6  
Numbers of Ecolabel Licenses and Organisations with EMAS  
Registration in the EU Countries, 2010



Source: Eurostat (2014c); own elaboration.

Figure 6 shows both numbers of Ecolabel licenses and Organisations with EMAS registration in the EU countries in 2010. It can be seen that four countries of the EU are outliers, i.e. Germany and Spain with especially high numbers of Organisations with EMAS registration, France with especially high number of Ecolabel licenses and Italy with both high numbers. In the left part of the picture there is a larger group of the EU countries, especially the new Member States, with both low numbers. On the right edge of this group there are countries such as Austria with relatively higher number of Organisations with EMAS registration and Denmark with relatively higher number of Ecolabel licenses than it is typical of this group.

To sum up, some countries of the EU dominate in the application of two analysed voluntary schemes and it could help improve sustainability of production and consumption in these economies and move towards sustainable development path. This, among others, depends on how these improvements are reflected in the Resource Productivity, which is the headline indicator of SCP theme. However, the character of the economy is important as well. It can be seen on the

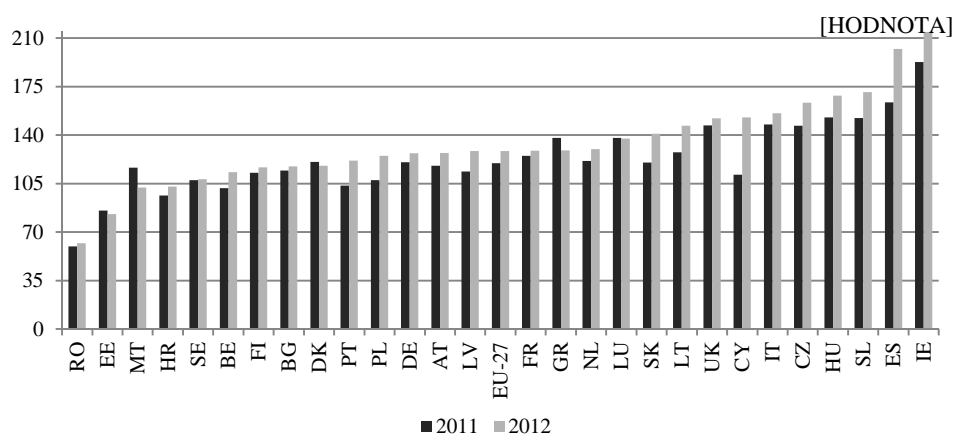
example of the Luxembourg economy in which the relatively highest gross value added (at basic prices, as a percentage of total) in comparison to other EU countries in the branch of financial intermediation and real estate has been achieved (Eurostat, 2014a).

### 3.2. Development of Resource Productivity in the EU Countries

Resource Productivity as a decoupling indicator can say a lot about the path of country to sustainability and SD. Figure 7 depicts the RP Index with the base period year 2000 = 100 in the EU countries and thus the development of RP in time can be monitored.

Figure 7

#### Resource Productivity in the EU Countries, 2011, 2012, Index 2000 = 100



Note: Data for countries are ordered from the highest to the lowest one in year 2012.

Source: Eurostat (2014c); own elaboration.

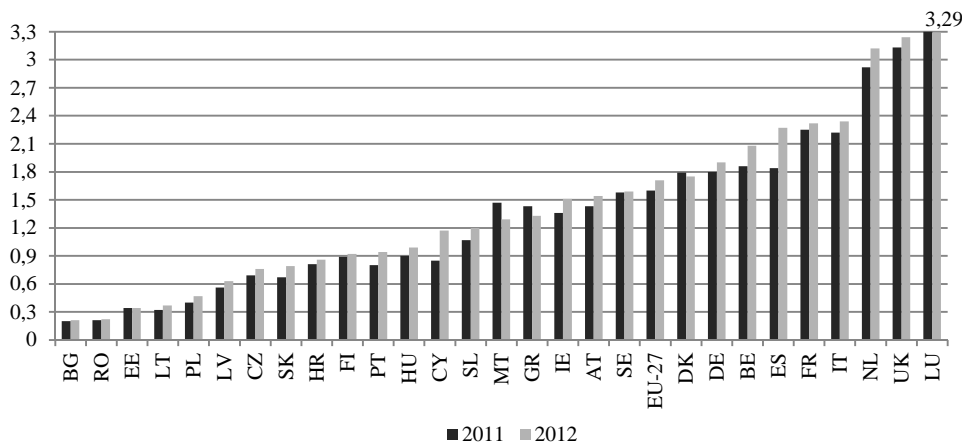
According to the RP Index depicted in Figure 7 it can be seen that until 2012 the RP only decreased in Romania (-37.98) and Estonia (-16.94) and until 2011 in Romania (-40.43) and Estonia (-14.54) again and moreover, in Croatia (-3.52). On the other hand the most significant increases were typical of Ireland (92.78 and 114.31% until 2011 and 2012 respectively), Spain (63.65 and 102.17 % respectively) and among the older Member States also in Italy (47.55 and 55.82 respectively). Spain and Italy are also the countries with large numbers (see Figures 1, 2, 6) and increase of numbers (see Figures 4 and 5) of both voluntary instruments. France and Germany which have been dominant in the number of one voluntary instrument (see Figure 6) also showed increases in RP higher than 20% until 2012.

Significant increases of RP in period 2000 – 2012 were also typical of several other new Member States such as Slovenia, Hungary, the Czech Republic, Cyprus, Latvia and Slovakia. The lowest increases occurred in Malta and Croatia (2.17% and 2.83% respectively). In Malta significant decreases in RP have taken place since 2011 (in 2011 = –32.2%). In 2010 the RP even achieved 148.67% of 2000 but in 2012 only 102.17%. However, the corresponding numbers of voluntary schemes in these countries are still low. This means the low numbers of Ecolabel licenses in these countries as well as low increases of its numbers (see Figures 1 and 5). Similarly, the numbers of EMAS registrations in these countries except Cyprus, which showed 70 registrations in 2012, are low (see Figure 2). However, regarding the increases in EMAS registrations in the new member countries, this development can be evaluated as a positive (see Figure 4) and consistent with RP increases, especially in Cyprus, Poland, Hungary, the Czech Republic, Lithuania and Slovenia with relatively higher increases in both the RP as well as EMAS registrations.

Figure 8

**Resource Productivity in the EU Countries Resource Productivity in the EU Countries Euro per Kilogram, 2011, 2012**

(Euro: chain-linked volumes, reference year 2005, at 2005 exchange rates)



Note: Data for countries are ordered from the highest to the lowest in year 2012.

Source: Eurostat (2014c); own elaboration.

Using the absolute figures, i.e. Euro per Kilogram, the cross-country comparison can be carried out. In Figure 8 it can be seen that the only three countries with the higher RP than 3 Euro per Kg in 2012 are Luxembourg (3.29), the United Kingdom (3.24) and Netherlands (3.12). Four additional countries, i.e. Italy, France, Spain and Belgium showed the higher RP than 2 Euro per Kg. This is

consistent with large numbers and high increases in voluntary schemes in these countries again, especially in the first three mentioned countries (see Figure 6). The RP lower than 1 Euro per Kg is typical of all the new member countries except Malta (1.29), Slovenia (1.2) and Cyprus (1.17). In 2000 there were only three countries with the higher RP than 2 Euro per Kg, i.e. Netherlands (2.4), Luxembourg (2.39) and the UK (2.13) and all new member countries except Malta (1.27) showed the figures lower than 1. However, Netherlands and the UK showed decreases in EMAS registrations in period 2003 – 2012. Other four developed EU countries with the RP higher than 1.5 in 2012, i.e. Austria, Sweden, Denmark and Germany showed even higher decreases in EMAS registration numbers.

Although in majority of the new Members States the RP increased, in two countries with the ones of its lowest level, i.e. Romania and Estonia, the RP even dropped. The numbers of both voluntary schemes increased in these countries but only very slightly.

### 3.3. Relations between Resource Productivity and Application of Voluntary Schemes

In this section two models are presented to point out to the relations between the Resource Productivity change as an explained variable and changes in numbers of two voluntary schemes applied in the EU countries and the percentage changes of real GDP per capita as explanatory variables. As a method the panel regression was applied. The detailed description of methodology can be found in Section 2. For creation of the model represented by the Equation (2) data from Eurostat (2014a, b, c) in period 2003 – 2010 were used. It shows the influence of the EU voluntary schemes on the Resource Productivity (*RP*) in its countries.

$$\Delta RP = 0.021 + 26635.4235 \times \Delta EL - 9984.0135 \times \Delta EMAS - 0.1083 \times dGDPpc + \quad (2)$$

$$+ [CX = F]$$

$$R^2 = 0.347348; \text{adj}R^2 = 0.228311; DW = 2.146711; S.E. \text{ of regression} = 0,209393$$

As indicators representing the voluntary schemes the Number of Ecolabel licenses (*EL*) and Number of Organisations with EMAS registration (*EMAS*) were used. These numbers were divided by population of particular countries to reduce the effects of different size of countries on the number of functioning voluntary schemes in these countries. Population data were extracted from Eurostat (2014a), namely the indicator of population (the inhabitants of a given area) on 1<sup>st</sup> January was used. As an indicator of GDP per capita the Real GDP per capita in Euro per inhabitant (*GDPpc*) was used. The annual changes instead of the absolute numbers of variables were chosen ( $\Delta$ ) because of the presence of unit root verified by the panel unit root tests such as *Levin*, *Lin&Chu t\**, *Im*, *Pesaran and*

*Shin W-stat, ADF – Fisher Chi-square* and *PP – Fisher Chi-square*. Only in the case of the GDP per capita variable the unit root was not indicated, however, the absolute level of GDP per capita is statistically insignificant in this model and GDP growth, i.e. annual percentage change was used. Thus the change in Resource Productivity seems not to be affected by the absolute level of the real GDP per capita.

The results indicate positive relationship between the change of the RP and the change of the number of Ecolabel licenses per capita and negative relationship between the change of the RP and the number of Organisations with EMAS registration as well as the Real GDP per capita growth in particular year. This can be explained by the facts that the Ecolabel licenses affect the Resource Productivity more directly than the EMAS registrations. Products and services which are awarded the EU Ecolabel have a reduced environmental impact throughout their life cycle. By developing EU Ecolabel criteria for products the focus is on the stages with the highest environmental impact of the product, and this differs between products (EC, 2014a). On the contrary, EMAS is a management instrument for companies and other organisations to improve their environmental performance. So the relationship between the Resource Productivity and EMAS registrations is not so straightforward. EMAS registration should affect many aspects of the activities of companies which should finally lead to the increase in Resource Productivity as well. This is however a long term process and the number of EMAS registrations can affect the Resource Productivity in following. This is not incorporated in the created model. It can also be true of Ecolabel licenses functioning and both voluntary schemes can affect the development of Resource Productivity with time lags and lead to gradual improvements in this indicator.

The last explanatory variable, i.e. annual percentage change of Real GDP per capita is associated with minus sign, i.e. positive changes of GDP per capita were connected with negative changes of Resource Productivity. However, this results can mainly be caused by inclusion of the period of economic crisis in the analysis, or more generally, by the actual economic development. In 2009 the RP increased in the whole EU-27 (28) because of higher percentage drop in DMC than that in Real GDP. It also increased in the majority of its countries (except Malta, Estonia, Luxembourg and Germany) whereas the real GDP per capita dropped in all countries except Poland. In 2008 the real GDP per capita decreased in 13 countries and RP in 12 countries<sup>2</sup> and in the whole EU-27 the RP slightly increased whereas by the real GDP per capita no annual change occurred. However

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<sup>2</sup> This number was received from data on RP Index, 2000 = 100 with last update on 29<sup>th</sup> of July 2014.



the simultaneous drop in both indicators took place only in Sweden, Finland and Portugal. In other EU countries the development of indicators went in the opposite direction. The increase in RP in the whole EU in this year was caused by simultaneous Real GDP growth increase and DMC decrease.

On the other hand the years of 2004 and 2011 were associated with the increase in the real GDP per capita and simultaneous decrease in the RP in the whole EU-27. The RP decreased in 17 countries in 2004 and 18 countries in 2011<sup>3</sup> whereas the real GDP per capita only in one country (Malta) in 2004 and 5 countries in 2011. In both years the development in opposite direction took place in many EU countries again. In 2004 the both indicators declined only in Malta and in 2011 only in Greece and Portugal. It means, in many EU countries the development of indicators in the opposite direction in particular years took place. As it was explained in the second section, RP is defined as the ratio between GDP and DMC. Then, RP increases when DMC decreases by simultaneous growth of GDP, i.e. absolute decoupling takes place, by faster increase of GDP than that of DMC, i.e. relative decoupling takes place, or by simultaneous decrease in both variables when DMC drops faster than GDP. Concretely, in the EU-27 the RP dropped in 2004 and 2011 because of higher percentage growth of DMC than that of GDP. On the contrary, in 2002 and 2003 and later in 2008, 2009, 2010 and 2012 the RP increase in the whole EU-27 was associated with decrease in DMC. Whereas in 2002, 2003 and then in 2008 and 2010 Real GDP annually grew, which indicates absolute decoupling, in 2009 and 2012 GDP dropped less than DMC which doesn't indicate positive development. Even in 2008 and 2010 it cannot be spoken about positive development, it was affected by the crisis. In 2008 the positive growth rate of GDP was very slow (0.372%). So, positive development is rather affected by actual economic situation than by structural changes. To sum up the path to SD is affected by decoupling, i.e. by relations between DMC and GDP growth, which determines the Resource Productivity. Voluntary instruments of environmental policy can positively affect Resource Productivity. However, the positive effects can take place with time delays.

### ***Model with Time Lags***

If time lags are included in the model, the results look quite differently. For creation of the model represented by the Equation (3) data from Eurostat (2014a, b, c) in period 2003 – 2010 were used again.

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<sup>3</sup> This number was received from data on RP Index, 2000 = 100 with last update on 29th of July 2014. Absolute figures (Euro per Kilogram) showed decline in 15 countries in 2004 and in 16 countries in 2011.

$$\begin{aligned} \Delta RPD = & -0,0478 + 73974,493 \times \Delta EL(-1) + 97437,3542 \times \Delta EL(-2) + \\ & + 15905,5209 \times \Delta EMAS(-1) + 28522,4567 \times EMAS(-4) + \\ & + 0,5464 \times dGDPpc(-2) + [CX = F] \end{aligned} \quad (3)$$

$$R^2 = 0.803965; \text{adj}R^2 = 0.679942; DW = 3.254261; S.E.\text{ of regression} = 0.268073$$

The used symbols have the same meanings as in the previous equation (2). Numbers in parentheses indicate time lags in years. All included variables have positive sign, which indicates directly proportional relationship of these variables with the RP indicator. According to the Equation (2) the changes of Ecolabel licenses and EMAS registrations in previous year significantly affect the changes of Resource Productivity in actual year. Significant effect on the RP was also detected by the changes of Ecolabel licenses with the lag of two years and Number of Organisations with EMAS registration with the lag of four years. The last effect is the largest one. The changes of the real GDP per capita positively affect the Resource Productivity with time lag of two years, however, this effect is quite small. The actual change of GDP per capita and the change in previous year seem to be statistically insignificant. So the previous development in macroeconomic activity and introduction of voluntary schemes indicate positive correlation with the Resource Productivity and shift to more sustainable development in the EU countries.

## Conclusions

Voluntary instruments of environmental policy have gained important role in encouraging sustainable patterns in consumption and production and hence the sustainable development as a whole. The EU EMAS was established in 1993 and the EU Ecolabel was launched in 1992. The latter is a part of the sustainable consumption and production policy of the EU, which is also one of ten themes included in the EU SDS. Both instruments represent an important part of this EU Strategy, i.e. its *Sustainable Consumption and Production* theme, where the headline indicator is the decoupling indicator, i.e. Resource Productivity.

Regarding the development of two examined voluntary instruments and its relation to Resource Productivity some conclusions can be drawn. In many advanced countries, such as Germany, Austria, the UK, Netherlands, three Northern countries and Ireland the number of Organisations with EMAS registration declined in period 2003 – 2012. However, all these countries showed increase in Resource Productivity in period 2000 – 2012. On the other hand, in Southern economies such as Italy, Spain, Cyprus and Portugal the numbers of EMAS registrations significantly increased with the simultaneous growth of Resource

Productivity. Spain and Italy are especially those countries with the high increase in Resource Productivity and large numbers and high increase in numbers of both voluntary instruments. Significant increases of RP were also typical of several other new Member States such as Slovenia, Hungary, the Czech Republic, Cyprus, Latvia and Slovakia. However, we cannot say that the numbers of voluntary schemes in these countries are quite consistent with this development, especially by the Ecolabel licenses. Numbers of Ecolabel licenses in these countries as well as increases of its numbers are low. The numbers of EMAS registrations in these countries except Cyprus, Poland, Hungary and the Czech Republic are relatively low as well. Regarding the changes in EMAS registrations in new member countries, this development can be evaluated as a positive because increases have taken place which is consistent with RP increases, especially in Cyprus, Poland, Hungary, the Czech Republic, Lithuania and Slovenia with relatively high increases in both Resource Productivity and EMAS registrations. So the relationship between Resource Productivity and application of voluntary instruments is more straightforward by less advanced EU countries in comparison to the most advanced ones.

Because these two instruments have different character, i.e. the first one is related to products and the second one to organisations, it is not possible to compare the effects of these instruments directly. As the analysis indicated, from the long term point of view the increase in number of both instruments can lead to more sustainable production and consumption and eventually to more sustainable development through encouraging the Resource Productivity. This can be achieved with time lags, whereas the longer ones are typical of the EMAS registrations in comparison to Ecolabel licenses. Changes in Resource Productivity can be negatively correlated with the actual development of real GDP per capita, but this development is mainly affected by actual economic situation such as economic crisis or, on the contrary, the periods of high economic growth can also lead to even higher growth in DMC which leads to drop in Resource Productivity. So, positive development is rather affected by actual economic situation than by structural changes

Between the Resource Productivity change and percentage change of real GDP per capita in previous two years the directly positive relationship exists. In the longer term the economic activity can positively affect the Resource Productivity in the EU and its countries. It means, decoupling needs to take place. Application of voluntary instruments such as EU Ecolabel and EMAS can encourage sustainable production and consumption patterns and help improve Resource Productivity in the long term and thus lead the EU countries to sustainable development.

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