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## Article

# Resource-efficient growth in the EU's sustainable development: A comparative analysis based on selected indicators

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**Resource-Efficient Growth In The EU's Sustainable Development  
–A Comparative Analysis Based On Selected Indicators<sup>1</sup>**

**Abstract**

*This article presents a theoretical and empirical analysis of resource efficiency in the use of natural resources for economic growth consistent with the principles of sustainable development in EU countries. To realize this objective, a review of the literature and EU strategic documents concerning the subject under study is presented. The comparative analysis has been prepared on the basis of international statistical data (Eurostat, EEA) for EU countries from the years 2002–2013. The analysis covers the following indicators: resource productivity, water exploitation index, water productivity, generation of waste, and the landfill and recycling rate. The results show that in general terms the efficiency of resource use in the EU is gradually improving, but only to a small extent. With regard to individual countries this process shows significant diversity, and is closely associated with the level of economic development of a particular country. In some individual countries, this resource efficiency is at a very low level, which is the case with several countries of Eastern and Central Europe.*

**Keywords:** *resource-efficiency, resource and water productivity, waste*

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## 1. Introduction

As the European Commission underlined in its *Resource Efficiency Scoreboard 2014 Highlights*, we all depend on our planet's natural resources. They are necessary for our survival, the functioning of economy, and our wellbeing. However, the supply of resources is limited. The ever-increasing global demand is putting growing pressure on the environment, and what's more, the competition for most of the essential resources is intensifying. Therefore it is essential that we recognise and respect the natural limits of our planet because – according to the EC – continuation of our current patterns of resource use is not an option (EC 2014c, p. 6).

Koellner notes (2011, p. 19) that global competition for natural resources has severe ecological consequences. He forecasts that “aside from the projected doubling of food consumption in the next fifty years, the growing trade in biofuels and other commodities is a global challenge as the economic activities in the primary sector can damage biodiversity and ecosystem services.”

Resource efficiency means using the earth's limited resources in a sustainable manner, while minimising impacts on the environment. It makes it possible to create more with less and to deliver greater value with less input (EC 2014b, p. 8). The support of resource-efficient economic growth necessarily means decoupling our use of resources and energy from productivity, by e.g. reducing CO<sub>2</sub> emissions, promoting greater energy security, and reducing what we use and consume.<sup>2</sup>

Among the milestones to be achieved are: reducing the stream of materials into the process of production, making this processes more efficient, and – last but not least – reducing the material losses and waste generated in the entire production and consumption cycle. It appears that transformation of the EU's economy is possible, although both concrete actions and long-term commitment are needed now and in the future. According to the EC, Europe has already achieved significant gains in increasing its resource efficiency, but – as it underscores – much more still needs to be done (EEA 2014b, p. 6).

The EU is making efforts to reduce pressures on the environment through its sustainable development policies and its promotion of sustainable growth,<sup>3</sup> especially through the two flagship initiatives of the Europe 2020 Strategy<sup>4</sup>:

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<sup>2</sup> <http://ec.europa.eu/resource-efficient-europe/>

<sup>3</sup> Sustainable growth, via a resource efficient, greener and more competitive economy, especially means building a more competitive low-carbon economy via the efficient and sustainable use of resources and protecting the environment, reducing emissions and preventing biodiversity loss (EC 2014a).

<sup>4</sup> EC (2010a), Europe 2020 – A strategy for smart, sustainable and inclusive growth, COM(2010)2020 final, Brussels.

*Resource-efficient Europe*<sup>5</sup> and *An industrial policy for the globalisation era*.<sup>6</sup> In general, it is worth noting that Europe's medium- and long-term strategic planning recognises the fundamental importance of resource efficiency. For example, the EU's *7th Environment Action Programme* identifies as one of its "priority objectives the need to 'turn the Union into a resource-efficient, green, and competitive low-carbon economy'" (EU 2013, pp. 182–186). Similarly, the EU's *Roadmap to a Resource-efficient Europe*<sup>7</sup> includes a vision for 2050, wherein 'the EU's economy has grown in a way that respects resource constraints and planetary boundaries, thus contributing to global economic transformation (EC 2011b).

In recent decades, the EU has introduced a set of political initiatives with the aim of ensuring the quality and sustainable use of Europe's water. Initially they mainly addressed health concerns. It was then followed by other measures to evaluate the impact on the environment of major water-using sectors (such as agriculture, industry and domestic households). According to the *Water Framework Directive*<sup>8</sup>, Member States were required to check the state of their waters and draw up plans explaining how they will clean them by the end of 2015. The Communication *A Blueprint to Safeguard Europe's Water Resources* up to 2020<sup>9</sup> should also help the EU meet its targets as regards water resources. Apart from policy papers, such as the above-mentioned Communication, there are of course also some scientific publications on water resources (its allocation, productivity, quality, or markets). For example Grafton et al. (2004, p. 187) suggests that "the growing reliance on pricing and markets to allocate water and on economic instruments to regulate the quality of water may lead to increased efficiency in the use of water resources." On the other hand Cole (2011, pp. 184–187) notes that "globally, both per capita and total water use are projected to increase for many years to come and water use is currently extremely inefficient in many countries, both developed and developing". In light of the foregoing, the latest statistical data in this field should be investigated.

The waste hierarchy strategy,<sup>10</sup> which was adopted in 2008, significantly contributes to the efficient use of resources and materials, and it also separates growth from waste generation in the EU and – which is crucial importance for this

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<sup>5</sup> EC (2011a), *A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy*, COM(2011) 21 final, Brussels.

<sup>6</sup> EC (2010b), *An industrial policy for the globalisation era*, COM(2010) 614, Brussels.

<sup>7</sup> EC (2011b), *Roadmap to a Resource Efficient Europe*, COM(2011) 571 final, Brussels.

<sup>8</sup> Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, L327/1, 22.12.2000.

<sup>9</sup> EC (2012), *A Blueprint to Safeguard Europe's Water Resources*, COM(2012)673 final, Brussels.

<sup>10</sup> The waste hierarchy encompasses: prevention; preparation for reuse; recycling; and recovery and disposal (EC, Directive 2008/98/EC on waste – Waste Framework Directive).

paper – it reduces waste generation in line. The Communication *Towards a Circular Economy* promotes a fundamental transition in the EU away from a linear economy towards one where resources are not simply extracted, used and thrown away, but are put back in the loop so they can remain in use longer. It sets out measures driving a more efficient use of resources and waste minimisation (EC 2014d).

In order to explore these issues, this article is divided into five sections: this introduction, three substantive sections, and conclusions. The following section 2 describes the test method and sources of statistical data. Section 3 is theoretical and contains a review of the literature in the area of efficient use of natural resources. Section 4 presents the results of tests and their interpretation, and is divided into three sub-sections devoted to selected analysis indicators. Section 5 presents general conclusions.

## 2. Methodology

Analysis of the literature and source material shows that nowadays there are numerous methods and indicators available to assess resource efficiency in an economy.<sup>11</sup> This study presents the outcomes of and analyzes a group of selected indicators proposed by the European Commission (EC) in its *Resource Efficiency Scoreboard*.<sup>12</sup>

The scoreboard presents indicators covering the themes and subthemes of the *Roadmap to a Resource Efficient Europe*. Its purpose is to monitor the implementation of the Roadmap, as well as indicate the relationship between resources and the economy. The scoreboard consists of about 30 indicators, which are arranged in three groups – lead, dashboard and theme-specific indicators (EC 2015, pp. 7-8):

- two lead indicators measuring resource productivity and domestic material consumption;
- eight macro indicators regarding land, water and carbon (known as dashboard indicators);
- twenty additional indicators grouped into three themes: transforming the economy, nature and ecosystems, and key areas.

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<sup>11</sup> See: EEA (2012), *Environmental indicator report 2012 – Ecosystem resilience and resource efficiency in a green economy in Europe*, European Environment Agency, Copenhagen or Eurostat (2015), *Smarter, greener, more inclusive? – Indicators to support the Europe 2020 strategy*, Publications Office of the European Union, Luxembourg, EEA (2014a), *Trends and projections in Europe 2014*, EEA Report No 6/2014, Copenhagen.

<sup>12</sup> The publication “*EU Resource Efficiency Scoreboard 2014*” is the first full analytical report covering all latest indicators, based on data available as of November 2014, <http://ec.europa.eu/eurostat/web/europe-2020-indicators/statistics-illustrated>.

In this comparative study the following indicators have been selected: resource productivity, water exploitation index, water productivity, generation of waste, and the landfill and recycling rate. The study uses the most recent statistics from Eurostat and the European Environment Agency. The time range analysis covers the years 2002-2013, and the spatial scope of the analysis encompasses the European Union countries. This test method used descriptive analysis based on available statistical data, with use of tabular, construction drawings and analysis of their results.

### 3. The Resource Efficiency Flagship Initiative

According to Eurostat data, the pressure on resources and environmental concerns are both increasing. Apart from the environmental impacts caused by this growing demand for resources, costs for essential raw materials and minerals for producing energy are increasing. At the same time the lack of security of supply and price volatility has a detrimental effect on the economy. As a result, the EU needs to use its resources more efficiently. This is expected to improve competitiveness, increase profitability, boost employment and, more generally – economic growth (Eurostat 2015, pp. 8–10).

The European Commission has declared conservation and the management natural resources as one of the seven key challenges of *The EU Sustainable Development Strategy*. The overall objective is to improve management and avoid the overexploitation of natural resources, recognising the value of ecosystem services. One of the main operational objectives and targets is to improve resource efficiency in order to reduce the overall use of non-renewable natural resources and the related environmental impacts of raw material use, thus using renewable natural resources at a rate that does not exceed their regeneration capacity. The next objective is to improve the management of and avoid the overexploitation of renewable natural resources in areas such as fisheries, biodiversity, water, air, soil and atmosphere, restoring degraded marine ecosystems by 2015 (EC 2006, pp. 13–14).

A *Resource-efficient Europe*<sup>13</sup> is one of the seven flagship initiatives forming part of the *Europe 2020 Strategy towards smart, sustainable and inclusive growth*.<sup>14</sup> It is the EU's main strategy toward the establishment of a long-term framework to integrate resource efficiency across EU borders, setting out EU policies covering, *inter alia*, the economy, raw materials, energy

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<sup>13</sup> EC (2011a), A resource-efficient Europe.... op.cit.

<sup>14</sup> EC (2010a), Europe 2020..... op.cit.

and industry. We can conclude that supporting the shift towards a resource efficient and sustainable growth is a particular target of this strategy.

The EU currently has many regulations and policies relating to sustainable use of the environment. Yu and Wu (2009, p. 1075) suggest that “since environmental sustainability is a global issue, sooner or later, the stringent environmental regulations currently being reinforced in EU countries will be adopted or adapted in other parts of the world.” However, it is difficult to agree with the authors when they state that “when the stringent global environmental standards are applied to most countries, firms will be able to realize the benefits which have resulted from their green efforts, if not earlier.”<sup>15</sup>

Here the fundamental issue needs to be underscored – according to EC, resource efficiency is about using the Earth’s resources in a sustainable manner, producing more value with fewer resources, lessening our impact on the environment, and consuming in a more intelligent way (EC 2015, p. 6). This includes moving from a linear economic model to a circular economy.<sup>16</sup> According to EC estimates, improvements in resource efficiency throughout industry value chains could reduce the need for materials input by between 17 % and 24 % by 2030. Additionally, better use of resources could potentially save European industry EUR 630 billion per year.<sup>17</sup>

In late 2011, EU governments adopted the *Roadmap to a Resource-Efficient Europe*.<sup>18</sup> It recognizes the direct and indirect impacts of EU policies on land use and aims to achieve no net land-take by 2050, as well as to reduce pressure on natural resources via the full implementation of EU environmental legislation by 2020. This document identifies the economic sectors that consume the most resources and suggests tools and indicators to help guide action both in Europe and internationally. It also indicates what can be done to improve resource efficiency and attain sustainable growth, as it is an agenda for competitiveness and growth based on using fewer resources when producing and consuming goods, and creating business and job opportunities from activities such as recycling, better product design, materials substitution and eco-engineering.<sup>19</sup>

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<sup>15</sup> This study was a first attempt to incorporate resource efficiency into the measurement of environmental performance by examining the possible linkage between environmental performance and financial performance.

<sup>16</sup> “Circular Economy” – the value of resources is maintained, products are re-used or recycled and materials are fed back into production.

<sup>17</sup> EC (2014d) Communication: Towards a circular economy ...op.cit.

<sup>18</sup> EC (2011b), Roadmap to a Resource... op.cit.

<sup>19</sup> [http://ec.europa.eu/environment/resource\\_efficiency/about/roadmap/index\\_en.htm](http://ec.europa.eu/environment/resource_efficiency/about/roadmap/index_en.htm)

## 4. Results and discussion

### 4.1. Resource productivity

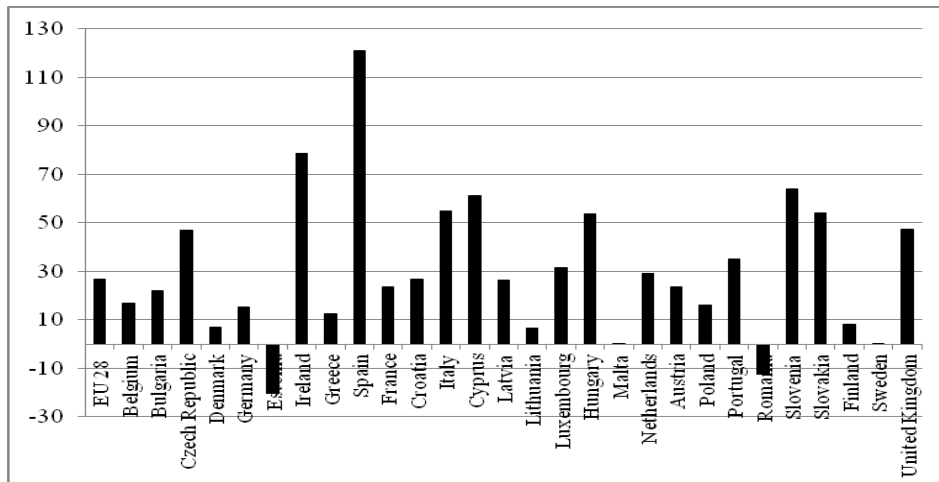
Resource productivity measures resource efficiency by asking: How efficient is the economy in using material resources to produce the products and services available in the market (GDP)? As the EC notes the resource efficiency of EU countries depends on the structure of their national economies and their international trade. This is clearly understood as reflecting the fact that in service economies GDP is created from services, which generally are not based on the consumption of materials to such a great extent as industrial economies, which import large quantities of raw materials. Therefore, service economies prove more efficient, because they consume fewer material resources per EUR of output (EC 2015, p. 9).

Resource productivity is one of the lead indicators of the *Resource Efficiency Scoreboard 2014*. It is expressed in EUR/kg; is used for time comparison; and indicates whether Member States are improving. Figure 1 compares the development of Member States' resource productivity in the period 2002–2013. Spain has made the greatest improvement and nearly doubled its resource productivity. Some Member States, however, have shown a decrease in resource productivity. Romania and Estonia are the worst performers (with 12.5% and 20.4% decreases). On average, EU resource productivity has improved from EUR 1.52/kg in 2002 to EUR 1.93/kg in 2013 (an improvement of nearly 27%). Most Member States have improved their results between 2002–2013, especially the Netherlands, Luxembourg and the United Kingdom.

To compare different countries in terms of their resource productivity it is necessary to use GDP in purchasing power standards (PPS). The average EU28 productivity amounted to 2.0 PPS/kg in 2013 (Figure 2). Using this comparison the Netherlands, Luxembourg, the United Kingdom, Spain, Italy and France and Belgium were the most resource-efficient Member States (from 3.76 to 2.31 PPS/kg). This is influenced by the fact that the economies of these Member States are strongly dominated by the service sector and a large share of their GDP comes from the sectors of banking and other services.

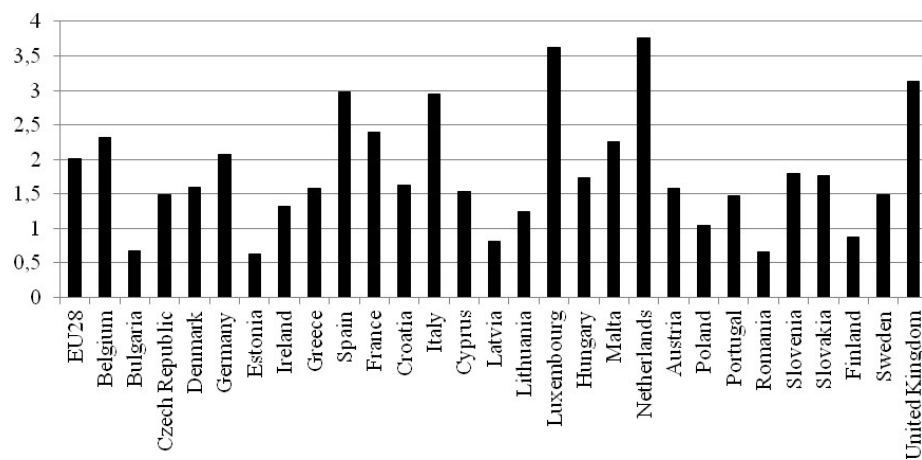


**Figure 1. Resource productivity, chain linked volumes 2010, ranked by percentage improvement 2002–2013, % of GDP/kg of materials used (% EUR)**



Source: own work based on Eurostat data<sup>20</sup>.

**Figure 2. Resource productivity, 2013 (PPS/kg)**



Source: own work based on Eurostat data<sup>21</sup>.

<sup>20</sup> <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdpc100> (access: 22.09.2015)

<sup>21</sup> <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdpc100> (accessed on 23.09.2015)

We can note a difference in resource productivity between the countries in Eastern and Western Europe, with some exceptions, which depends on their economies, geography and climate, and how intensively they exploit their natural resources for growth. For example, in the middle of this ranking are Austria, Germany, Sweden and Denmark - countries with high income and an export-oriented manufacturing sector. Resource productivity ranges between 0.87 PPS/kg in Finland and 2.06 PPS/kg in the case of Germany. Some countries with strong service-based economies, such as Portugal, Malta, Greece, Cyprus and Ireland, are approaching to medium to high productivity.

#### 4.2. Water exploitation index and water productivity

While water is a resource which is used in most sectors, it is however a limited resource and under significant stress in most of the countries in Europe. The water exploitation index (WEI) measures how much water is abstracted each year compared to the amount of water available. It is measured as the total fresh water abstraction divided by the long term average available water, expressed as a percentage. A high WEI indicates water stress. Water scarcity can indicate low freshwater supplies, but also a high level of water use, so even countries with high rainfall can experience water stress problems caused by overexploitation (EC 2015, p. 14). It is highly dependent on climate, geography and the type of economy, but in general an area is considered under stress if it exceeds the 20% threshold.

**Table 1. Water productivity (GDP 2005 chain-linked volumes) and water exploitation index (selected countries), 2010–2013**

Country/Index	Water productivity, PPS/m <sup>3</sup>				Water exploitation index, %			
	2010	2011	2012	2013	2010	2011	2012	2013
Bulgaria	13.6	13.4	15.5	15.9	5.6	6	5.4	5.1
Czech Republic	106.2	113.2	118	130.9	12.2	11.8	11.5	10.3
Denmark	264.7	179.7	275.3	:	4	6	4	:
Germany	72.3	:	:	:	17.6	:	:	:
Estonia	11.5	12.4	15	14.4	14.9	15.2	13.2	14.2
Spain	31.4	30.9	30.1	:	32	32.6	33.6	:
France	60.8	62.9	60.5	:	15.2	15.2	16.1	:
Croatia	93.4	96.8	100.7	104.9	0.6	0.6	0.6	0.6
Cyprus	97.5	90.5	79	75.2	62.6	68.8	79.6	79.6

Latvia	102.6	83.8	128	140.6	0.8	1.1	0.8	0.7
Lithuania	61.5	81.2	81.7	:	3.1	2.6	2.7	:
Luxembourg	684	748.2	801.9	858.3	2.9	2.8	2.7	2.6
Hungary	30	32.2	33.4	:	4.6	4.5	4.3	:
Malta	215.7	236.5	232.5	212	52.5	48.9	51.1	58.1
Netherlands	48.2	53.2	50.8	:	11.9	11.1	11.7	:
Poland	51	52.9	57.5	59.9	18.5	18.9	18.2	17.8
Romania	40.3	39.4	42	43.4	14.7	15.6	15.3	15.2
Slovenia	45.6	51.1	47.4	37.9	2.9	2.6	2.9	3.6
Slovakia	163.9	172.1	157.7	166.6	0.7	0.7	0.8	0.8
Sweden	105.2	:	:	:	1.4	:	:	:
United Kingdom	198.3	215.7	206.6	:	4.8	4.4	4.8	:

Note : = data are not available

Source: own compilation based on Eurostat data<sup>22</sup>.

Table 1 shows that water stress varies markedly between countries. Of course geographic location is a major factor in this comparison. Cyprus, Malta, Spain and Italy are countries with water-stress challenges. Cyprus is under severe water scarcity (79.6% in 2013) and some other countries are experiencing water scarcity – e.g. Malta (58.1% in 2013) and Spain (33.6% in 2012). Malta and Cyprus are island nations, but some countries are located in southern Europe with quite hot, dry climates and fairly limited natural freshwater resources. For Spain the critical factors putting its water resources under stress are the climate and heavy consumption by its large agricultural sector. Sweden, Slovakia, Latvia and Croatia are countries in the bottom 1% of the WEI, so we can say they are not experiencing with water-stress challenges.

The water productivity indicator measures how efficiently water is used in terms of the amount of Euro of GDP generated for every m<sup>3</sup> of water abstracted. It varies in relation to different economies and also in relation to the climate. Table 1 compares water productivity and the WEI in selected countries, and shows how some Member States are able to use water efficiently, even though their overall abstraction is above sustainable levels. In Luxembourg, Denmark, Slovakia, Sweden, Croatia, Latvia, Slovenia and Lithuania water productivity is quite high and water stress low. Relatively high levels of water exploitation are visible in Spain, Belgium, Malta and Cyprus. However, productivity in Spain is quite low, whereas in Malta and Cyprus it is fairly high.

<sup>22</sup> <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdnr310>; [http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=t2020\\_rd210](http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=t2020_rd210) (access: 22.09.2015).

Luxembourg, Denmark and Malta are the countries with the highest water productivity (Table 1). For Luxembourg and Malta, this is partly due to the size of their agricultural and industrial sectors. In Denmark's case, important roles are played by its extensive eco-efficiency programme and ability to enforce compliance with protection zone legislation and groundwater technical guidelines (as it relies on groundwater for its entire supply of drinking water). Over time, there has been a significant growth in productivity in Czech Republic, Croatia and Latvia. Most of the other countries have lost ground in recent years.

#### **4.3. Transforming the economy – turning waste into a resource**

One of the thematic indicators of the *Resource Efficiency Scoreboard 2014* is monitoring the transformation of the economy. Turning waste into a resource is one of three sub-thematic indicators in this theme and consists of four indicators: generation of waste, excluding major mineral waste; landfill rate of waste, excluding major mineral waste; recycling rate of municipal waste. and recycling rate of e-waste. Table 2 presents the data for three of these indicators.

##### **Generation of waste**

The indicator of waste generation shows the amount of waste generated per person. It is defined as total waste generated in a country per inhabitant and year. Table 2 shows an overall 4.2 % reduction in waste generated per capita across the EU28 in 2012 (compared to 2004). More than half of the Member States have seen their waste generation decrease, so it may be concluded that Member States are becoming more efficient in sustainable production and consumption. It seems that this is a proof of the decoupling of economic growth and material use, and also of more resource-efficient economic activity in the European Union.

There are however some major differences at the national level and in some Member States waste generation per capita increased by up to 100%, while in others it was reduced by over 60 % between 2004 and 2012. Generally we can say that Member States with a higher GDP have higher levels of waste generation per capita. Croatia, Latvia and Malta exhibit the lowest levels of waste generation per capita and Cyprus reduced its waste generation by 63%. Estonia, Finland and Belgium are all high waste generators.

### Landfill rate of waste

As the EU moves towards a circular economy,<sup>23</sup> according to the waste hierarchy landfilling is the least preferred option for dealing with waste. Landfilled waste can have adverse environmental impacts due to the production of toxic gas.

Overall, the average landfill rate in the EU was 28% in 2012. However, some Member States in Eastern and Southern Europe had landfill rates of over 50%. Luxembourg, the Netherlands, Denmark, Belgium, Austria, Sweden, Germany, Finland and Slovenia all had very low landfill rates – of less than 20%, which indicates improvement in waste management according to the principle of sustainable growth (Table 2).

**Table 2. Generation of waste (excluding major mineral wastes), landfill rate of waste (excluding major mineral wastes) and municipal rate recycling in the EU in selected years**

Country/ Index/Year	Generation of waste, kg/capita		Landfill rate, %	Municipal rate recycling, %	
	2004	2012		2004	2013
EU 28	1906	1826	28	:	41.8
EU 27	1913	1836	28	30.5	42
Belgium	3285	4999	8	51.5	55
Bulgaria	2174	2456	88	17.2(e)	28.5
Czech Republic	1736	1197	30	5.5(e)	24.2 (e)
Denmark	1520	1788	6	34	44.3
Germany	1473	1810	10	56.4	64.5(e)
Estonia	10791	8589	74	24.8	17.4
Ireland	1316	2067	52	29.5(s)	36.6(s)
Greece	2528	2042	79	10.1	19.3(s)
Spain	1906	1379	43	30.9	30(e)
France	1491	1513	28	29	37.6(e)
Croatia	1134	620	63	:	14.9
Italy	1441	1830	23	17.6	39.4
Cyprus	2607	964	59	3.2	21.4(e)
Latvia	530	895	40	4.6	16.9
Lithuania	1899	993	58	1.9(s)	27.8
Luxembourg	2706	2423	1	41.5	47.9(e)
Hungary	1864	1136	60	11.8	26.4
Malta	826	922	93	6.4	10.4

<sup>23</sup> [http://ec.europa.eu/environment/circular-economy/index\\_en.htm](http://ec.europa.eu/environment/circular-economy/index_en.htm)

Netherlands	2513	2555	3	46.9	49.8
Austria	2853	1735	8	57.4	57.7
Poland	1530	1883	30	4.9	24.2
Portugal	1825	1180	38	13.5	25.8
Romania	1883	2041	49	1.1	2.6(s)
Slovenia	2143	1701	12	20.4	42.7
Slovakia	1285	1250	53	6.2	10.8
Finland	4479	3912	11	33.6	32.5
Sweden	2694	1920	9	44	49
United Kingdom	2676	1734	36	22.6	43.5

Note := data are not available; e=estimated; s=Eurostat estimate (phased out)

Source: own compilation based on Eurostat<sup>24</sup>.

As noted by the EC in its *Resource Efficiency Scoreboard 2014*, there is quite a strong correlation between low landfill rates and high recycling rates. It is crucial to note that low landfill rates can sometimes be a result of large-scale use of energy-from-waste technologies. For example, Austria, Germany, Sweden and the Netherlands have bans on sending some biodegradable wastes or recyclable materials to landfill, so their landfill rates in recent years are among the lowest in Europe.

## Recycling rate

Recycling is crucial for resource efficiency and is a useful indicator for sustainability and the development of a circular economy. A higher level of recycling obviously decreases the negative environmental impact of waste generation and reduces the demand for raw materials.

Table 2 shows that even if there are significant differences among the EU countries, recycling rates have increased significantly for the majority of Member States. Overall, the EU recycling rate has increased from 30.5 % in 2004 to 42% in 2013, which is encouraging and evidences the steady development of a circular economy. Germany, Austria, Belgium, the Netherlands and Sweden are the countries with the highest recycling rates, while Romania has the lowest. The United Kingdom and Slovenia showed the greatest improvements, increasing their recycling rates by over 30%.

<sup>24</sup>[http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdp\\_c210](http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdp_c210) (access: 22.09.2015); [http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=t2020\\_rt110](http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=t2020_rt110) (access: 23.09.2015); [http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=t2020\\_rt120](http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=t2020_rt120) (access: 24.09.2015).

From the comparative perspective, the overall improvement in the recycling rate in Europe is a very positive symptom. Nevertheless, many countries are still wasting resources in landfills. However, they are required to achieve the municipal waste recycling target (50%) by 2020, as set out in the Waste Framework Directive.<sup>25</sup>

## 5. Conclusions

The study conducted leads to several general conclusions. The first is that natural resources are fundamental to the functioning of economy and the quality of life. Global demand for natural resources is rapidly growing, and it will continue to increase due to the growth of the population.

Secondly, resource efficiency aims to decouple economic growth from the use of material resources. It pushes the economy toward the use of resources in a sustainable way, managing them more efficiently throughout their life-cycle and minimising the impact of their use on the environment. Building a more resource-efficient Europe seems crucial to the EU's economic and ecological security. Numerous EU strategies and initiatives are aimed at achieving sustainable economic growth in the long-term perspective. The flagship initiative *Resource-efficient Europe* plays a central role in the EU's policy in this area.

Thirdly, there have been positive developments in the status and use of natural resources in the EU. Overall, resource productivity has increased. This means that the European economies have been producing more using fewer resources. Resource productivity is higher in countries with high incomes and in economies with large service sectors. Therefore, the best performers at the moment are the Netherlands, Luxembourg, the United Kingdom, Spain, Italy, France and Belgium. However, in many countries in Eastern Europe resource productivity is significantly lower. Their economies have a lower GDP and also more developed industrial and primary sectors. Generally they have to become more resource efficient, get more out of less, and decrease the amount of resources which are extracted and used.

Fourthly, water productivity and efficiency in Europe should be improved. Many countries are exploiting their water resources at relatively high levels and are experiencing either a 'severe water scarcity' or 'water scarcity'.

And finally, reducing waste generation (according to the waste hierarchy) contributes to improving resource efficiency and building a circular economy, which means less waste generation and better recycling. The EU recorded a reduction in both waste generation and landfill rate. There has also been a 42%

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<sup>25</sup> EC (2008), Directive 2008/98/EC on waste (Waste Framework Directive), L 312/3, 22.11.2008.

improvement of municipal recycling rates (in 2013, compared to 2004). All of these results can be taken as an encouraging signal, because while the European economy has been growing, waste generation appears to have fallen over the same period.

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## Streszczenie

### **WZROST GOSPODARCZY UWZGLĘDNIAJĄCY EFEKTYWNE WYKORZYSTANIE ZASOBÓW NATURALNYCH W UNIJNEJ STRATEGII ZRÓWNOWAŻONEGO ROZWOJU – WSKAŹNIKOWA ANALIZA PORÓWNAWCZA NA WYBRANYCH PRZYKŁADACH**

*Głównym celem artykułu jest teoretyczna i empiryczna analiza efektywności wykorzystania zasobów naturalnych dla wzrostu gospodarczego zgodnego z zasadami zrównoważonego rozwoju w krajach UE. Dla realizacji tak założonego celu dokonano przeglądu literatury oraz unijnych dokumentów strategicznych z zakresu tematu opracowania. Analiza porównawcza została przygotowana w oparciu o dane statystyczne pochodzące z zasobów statystyki międzynarodowej (Eurostat, EEA). Badania obejmują dane dotyczące poszczególnych państw UE pochodzące z lat 2002–2013. Do analizy wybrano następujące wskaźniki: produktywność zasobów, produktywność i eksploatacja wody, ilość wytwarzanych odpadów oraz poziom recyklingu i składowania odpadów.*

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*Wyniki badań wskazują, że w ogólnym wymiarze efektywność wykorzystania zasobów w UE choć w nieznacznym stopniu, ale stopniowo wzrasta. W odniesieniu do poszczególnych krajów wykazuje jednak znaczące zróżnicowanie i jest istotnie związana z poziomem rozwoju gospodarczego danego kraju.*

*W przypadku wielu indywidualnych państw efektywność ta kształtuje się na bardzo niskim poziomie i problem ten w szczególności dotyczy kilku krajów Europy Wschodniej i Środkowej.*

**Słowa kluczowe:** efektywność wykorzystania zasobów, produktywność zasobów i wody, odpady