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ProEnvironment

ProEnvironment 8 (2015) 606 - 615

Original Article

Perspectives on the Responsible Consumption of the Water Resources in Romania

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Received 10 July 2015; received and revised form 15 September 2015; accepted 14 October 2015
Available online 31 December 2015

Abstract

The climate change, the greenhouse emissions, the weather extreme events are, in general, accepted as a result of intensive industrialization and of our way of life. Environmentalists use all the communication channels in order to alarm the authorities and the population with regard to the effects that industrialization has on the environment. One such effect is lowering the quantity of limited resources, one of them, perhaps the most important one, is the volume of fresh water on the Globe. Under these circumstances, the authors propose new approaches for lowering the volume of fresh water abstraction and consumption, through reuse of properly treated wastewater in areas where this does not impede optimal functioning of the systems.

Keywords: sustainable development, water resources, properly treated wastewater reuse.

1. Sustainable development

"When the well's dry, we know the worth of water" [1] said Benjamin Franklin, US statesman (1706-1790), and, in the conception of Norman E. Borlaug, "the father of the Green Revolution" (founder of the World Food Prize, 1970 Nobel Peace Prize Laureate) [2], "if we produce, we have, unless we don't keep, we will not be!", which indicates that a sustainable society cannot exist unless every human being contributes to the sustainable development of that society. For the first time, the universal concern about the healthy and the sustainable use of the planet and its resources continued to grow, in 1972 the United Nations organizing a Conference on the Human Environment, in Stockholm [3, 4].

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The Brundtland Report, "Our Com 606 Future", included the "classic" definition of the sustainable development, as the "development which meets the needs of the present, without compromising the ability of future generations to meet their own needs" [5].

The sustainable development cannot be realized without the optimal management of all resources, through using the best mix of renewable and non-renewable ones.

"A non-renewable resource is a natural resource that cannot be produced, re-grown, regenerated, or reused on a scale which can sustain its consumption rate. These resources are often in a fixed amount or are consumed much faster than nature can recreate them" [6].

Over the last decade, environmental issues, such as resource efficiency and sustainability, biodiversity protection, climate change, risks of

accidents and disasters became more important in policy making.

They should, therefore, constitute an important element in the assessment and decision-making processes, in accordance with Directive 2014/52/EU of the European Parliament and of the EU Council released in 16th of April 2014, which amends the Directive 2011/92/EU regarding the assessment of the effects of certain public and private projects on the environment [7].

This EU acquis presented above is entirely transposed in the Romania's legislation.

Resources' management includes the preservation, maintenance and enhancement of the stock of natural resources and, therefore, the safeguarding of those resources against depletion [8]. EU asks member-states to transmit the statistics within 24 months after the end of the reference year, the first reference year being 2015.

2. Quality of the water resources in Romania

The implementation of the Water Framework Directive 2000/60/CE [9] is mainly realized in Romania through the «river basin management plans», which also are the main tool for the implementation of the majority of requirements present in other EU Directives regarding water [10].

The reduction of the waters' pollution is supported by the most important directives which ensure the reduction of wastewater's pollution:

- Directive 91/271/CEE [11] regarding the towns' wastewater treatment, amended by the 98/15/EC [12] and of the EC Regulation no. 1882/2003;
- Directive 2006/11/CE [13] regarding the pollution caused by some dangerous substances in the aquatic environment of the Community and its daughter directives: 82/176/CEE, 83/513/CEE, 84/ 156/CEE, 84/491/CEE and 86/280/CEE, modified through 88/347/CEE and 90/415/CEE;
- Directive 91/676/CEE regarding the protection of waters against the pollution caused by nitrates from agriculture, amended by CE Regulation no. 1882/2003 [14].

According to the Report made by the National Authority „Romanian Waters" in 2013 [15], made public in 2014, the deterioration of the water quality, both of the ground waters as surface waters, can be caused by a series of pollution sources.

Among the pollution sources negatively influencing the quality of the ground waters, we can name here: "chemical products (fertilizers, pesticides) used in agriculture, which provoke a diffuse pollution hard to trace and prevent, household waste and products resulted from zoo-techniques, heavy metals, the lack of correlation between the increase of the production capacities and of the urban growth, along with the modernization of the sewerage works and the realization of the wastewater treatment, inadequate exploitation of the existent sewerage stations and of the management of the sludge resulting from wastewater treatment, products resulted from oil, products resulted from industrial processes"[16].

The project also included the monitoring of the quality of ground water. The admitted concentration of nitrates in the ground waters "has been observed in 185 wells, which represent a total of 14.55% of the total monitored wells" [16].

EU requires to the member states big efforts, in order to align themselves to the requirements of the Nitrates Directive.

Within this context, the Romanian Ministry of Environment and Forests implemented the project „Integrated Control of the Pollution with Nitrates", considered to be the following, at national scale, of the project „The control of agricultural pollution".

The project's main objective is giving support to the Romanian Government in the perspective of aligning to the requirements of the Nitrate Directive, through:

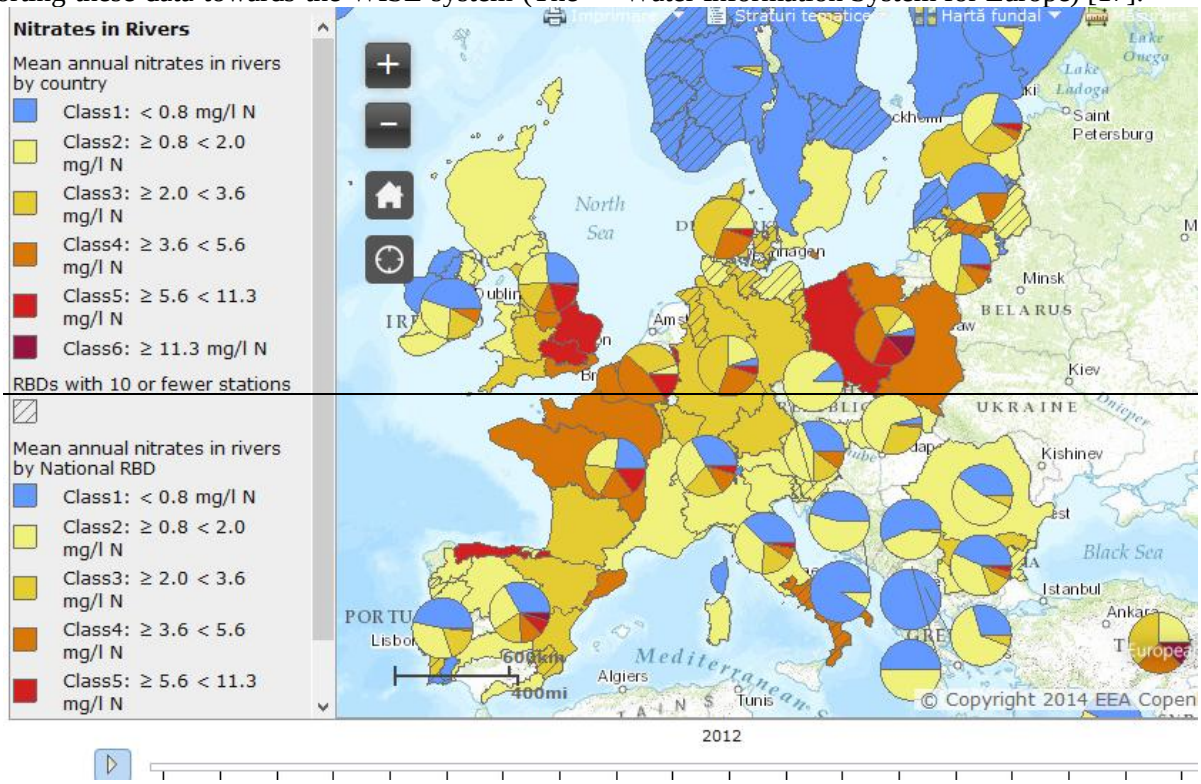
(a) Reduction of nutrient spills in the water bodies;
(b) Promotion of behavioral modifications at regional level and
(c) Support for enhancing the regulation framework and of the institutional capacity.

The environmental global objective is the reduction, on a long term basis, of the nutrient spills in the waters which arrive in the Danube and in the Black Sea, through a soil and waters' integrated management.

As with regard to the quality of the surface waters, the efforts of the decision making and administration stakeholders, interested in their quality, are consistent. In this regard, we present comparative figures indicating the level of nitrates in rivers, based on data from 2012, which make us be more confident in the success of the Romania's efforts.

Fig. 1 presents comparisons, at country level, of the yearly average value of the nitrates' concentration (NO_3) in rivers, expressed in NO_3-N per water liter, the data being gathered and obtained through the reporting stations and from the countries

reporting these data towards the WISE system (The Water Information System for Europe) [17].

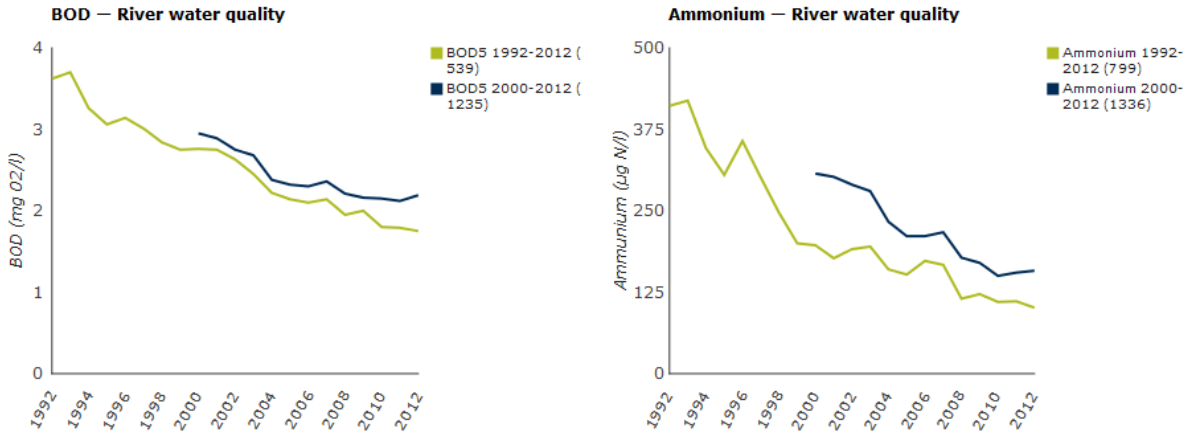


Source: European Environment Agency [18]

Figure 1. Comparative presentation, at country level, of the nitrates level in rivers in 2012

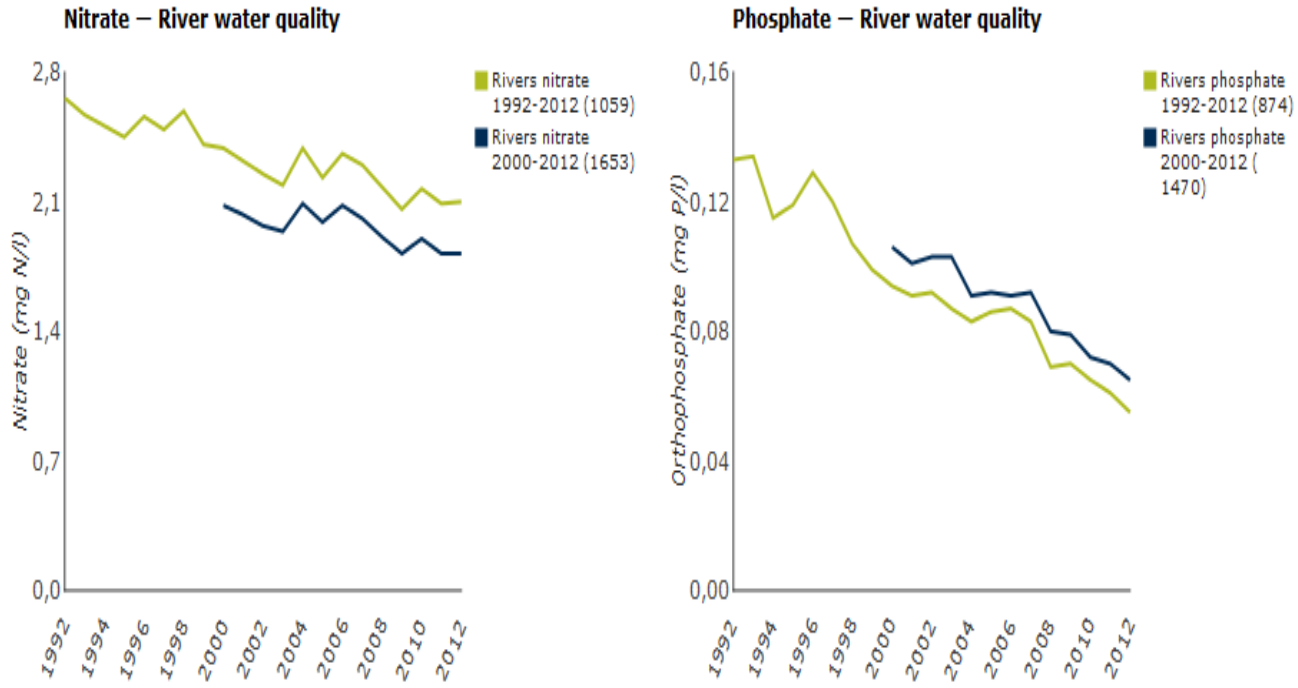
In other words, from Fig. 1 presented above, we can see that Romania is among the best positioned countries with regard to the nitrates' concentration in rivers. Of course, this result is flattering for the Romanian authorities and not only! Nevertheless, it is possible that, beside the efforts made by the central authorities and other responsible institutions, Romania to be «favored» by other causes, as the fact that Romania started to make intensive agriculture later than Western countries, which is a real advantage with regard to the value of this indicator and of similar ones.

We will continue by presenting the figures for the average values at European level at the BOD concentrations, ammonium, nitrates and phosphates in rivers between 1992 and 2012 (Figs. 2 and 3).



Source: EEA [19]

Figure 2. Evolution of the average European value at BOD concentration (left side) and ammonium (right side) in 1992-2012 period of time



Source: EEA [19]

Figure 3. Evolution of the average values at European level for nitrates (left side) and phosphates (right side) between 1992 and 2012

Although Romania still has a lot to do for improving the quality of the water sources, the statistics presented by Eurostat (European Statistics Institute) are promising, taking in consideration that the evolution of the European value at BOD, ammonium, nitrates and phosphates concentrations in rivers dropped almost at half in the 1992-2012 period.

3. Water abstraction and water consumption for household consumers and services – comparative study at country level, in 2011

The „Energy, transport and environment indicators - 2014 edition" Eurostat report [20] presents a comparative situation at country level for the fresh water abstraction volume for water supply in 2011, measured in m^3/inhabitant. The data are presented in Fig. 4.

In Fig. 4, we can see that Romania is one of the countries with the lowest values in Europe with regard to the quantity of water abstraction per inhabitant and year. At the other end is Italy, with more than 150 m^3 of fresh water abstracted per inhabitant and year and non-EU country Norway, with more than 150 m^3/inhabitant and year.

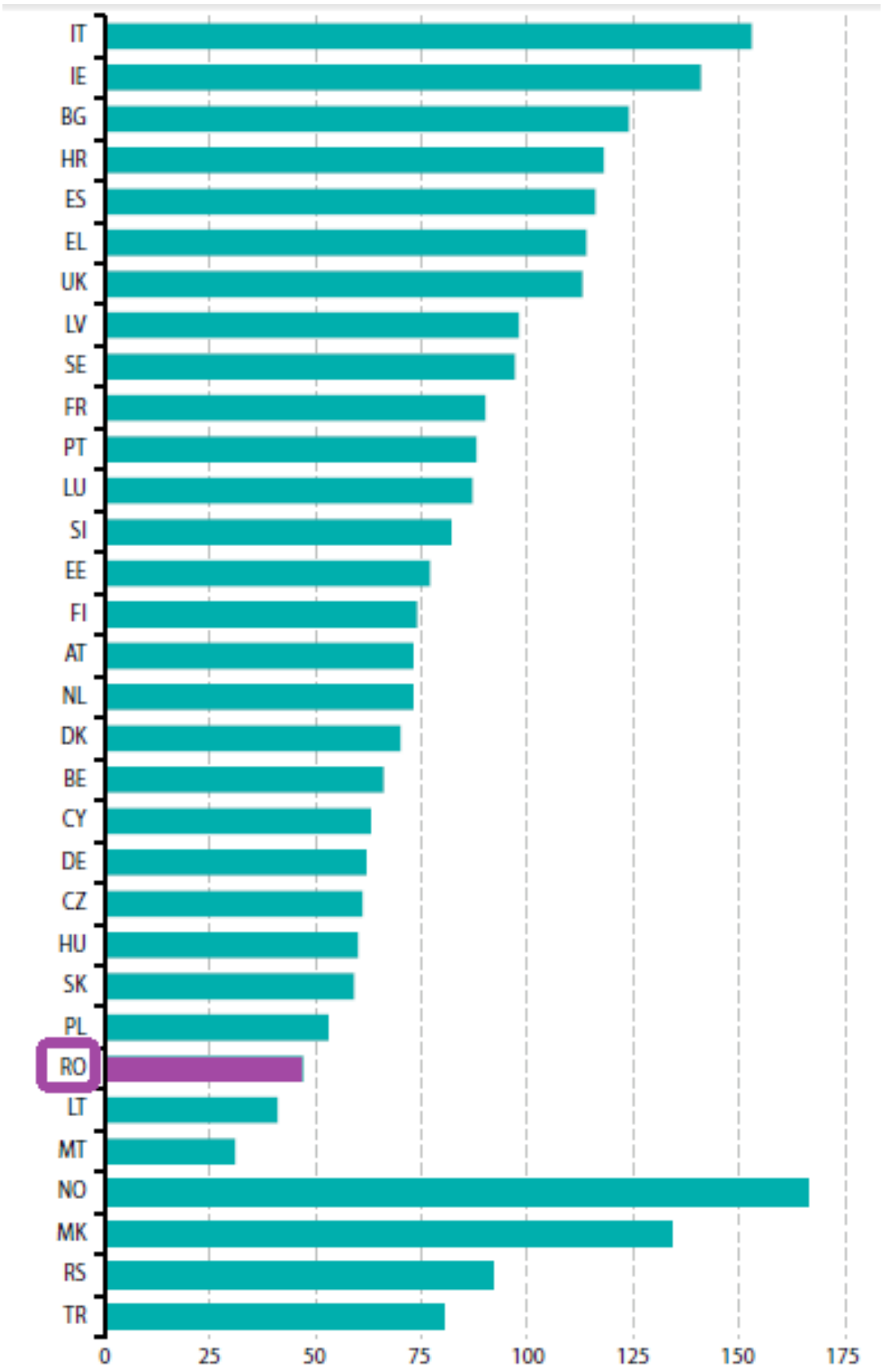
The report's „Energy, transport and environment indicators - 2014 edition" authors explain the large difference among the values for yearly fresh water abstraction per inhabitant and year through the amount of water available, in some cases and through the practices regarding the water abstraction, depending on the climate and of the industry's and agricultural structure in every country.

We would like to add to these factors potentially influencing the water abstraction for the water supply, the coverage of the water supply systems (the share of the total population with access to centralized water supply), which is lower in Romania (61.9% of the total population, [20]) in comparison to the Western countries.

Starting from the volume of fresh water abstracted yearly, we can intuitively affirm that the countries where the volume of water abstracted per inhabitant is higher should be the same with those where the water consumption volume is higher. In the present article, we did not undertake a more profound analysis of this aspect, but the data for the two indicators do not seem to conduct to such a conclusion.

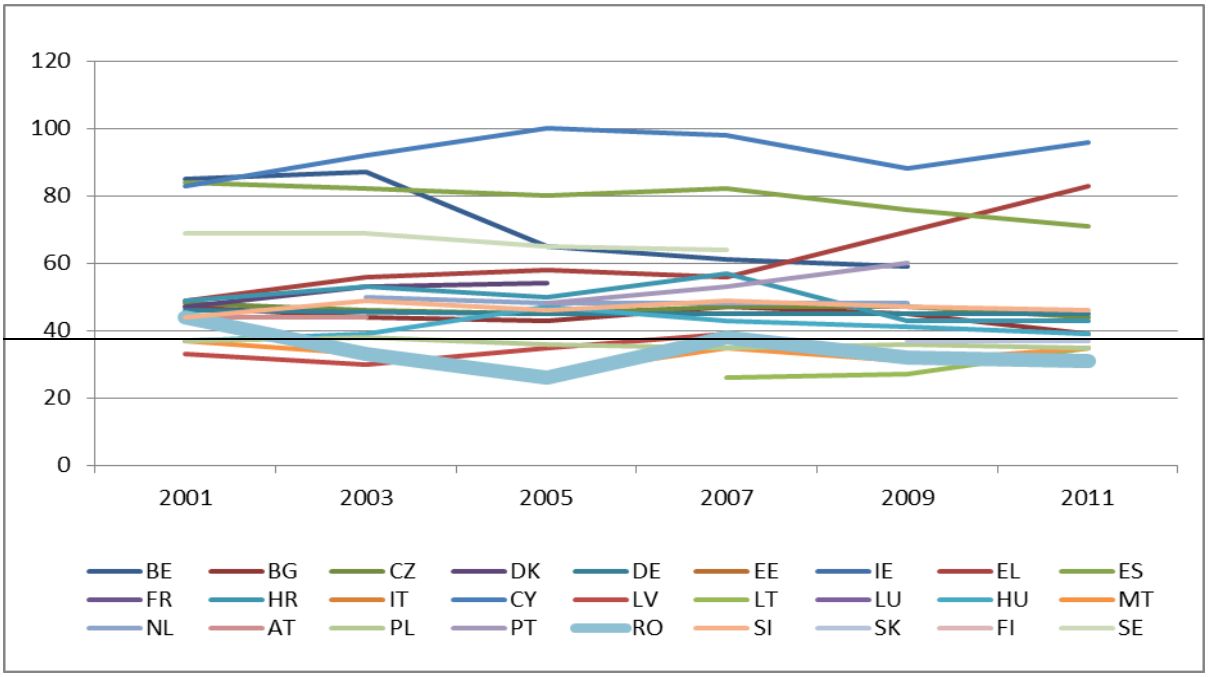
We will present, hereafter, the evolution of household water consumption and services' water consumption, at country level, between 2001 and 2011.

As can be observed in Fig. 5, the values for Romania at this indicator, represented with a bolder line, indicate a consumption of water per inhabitant (including other services) and year under the European average.



Source: Eurostat (2014) [20]
Note: Ireland, 2007; Italy, Austria and the United Kingdom, 2008; Portugal, Belgium and FYR of Macedonia, 2009; Spain, Sweden, France, Netherlands, Denmark, Germany, Turkey and Latvia, 2010.

Figure 4. Yearly volume of fresh water abstraction for water supply at country level, in 2011 (m^3/inhabitant)



Source: Eurostat [20].

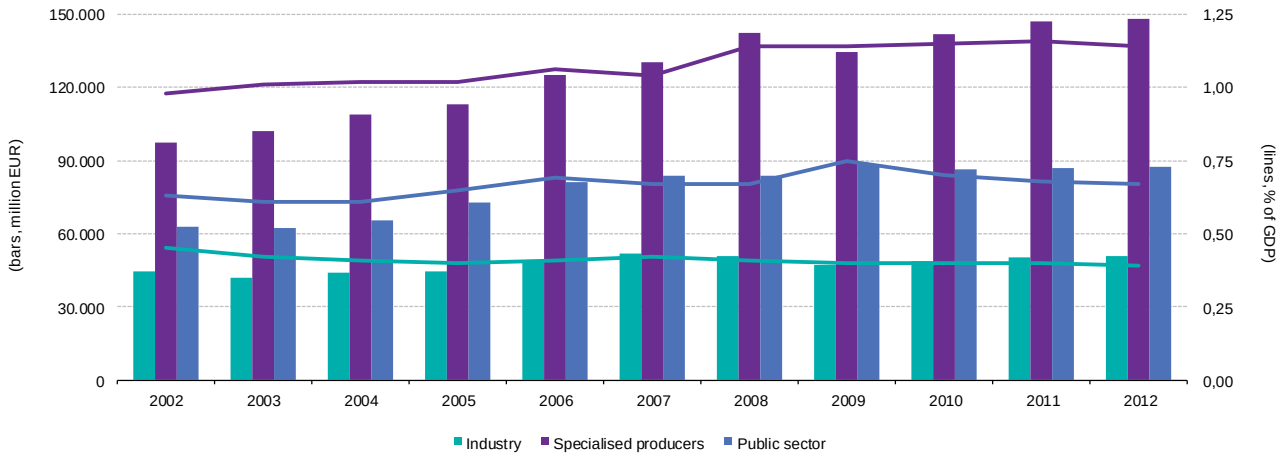
Figure 5. Water use by the domestic sector (households and services) (m^3/inhabitant)

Actually, Romania seems to have one of the smaller volumes of water used per inhabitant (and other services) and year all along the 2001-2011 period.

Among the causes for this, we could name, in our opinion, the increase in tariffs and in the connections' metering, but also a level of water supply services' coverage, although in a continuous increasing trend, still behind the Western European countries.

4. Total expenses for the environment's protection

The sustainable development is, often, considered more expensive on the short run than the intensive development, its positive effects becoming more visible on mid- and, especially, long-term. In this context, it becomes very important which amount of money is allocated to solutions allowing environment protection and which its structure is.

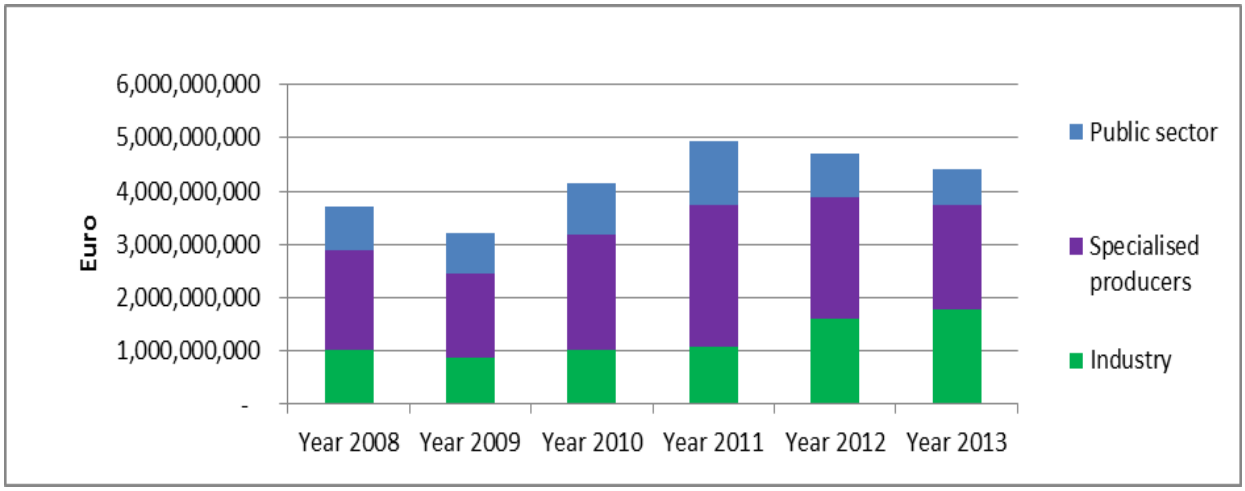


Source: Eurostat (2014) [20].

Figure 5. Yearly expenses for the environment protection, EU 28, between 2002 and 2012

A first overall image is visible at EU 28 level, presented in Fig. 6.

If we look at the bars chart, we will observe that, despite a variation along the 2002-2012 period, the expenses' structure is maintained: the higher share of the total expenses is realized by specialized producers, followed by the public administration and, in the end, by the industry. If we look at the lines chart, we will observe that the value of the expenses realized by the specialized producers increased from somewhere about 1% of the GDP in 2002 and it flowed between 1% and 1.25% of the GDP in the considered period of time. The value of the expenses for the environment's protection between 2002 and 2012 fluctuated between 0.5% and 0.75% of the GDP in the public sector, while the industry's expenses for the environment fluctuated between 0.25% and 0.5% of the GDP. Overall, the share of the expenses for the environment's protection, in the considered period of time, stayed pretty low, we could say. With respect to Romania, the expenses for the environment's protection are presented in the following two figures.

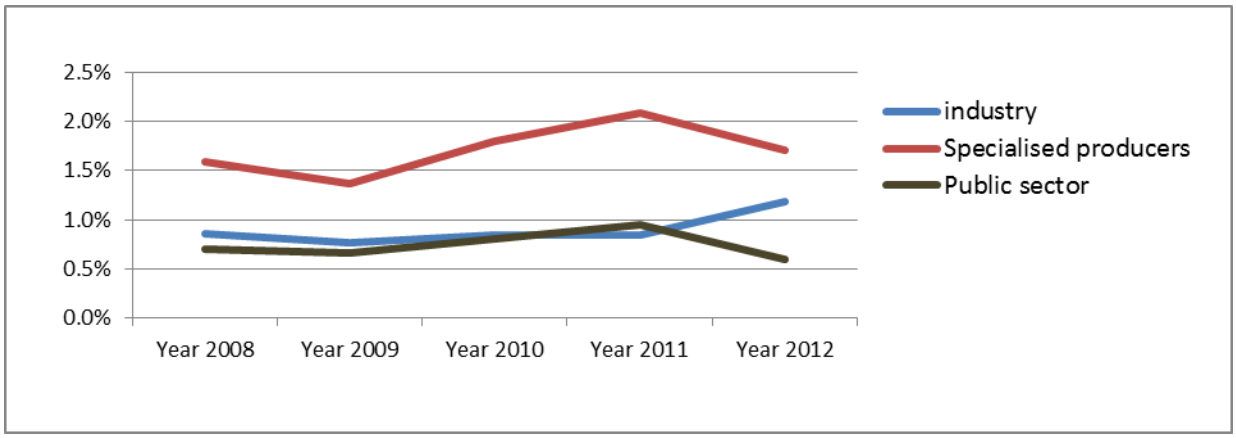


The values have been calculated at an exchange rate of 1 Euro = 4.43 Romanian Lei
Source: National Statistics Institute [21]

Figure 6. Yearly expenses for the environment's protection within 2008 and 2013 period

From the Fig. 6, we observe that, between 2008-2013, the highest value of the expenses for the environment's protection has been realized also by specialized producers, but followed by unspecialized producers (except for 2011) and after, by the public administration.

It still remains the question of the share in GDP of the expenses for environmental protection in Romania. Fig. 7 presents the evolution of the share of the expenses for the environmental protection within GDP, in the 2008-2012 period.



Source: National Statistics Institute [21]

Figure 7. Evolution of the expenses for the environment's protection in GDP between 2008 and 2012 in Romania

The share of the expenses for the environment's protection in Romania fluctuates more within 2008-2012 period of time as against the EU average, taking in consideration that:

- The share of the expenses realized by the public administration in the GDP fluctuated between 2.5% and 4% of the GDP.
- The share of the expenses made by specialized constructors fluctuated between 2% and 3% of the GDP
- The share of the expenses of the unspecialized producers in GDP fluctuated between 0.5% and 1.5%.

In conclusion, the financial allowance per year for the environment's protection had a higher share in GDP than the EU 28 average.

5. Reuse of correspondingly treated wastewaters - alternative approaches to the water resources' conservation

In the context of sustainable development and given the fact that water resources are non-renewable resources, the authors propose as an alternative approach to water consumption in some industries, properly treated wastewater reuse. Water reuse is not a widespread practice in Europe. The majority of wastewater from urban water treatment plants is simply shed back into the rivers and lakes.

Barriers to water reuse implementation

Among the barriers encountered in the reuse of properly treated wastewater, we can name the following:

- "Inconsistent or inadequate water reuse regulations/guidelines, which lead to delays and misjudgments;
- Inconsistent and unreliable methods for identifying and optimizing appropriate wastewater treatment technologies for reuse applications, which are able to balance the competing demands of sustainable processes;
- Difficulties in specifying and selecting effective monitoring techniques and technologies for the whole system;
- Significant challenges in reliably assessing the environmental and public health risk/benefit of water reuse across a range of geographical scales;
- Poorly developed business models for water reuse schemes, and markets for reclaimed water;
- Low levels of public and government enthusiasm for water reuse;
- Limited institutional capacity to formulate and institutionalize recycling and reuse measures;
- Lack of financial incentives for reuse schemes" [22].

In the public policies for water reuse, EU Commission considers that „water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such" [9]. This is why, with the aim to achieve sustainable development, the EU Commission examines alternative options for reuse of wastewater properly treated, especially for agricultural irrigation or industrial purposes.

The reuse of water (e.g. from wastewater treatment or industrial installations) is considered to have a lower environmental impact than other alternative water supplies (e.g. water transfers or desalination), but it is only used to a limited extent in the EU, nowadays. This appears to be due to the lack of common EU environmental and health standards for reused water and the potential obstacles to the free movement of agricultural products irrigated with reused water [23].

An advantage that water reuse would have in Romania is related to droughts, which became more frequent in recent years. Thus, due to the high summer temperatures, meteorological droughts are increasing which, in time, leads to the installation of hydrological drought or reduce the flow of surface water resources. However, the degree of reuse of corresponding treated wastewater is close to "0", although in the areas mentioned above: some types of industrial or agricultural irrigation instead of using drinking water from a centralized system in dry weather conditions should be an advantage.

Water recycling has proven to be effective and successful in creating a new and reliable water supply without compromising public health. Grey water use is a widely accepted practice that will continue to grow. However, in many parts of the world, such as United States, the use of recycled water is expanding in order to accommodate the needs of the environment and growing water supply demands. Advances in wastewater treatment technology and health studies of indirect potable reuse led many to predict that planned indirect potable reuse will soon become more common. Recycling waste and gray water requires far less energy than treating salted water using a desalination system [24].

The EU Commission launched a public consultation regarding a series of measures which should encourage the stakeholders: the industry, the NGOs and the public authorities to use properly

treated wastewater. The aim of the public consultation was to evaluate the most suitable EU-level instrument/s to foster water reuse, while ensuring the health and environmental safety of water reuse practices and the free trade of food products. The consultation gave, both private citizens and stakeholders, the opportunity to actively contribute to the design of this initiative. Following the conclusion of the impact assessment, the Commission intends to submit the most suitable measure(s) on water reuse to the Impact Assessment Board for opinions. In case of a positive opinion on the proposed measure(s), the corresponding EU-level tools will be drafted for adoption by the Commission [23].

6. Conclusions

1. Some of the resources used by the society are limited. They should be consumed with greater care and in combination with other resources in industrial sectors, where this is possible. Such resources comprise also the water resources. It is therefore necessary a proactive thinking of the decision makers at public policy for more efficient use of water. The Europe 2020 Strategy is based on the Lisbon Strategy and establishes a larger approach to the need for more efficient use of resources, in order to ensure sustainable growth in the future.

2. The sustainable development in the field of the water resources and its use in EU show that Romania managed to keep the quality of the water resources at a better level than in other EU countries. Also, the water quantity abstracted for household consumers' supply and for other services are below the EU average. Furthermore, the share of the expenses for the environment's protection in the GDP is higher than the indicator's average in EU-28.

3. Even if wisely used, the water resources remain a finite resource, so reuse of wastewater treated properly, in sectors in which it is suitable for (irrigation, some industrial processes) can be alternatives to the fresh water consumption.

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