ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

Volume 27 (6), 2018

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# SUSTAINABLE WATER RESOURCES MANAGEMENT (THE CASE OF NATURAL SYSTEMS FOR WASTEWATER TREATMENT)

*The paper presents the concept of sustainable water resources management in the context of United Nations' sustainable development goals (UN SDG) and in relation to policies for water resources management in Bulgaria. The natural systems for wastewater treatment are discussed as an example for sustainable management. They could be used without the application of complex equipment or chemical processes. The economic and social advantages of these systems are discussed too.*
*Keywords: UN SDG 6.5.1, integrated water resources management, natural systems for wastewater treatment*
*JEL: Q25; Q58; Q5*

## 1. Introduction

A survey on the implementations of the integrated water resources management (IWRM) was conducted in 2017 and 2018 in 172 countries, which is about 90% of the United Nations (UN) member states. It is SDG indicator 6.5.1 for sustainable development (UN Water, UN Environment- DHI Centre, Global Water Partnership, UN Environment, 2018). The survey included a questionnaire concerning the status of national policies and legislation, institutional capacity, management instruments and financing in order to assess the degree of IWRM implementation to achieve "by 2030 integrated water resources management at all levels, including through transboundary cooperation as appropriate" as stated in 2030 Agenda for Sustainable Development.

The first part of the current paper presents the results of this survey, including also the results for Bulgaria. Second, the natural systems for wastewater treatment are discussed as a

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good practice, which is not only a part of the IWRM, but also meets the UN SDG indicator 6 "Ensure availability and sustainable management of water and sanitation for all".

## 2. Sustainable development, integrated water resources management

The 80s of the XX century called for the idea about the interrelation among the economic, social and environmental issues, which has been articulated in the concept for sustainable development. It was defined most clearly in 1987 in a report by UN World Commission on Environment and Development. Sustainable development can be classified as a development that meets the needs of the present without compromising the ability of future generations to meet their needs. The definition has become very popular. However, the main challenge is how to achieve such development in practice. Later, sustainable development has started to be discussed through the prism of green economy policies (Barbier, 2011; Kotseva-Tikova, 2018). These policies are supported and encouraged on an international level. In 2000 the UN adopted the Millennium Declaration and defined respective development goals in the three major spheres – economic, social and environmental. Analyses made after several years show that some progress was achieved, but the formulated goals were criticized. It was difficult to evaluate implementation and assess if they were achieved in reality – some of them were not time-limited and measurable (Attaran, 2005). In 2015 UN member states adopted new post-2015 development agenda. The agenda includes 17 Sustainable Development Goals (SDG) and 169 targets for the means of implementation, global partnership, monitoring and review. SDG indicator 6 concerns water – the goal is to ensure availability and sustainable management of water and sanitation. It also encourages integrated water resources management. The mechanisms for measuring of IWRM, included in the SDG Agenda, are an example for overcoming the deficiencies of the previous UN development goals.

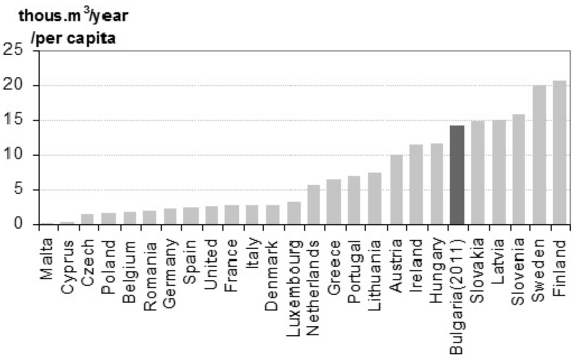
Water resources have been managed "in pieces" for many years, because the decisions were usually dominated by engineers and the long-term economic, social and environmental consequences of these decisions were not taken into account, i.e. the far-reaching effects of: discharging untreated wastewater in rivers, heavily modifying water bodies, building artificial water reservoirs, etc. The policies have been changing gradually and the management approach has been transformed from a fragmented towards an integrated one. Integrated water resources management is "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (Global Water Partnership, 2000). In contrast to the traditional fragmented management approach, the IWRM concept concerns both the management of demand and supply of water resources.

## 3. Water resources management in Bulgaria

The freshwater resources of Bulgaria are estimated at 106.7 billion $m^3$ annually, including the Danube river (long-term average, 1961-2011) and they are distributed unevenly on the territory of the country. A predominant part of water resources consists of external flow (84%), as in most countries in the Danube basin. Characteristic of the country are the high costs of precipitation for evaporation (75%). Water resources vary a lot from country to country in Europe depending on the climatic and hydrological conditions. Freshwater resources of Bulgaria are about 14 000 $m^3$/year/capita and Bulgaria is among the first ten European countries according to this indicator. Considerable water quantities are used by the energy sector for cooling purposes. On average water for cooling is about 60% of the annual surface water abstraction in Bulgaria, however after using these waters are returned back to the source. Nevertheless, some regions in the country could experience water shortages because of the uneven territorial allocation of water resources.

Figure 1

Annual freshwater resources per capita in some European countries




*Source: http://eea.government.bg/bg/soer/2011/water/water1*

In 2016 the fresh surface water abstraction is 5128,29 million $m^3$, and groundwater abstraction – 560,98 million $m^3$. According to the 4 Second River Basin Management Plans (RBMPs) 2016-2021 out of 955 surface water bodies with 44082 km length and 1720 $km^2$ area, heavily modified are 201 bodies with 7146 km length and 175 $km^2$ area. The condition of the groundwater bodies (GWBs) is as follows, quantity status: good status – 161GWBs with 156314 $km^2$ area and bad status – 8 GWBs with 2288 $km^2$ area; quality status: good – 111 GWBs with 87662 $km^2$ area and bad – 58 GWBs with 70939 $km^2$ area.

After 1990, freshwater abstraction decreased quickly because of the economic restructuring and especially the collapse of agriculture, and the fall in irrigated land. The structure by economic activity has been relatively stable in the recent years, after 2000 the annual water abstraction is between 5.8 and 6.9 billion $m^3$. Water stress measured by the water exploitation index (WEI+) on a national level is below 10%, i.e. the water abstraction does not cause stress on water ecosystems. Public water supply systems ensured the access to drinking water for 99.3% of the population in 2016 (Table 1). During the same year seasonal water supply restrictions faced 1.9% of the population and year-long restrictions – 0.2%. As a result of the absorbed EU funds the number of constructed wastewater treatment plants increased, but mainly in the big agglomerations with above 10 000 p.e.

Table 1

Share of population with water services in Bulgaria

| Indicator | 2010 | 2016 |
|---|---|---|
| Population connected to public water supply | 99.1 | 99.3 |
| Population connected to drinking water purification plants | 46.3 | 48.9 |
| Population with water supply regime: | 1.0 | 2.1 |
| seasonal (below 180 days) | 0.9 | 1.9 |
| all year (over 180 days) | 0.1 | 0.2 |
| Population connected to wastewater treatment plants: | 47.8 | 63.2 |
| primary treatment (mechanical stage) | 2.7 | 1.3 |
| secondary treatment (biological stage) | 18.3 | 17.2 |
| tertiary treatment (N and P removal) | 26.8 | 44.7 |
| Population connected to public wastewater collecting systems without treatment | 22.9 | 12.6 |
| Population connected to wastewater collecting systems - total | 70.6 | 75.7 |
| Independent wastewater treatment | 29.4 | 24.3 |
| Total connected to wastewater treatment | 77.2 | 87.5 |

*Source: National Statistic Institute (NSI).*

Due to funds from the Operational Programme Environment (OPE) 2007-2013 water supply network totaling to 1038 km was built and reconstructed, as well as 50 wastewater treatment plants (WWTP) were built and reconstructed and 1536 km sewage network. Grant contracts were concluded within the framework of OPE 2014-2020 for: supporting the regional investment planning in the water supply and sewage (WSS) sector and preparing tender documents for financing of 14 consolidated regions of 14 WSS operators and the territory of Sofia city; supporting efficiency, management and institutional capacity related to the reforms in WSS sector; improvement of monitoring networks of water quantity; RBMP 2016-2021, which are already adopted.

The Water Act (adopted in July 1999, last amendments in February 2017) regulates the ownership and management of water on the territory of the Republic of Bulgaria as a common national indivisible natural resource, as well as the ownership of water systems and infrastructure. According to article 2 the purpose of the law is to ensure integrated water management in public interest and for protecting the health of the population. The water management on a national level is conducted by the minister of environment and water. Higher Consulting Water Council has been established within the Ministry of Environment and Water (MoEW) with members – representatives of MoEW, other ministries, Bulgarian Academy of Sciences, municipalities, environmental non-governmental organisations (NGOs), business, etc. The basin management is conducted according to the basin territories and four basin directorates are established (Danube, Black Sea, East Aegean and West Aegean Directorate).

## 4. Assessment of integrated water resources management implementation in Bulgaria

The SDG indicator 6.5.1 tracks the degree of IWRM implementation, by assessing the four key components of IWRM (*UN Water, UN Environment- DHI Centre, Global Water Partnership, UN Environment. 2018*):

- Enabling environment;
- Institutions and participation;
- Management instruments;
- Financing.

Each section contains two sub-sections, the first covering the national level, and the second covering all other levels, which includes sub-national, basin/aquifer and transboundary levels as appropriate. For each question, a score between 0 and 100 may be selected. The score selection is guided by a descriptive text for six thresholds, which are specific to each question:

- 0 – <=10: *Very low:* development of elements of IWRM has generally not begun, or development has stalled;
- >10 – <=30: *Low*: implementation of elements of IWRM has generally begun, but with limited uptake across the country and potentially low engagement of stakeholder groups;
- >30 – <=50: *Medium-low*: elements of IWRM are generally institutionalised and implementation is underway;
- >50 – <=70: *Medium-high*: capacity to implement elements of IWRM is generally adequate and elements are generally being implemented under long-term programs;
- >70 – <=90: *High*: IWRM objectives of plans and programmes are generally being met, and geographic coverage and stakeholder engagement is generally good;
- >90 – <=100: *Very high*: the vast majority of the elements of IWRM are fully implemented, with objectives consistently achieved, and plans and programmes periodically assessed and revised.

Data on SDG indicator 6.5.1 is collected through an UN questionnaire and responses are consolidated through consultations between relevant stakeholders, such as national and subnational line – ministries and institutions involved in water resources management and other stakeholders such as NGOs, academia and business. It takes into account the various users and uses of water, with the aim of promoting positive social, economic and environmental impacts at all levels, including the transboundary level, where appropriate.

The assessment of the degree of IWRM implementation in Bulgaria took place in the period February – March 2018. Average results are as follows: average rating for Bulgaria – 60 points and by components: for funding – 52 points, and for the other three components – 62 points (Table 2).

Table 2

Selected average results of the assessment of IWRM implementation in Bulgaria

| Indicators and points | Short comment on the evaluation |
|---|---|
| *1. Enabling Environment: status of policies, laws and plans to support IWRM at the national level and other levels (basin, transboundary etc.)* | |
| National water resources policy, or similar – 60 points | Water management is carried out in accordance with the EU and national legislation – Environment Protection Act, Water Act, regulations, national strategic and planning documents – National Strategy for Management and Development of the Water Sector, River Basin Management Plans (RBMPs), Flood Risk Management Plans (FRMPs), Marine Strategy, national programs in the field of protection and sustainable development of waters. Measures for sustainable use and development of water resources on the basis of IWRM concept are part of: the four RBMPs and FRMPs; national strategy on water sector management, and national forestry strategy; the program for rural areas development, etc. |
| National water resources law(s)- 60 points | Water Act and relevant sub-documents are being applied by the majority of relevant authorities. |
| National integrated water resources management (IWRM) plans, or similar - 60 points | The involvement of a large number of state institutions, as well as the municipalities, the private sector and European funding will ensure the implementation of a big part of the measures in RBMPs/FRMPs 2016-2021, based on integrated water resource management. |
| Sub-national water resources policies or similar –40 points | Progress towards IWRM over the past decade is significant, but much more efforts need to be made to coordinate planning on sub-national levels. |
| *2. Institutions and Participation: status of institutions for IWRM implementation at the national level* | |
| National government authorities' capacity for leading implementation of national IWRM plans or similar – 80 points | The 4 Basin Directorates developed the first RBMPs for 2010-2015 and its subsequent update (RBMP 2016-2021 and the FRMP 2016-2021), which include measures for the implementation of IWRM. |
| Coordination between national government authorities representing different sectors on water resources, policy, planning and management – 80 points | A Coordinated Water Council at Ministry of Environment and Water has been established with an official representation of all state bodies. |
| Public participation in water resources, policy, planning and management at national level – 60 points | The Bassin Council have been created at each Bassin Directorate with the participation of all stakeholders on a quota principle. RBMPs and FRMPs are approved after public consultations. There is an opportunity for public participation online though the sites: www.strategy.bg, www.moew.government.bg |
| Developing IWRM capacity at the national level – 40 points | Normally limited - to short-term activities. |
| *3. Management Instruments: status of management instruments to support IWRM implementation at the national level and at other levels (basin, transboundary etc.)* | |
| National monitoring – 60 points | Monitoring is being carried out, but with insufficient coverage and limited use by stakeholders. |

| Indicators and points | Short comment on the evaluation |
|---|---|
| Basin management instruments – 60 points | Programmes of measures for each river basin include specific management tools appropriate for the specific basin/sub-basin and in coordination with measures in neighbouring basins , ensures a cumulative effect. |
| *4. Financing: status of financing for water resources development and management at the national level and at other level (basin, transboundary etc.)* | |
| National budget for investment including water resources infrastructure - 40 points | Co-financing in the frame of EU Operational Environment Programme 2016-2021 for water infrastructure which is not sufficient. |
| National budget for the recurrent costs of the IWRM elements – 60 points | National budget for policy, lawmaking and planning, institutional strengthening, coordination, stakeholder participation, research/studies, environmental assessments, data collection and monitoring of IWRM elements. |
| Sub-national or basin budgets for investment including water resources infrastructure – 40 points | There is no separate budget in sub-national or basin investment plans. But there is a limited municipal budget and funding from water and sewerage operators. |
| Revenues raised from dedicated levies on water users at basin, aquifer or sub-national levels – 60 points | Revenue generated by fees is not directly linked to the financing of IWRM activities. However, it is possible to finance some of the IWRM activities. |
| Financing for transboundary cooperation – 40 points | Financing by the Danube Strategy, the Black Sea Cooperation Program, and the Interreg Programme which is a series of five programmes to stimulate cooperation between regions in the European Union, funded by the European Regional Development Fund. |

*Source: UN SDG 6.5.1, Bulgaria Country Questionnaire.*

The data collection for SDG indicator 6.5.1 on the Degree of implementation of IWRM was completed in 2017 and 2018, a total of 172 countries submitted their assessments on the status of implementation of IWRM (*UN Water, UN Environment- DHI Centre, Global Water Partnership, UN Environment. 2018*). Country implementation of integrated water resources management ranges from very low to very high, with a global average 6.5.1 score of 49 on a scale of zero to 100:

- An estimated 40 percent of countries are implementing most elements of IWRM through long-term programmes (medium-high and above);
- Another 41 percent of countries have adopted most elements of IWRM and implementation is underway, but uptake of arrangements and stakeholder engagement may be relatively low (medium-low);
- The remaining 19 percent of countries have only started developing elements of IWRM (low and very low).

The SDG indicator 6.5.1 score (points) of the countries is presented in Table 3 (UN Water, UN Environment- DHI Centre, Global Water Partnership, UN Environment. 2018).

Table 3

SDG indicator 6.5.1 score (points) of UN member countries

| Very low | Low | Medium-low | Medium-high | High | Very-high |
|---|---|---|---|---|---|
| 10 (Somalia) | 30 (Antigua and Barbuda, Gambia, Kazakhstan, Peru, Serbia, Tonga); 29 (Haiti); 27 (Myanmar); 26 (Comoros, Solomon Islands); 25 (Grenada, Guatemala, Iraq, Papua New Guinea, Sri Lanka, Trinidad and Tobago); 24 (Equatorial Guinea, Guinea); 23 (Chile, Sao Tome and Principe); 22 (Saint Kitts and Nevis, The former Yugoslav Republic of Macedonia); 21 (El Salvador, Honduras); 20 (Belize); 19 (Sierra Leone); 16 (Guyana); 15 (Liberia, Suriname); 14 (Gabon, Timor-Leste); 12 (Afghanistan) | 50 (Bangladesh, Colombia, Niger, Pakistan, United Republic of Tanzania); 49 (Bolivia, Ghana, Mexico); 48 (Algeria, Indonesia); 47 (Libyan Arab Jamahiriya, Tuvalu); 46 (Cambodia, Zambia); 45 (Mauritania, Seychelles, Uzbekistan); 43 (Albania, Costa Rica, Jamaica, Malaysia, Mongolia); 42 (Barbados, Ecuador); 41 (Botswana); 40 (Bahrain, Dominica, Egypt, Malawi, Poland, Saint Lucia, Sudan); 39 (Ukraine, Vanuatu, Yemen); 38 (Argentina, Belarus, Democratic People's Republic of Korea, Micronesia, South Sudan, Viet Nam); 37 (Angola, Panama); 36 (Andorra, Armenia, Dominican Republic, Madagascar); 35 (Georgia, Maldives, Nigeria, | 70 (Liechtenstein, Samoa, Turkey); 68 (Republic of Korea); 66 (Azerbaijan, San Marino, Slovakia); 65 (South Africa); 64 (Cape Verde, Latvia, Mauritius, Morocco); 63 (Benin, Burkina Faso, Jordan, Norway); 61 (and Herzegovina, Zimbabwe); **60 (Bulgaria)**; 59 (Iran, Namibia, Uganda); 58 (New Zealand, Slovenia); 57 (Lithuania, Saudi Arabia); 55 (Italy, Mozambique, Tunisia); 53 (Kenya, Mali, Senegal, Swaziland); 52 (Iceland); 51 (Brazil, Philippines) | 90 (Croatia, Luxembourg, Monaco); 89 (Sweden); 88 (Germany); 86 (Australia); 85 (Israel); 83 (Greece); 82 (Kuwait, Qatar, Spain); 81 (Ireland, Switzerland); 80 (Cuba, Estonia); 79 (Czech Republic, Russian Bosnia Federation); 78 (Belgium); 77 (United Kingdom of Great Britain and Northern Ireland); 75 (China, Finland, Malta, United Arab Emirates); 74 (Portugal); 73 (Hungary); 72 (Romania) | 100 (France, Singapore); 94 (Japan); 93 (Denmark, Netherlands); 91 (Austria, Cyprus) |

| Very low | Low | Medium-low | Medium-high | High | Very-high |
|---|---|---|---|---|---|
| | | Rwanda); 34 (Cameroon, Montenegro); 33 (Bahamas, Lesotho, Marshall Islands, Nepal, Oman); 32 (Bhutan, Burundi, Chad, Congo, Côte d'Ivoire, Lebanon, Paraguay, Republic of Moldova, Togo); 31 (Central African Republic, Democratic Republic of the Congo, Ethiopia) | | | |

The assessment of SDG 6.5.1 for Bulgaria (60 points) is within the European average, indicating that the country has achieved a relatively good implementation of the principles of IWRM (for Europe SDG indicator 6.5.1 ranges from 53 points to 67 points – medium to high level of application of IWRM). The RBMPs/ FRMPs of the 4 Basin Directorates in the country are well developed, but an issue stands out concerning their practical application and the adequate financing of the measures. Another important problem is the frequent change in legislation, the need of security and predictability of the processes, the lack of high institutional capacity and good management. The problems are aggravating especially on a regional level – the scores of a component of IWRM on a basin level are lower than those on a national level.

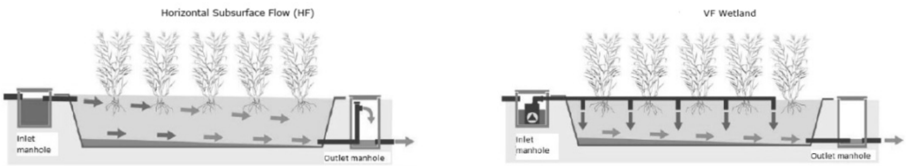
## 5. Natural systems for water treatment

The topic of the UN World Water Development Report of 2018 (UN Water, 2018), presented at the 8th World Water Forum in the town of Brasilia, is on natural water-based solutions. A successful public discussion in the European Parliament of this report is organised in the framework of the Bulgarian European presidency. Natural water-based solutions will contribute to achieving the UN's sustainable development goals by 2030, also they may be instrumental in the EU's circular economy.

Natural treatment methods are mainly used for wastewater treatment from decentralized houses, small settlements, dwelling, hotels, recreational facilities, restaurants and summer camps, smaller municipalities or their parts, usually up to 2000 p.e. According to the composition of wastewater, these methods are also applicable for treatment of industrial wastewater from the food processing industry, trade facilities (workshops) and selected small industrial plants, landfill leachate treatment, organically low-loaded agricultural runoff and wastewater agricultural facilities, polluted stormwater runoff, erosion washes of polluted surface water and backwashing filters water of drinking water purification plants. There is a great need for wastewater treatment for all sources of pollution < 2,000 p.e. in Central and Eastern Europe and there is an obvious potential for natural treatment systems. In recent years the most widely used are the treatment wetlands (*TW*) usually planted by *Phragmites australis* (reed), which appear to be an alternative to the conventional method of wastewater treatment of small agglomerations (Rozkošný et al., 2014). TW as a method of water purification are part of green infrastructure and are defined as an ecosystem approach in the development of water infrastructure projects. TW are watertight beds filled with filter material and planted with local plant species – most often with reed (Figure 2) (Masi et al., 2017). The filter layer with a root zone and attached microorganisms must comply with predefined requirements in terms of hydraulic conductivity and pollution load, including specific substances (removal of phosphorus, heavy metals etc.).

Figure 2

Treatment wetlands with horizontal and vertical water flow



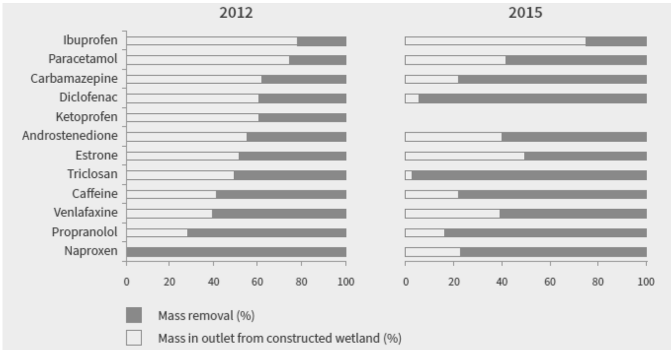

The investment of TW for wastewater treatment of village Dobeno, Slovenia, with a population of 223 inhabitants is 146818.94 euro, and operating annual costs 2289.40 euro or annually 10.27 euro per capita (Masi et al., 2017). The TW includes an equalizing tank – 3 $m^3$, chambers with siphons for loading the first and the second stage of the TW with an area of the first stage of the TW of 288 $m^2$ and with an area of the second stage of the TW of 224 $m^2$, a sump at the outlet for sampling and infiltration area for treated wastewater.

When designed appropriately TW can be also efficient for removal of pharmaceuticals (Figure 3). Initially, when entering the wetland to create a well-developed root system, the treatment effect was smaller, but subsequently increased. This is established on a pilot TW in Ukraine, built in 2012 (Figure 3) (information by GWP-Ukraine).

The main advantages of TW are: a) aesthetic integration into the environment, b) increasing the biodiversity of the landscape by creating an artificial wetland; c) a favorable impact on the microclimate in the immediate vicinity (cooling effect); d) an energy-efficient method of treatment, as it uses gravity instead a power supply; e) the costs of operation and maintenance are moderate; f) a relatively simple construction with possibilities to be constructed by local resources (manpower, machines); g) a proper design can achieve high effects in the removal of organic substances, pathogens, metals, pharmaceuticals, etc.; h) the intermitted flow provides additional oxygenation of the filter material and removal of ammonium nitrogen; i) the removal of heavy metals can achieve efficiences of: 81% for Mn, >82% for Cu, > 91% for Al and > 98% for Zn (Rozkošný et al., 2014).

Figure 3

Removal of pharmaceuticals from wastewater by a pilot TW in Ukraine




The lower removal effeciency can be recorded by the horizontal TW (*HF*): $BOD_5$ – 85%; COD – 75,%; SS – 80%; $NH_4$-N – 30% and total P – 35% (Rozkošný et al., 2014). Normally, the sorption P-capacity is from 0.93 to 1.15 g of phosphorus per 1 kg of the filter material. When zeolite is used as a filter layer, sorption capacity increases to 2.15 g P per 1 kg zeolite. In the study of 70 species of pathogens were removed in the first meters from the inlet of the 3 TW-HF for 150, 200 and 300 p.e. in the Czech Republic. No significant seasonal fluctuations in the performance efficiency were reported. The TW - VF in the Netherlands achieved the treatment effeciency of 98% for *Escherichia coli* and *F-specific RNA bacteriophages*.

In Slovenia, 99% reduction of coliforms and 98% of fecal streptococci (*enterococci*) were achieved for wastewater from a food processing industry by TW-HF (Zupančič Justin et al., 2009).

The disadvantages of TW for wastewater treatment are: when used as a main step of treatment, a large area is needed – from 2 to 5 $m^2$/p.e.; there is a risk of clogging of the filter bed as a result of inappropriate design of the preliminary treatment stage or inappropriate operation and maintenance of mechanical pre-treatment installations; difficult to regulate the ongoing processes, especially in case of need for rapid response to corrections and changes (Rozkošný et al., 2014).

In spite of some penetrable shortcomings, the TW are suitable for areas with dispersed settlements, because they present robust solution with no need for highly educated operators.

## 6. Conclusions

The assessment of SDG indicator 6.5.1 provides a wealth of data and a comprehensive global picture on the progress of IWRM implementation in countries. It will serve as a baseline for continued tracking of progress towards 2030 Agenda and future global IWRM implementation assessments. Bulgaria is in the group of countries with a mean-high IWRM score, i.e. these are countries that have staked the integrated management of water resources in long-term programmes. It is believed that these countries will be able to achieve the global goal of the UN Agenda, but it is necessary to make efforts until 2030. The use of natural wastewater treatment systems as an alternative to the conventional treatment method provides affordable sanitary services for the population of small settlements, as well as for people with low income. The construction of a treatment wetland is not only an environmentally friendly solution, but it also has a proven socio-economic impact.

## References

Attaran, A. (2005). An Immeasurable Crisis? A Criticism of the Millennium Development Goals and Why They Cannot Be Measured. – PLoS Medicine, Policy Forum, Oct. 2005, Vol. 2, N 10.

Barbier. (2011). The policy challenges for green economy and sustainable economic development. – Natural Resources Forum, 35, p. 233-245.

Global Water Partnership (GWP). (2000). Technical Advisory Committee, Integrated Water Resources Management, Stockholm, https://www.gwp.org/.

Kotseva-Tikova, M. (2018). Regional Policy for Inclusive Development of the Districts of Bulgaria. Proceedings from NISPACee conference, May 2018, Romania.

Masi, F., Conte, G., Rizzo, A., Griessler Bulc, T., Banovec, P., Pflieger, M., Istenič, D., Ovca, A., Muller, R. (2017). Synthesis centres on innovative wastewater treatment: feasibility studies in the Lower Danube. Lot 1: Slovenia, Slovakia, Czech Republic, Hungary, Bosnia-Herzegovina, Montenegro, Croatia. IRIDRA, GWP CEE, Institut za vodarstvo, p. 381.

Rozkošný, M., Kriška, M., Šálek, J., Bodík, I., Istenič, D. (2014). Natural Technologies of Wastewater Treatment. GWP CEE, p. 138.

UN Water, UN Environment- DHI Centre, Global Water Partnership, UN Environment. (2018). Progress on IWRM. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation. p. 68 and A-21, http://iwrmdataportal.unepdhi.org/iwrmmonitoring.html

UN Water. (2018). Nature based solutions for water treatment. The UN World Water Development Report 2018, p. 156.

Zupančič, J. M., Vrhovšek, D., Stuhlbacher, A., Griessler Bulc, T. (2009). Treatment of wastewater in hybrid constructed wetland from the production of vinegar and packaging of detergents. – In: Selected papers presented at Multi functions of wetland systems, International Conference of Multiple Roles of Wetlands, June 26-29, 2007, Legnario (Padova) Italy, (Desalination (Amsterdam), ISSN 0011-9164, vol. 246, no. 1/3, 2009, p. 100-109.