

WASTE MANAGEMENT IN POST-SOVIET COUNTRIES: HOW FAR FROM THE EU?

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ABSTRACT

After the collapse of the Soviet system, every new independent state selected its own way of development, own goals and speed of transformation. Dramatic changes were linked not only to the political and economic sphere, but also to environmental governance as a whole and waste management in particular. 25 years later the authors looked at 6 post-soviet countries and analysed the situation in the sector of municipal solid waste management by comparing this with EU member states (some of them have a socialistic past). We used BiPRO approach (BiPRO, 2012) and looked for answers related to the question: how far developed is the current state of waste management in post-soviet countries compared to EU members? Which factors define the potential efficiency of waste management system and its full conformity with the situation in "old" EU member states? The overall scores of 6 post-soviet countries range from 2 (Georgia) to 11 (Belarus). The common reasons for these low scores in all mentioned countries are weak waste management policies, and landfilling as a main way of waste disposal, the lack of economic instruments for stimulating reducing of waste generation and recycling, as well as underdeveloped infrastructure for waste treatment facilities. Specific problems for post-soviet countries are, for example, the high share of landfilled biodegradable waste, incomplete coverage of waste collection systems, the lack of forecasting of waste quantities and planning of waste management, preserved obsolete soviet approach to tariff policy, statistical accounting and administrative procedures in the sector of waste management. The improvement of waste management systems should aim at the legislative ban on the disposal of municipal solid waste at landfills, the re-establishment of a separate waste collection system (disestablished after USSR collapse), the establishment of economic and financial mechanisms supporting the waste processing sector and stimulating the population to reduce waste generation.

1. INTRODUCTION

The issue of municipal solid waste management is an urgent problem of urban management and environmental governance in the countries with different level of social and economic development. Constant growth of consumption goes along with an increase of waste generation all over the world. The strategic goals of waste management are becoming recycling, minimization and waste avoidance. The main challenge of the environmental governance is municipal solid waste management (MSWM) linked to the quality of waste collection, removing and recycling, as well as the efficiency of the institutions for waste management.

The geographical focus of the paper is on post-soviet

countries. After the collapse of the Soviet system, every new independent state selected its own way of development. Dramatic changes were linked not only to the political and economic sphere, but also to the environmental governance as a whole and waste management in particular. The speed of transformation was quite different in different countries: some of them transformed fast and dramatically (Russia and Ukraine), some of them saved a lot of societal performances of waste management system (Belarus), others had middle speed of transformation (Kazakhstan and Moldova), and Georgia has changed the goal of transformation drastically. In present post-soviet countries have different GDP, incomes and economic growth (table 1). The speed of the transformation, as well as level of



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IN PRESS

TABLE 1: General information about analysed countries*

	Belarus	Russia	Kazakhstan	Ukraine	Moldova	Georgia
Total area	207,600 km ²	17,098,242 km ²	2,724,900 km ²	603,550 km ²	33,851 km ²	69,700 km ²
Population	9,549,747 (2017)	142,257,519 (2017)	18,556,698 (2017)	44,033,874 (2017)	3,474,121 (2017)	4,926,330 (2017)
Urbanization	77.4% (2017)	74.2% (2017)	53.2 % (2017)	70.1% (2017)	45.2% (2017)	54% (2017)
GDP (purchasing power parity)	\$175.9 billion (2017)	\$4 trillion (2017)	\$474.3 billion (2017)	\$366.4 billion (2017)	\$20.07 billion (2017)	\$39.32 billion (2017)
GDP - real growth rate	0.7% (2017)	1.8% (2017)	3.3% (2017)	2% (2017)	4% (2017)	4% (2017)
GDP - per capita (PPP)	\$18,600 (2017)	\$27,900 (2017)	\$26,100 (2017)	\$8,700 (2017)	\$5,700 (2017)	\$10,600 (2017)
Population below poverty line	5.7% (2016)	13.3% (2015)	2.7% (2015)	24.1% (2010)	20.8% (2013)	9.2% (2010)

* Data from web-site Index Mundi <https://www.indexmundi.com/>

social and economic development, was a reason to choose the following 6 countries for analysis: Belarus, Russia, Kazakhstan, Ukraine, Moldova and Georgia. Some current data about mentioned countries is represented in table 1. Mentioned countries have different square and population, and very different GDP. At the same time, all of them have middle level of GDP per capita and similar real growth rate (excluding Belarus). Three of them (Belarus, Russia and Ukraine) have high level of urbanization (more than 70 %), and Kazakhstan, Moldova and Georgia have a middle level of the urbanization (45 – 54 %). Moreover, all of them chosen different goals of the development: Moldova and Ukraine try to integrate fully with EU, Belarus, Russia and Kazakhstan are developing a strong economic and political partnership (The Eurasian Economic Community), Georgia provides own independent policy. So, analysed countries are characterized by diverse social, economic and political conditions at present times, but have common soviet past, that why the assessment of the MSWM systems could be interesting for the identification of driving factors and effective tools of the waste policy implementation.

The waste generation in total and waste generation per capita in analysed countries are presented in table 2. The main characteristics of the MSWM system in the mentioned countries are (1) landfilling as a main method of waste management; (2) tariff policy based on the “normative of waste generation” for the waste collection and removing per capita; (3) significant over-use of the equipment; (4) under-development of recycling capacities; (5) littering of urban areas; (6) development of the informal and illegal sector for collection and treatment of recyclables. In spite of common issues in the waste management sector, every analysed state has own specifics and features of the MSWM system.

The main goal of the research was to analyse the current state and level of development of the MSWM system

in 6 post-soviet countries, identify strong and weak points of national waste policy, and to compare results with EU countries. Comparisons with EU countries could be useful for identifying the efficiency of national MSWM systems, analyzing more sufficient instruments and tools of MSW management, driving factors of waste policy implementation. We assume that analysing and comparing post-soviet countries with each other and EU members could allow identifying implementation gaps and improve national waste policy and MSWM system performances.

2. METHODS AND MATERIALS

The research is based on the BiPRO approach developed under the EU project “Support to Member States in improving waste management based on assessment of Member States’ performance”, project number 070307/2011/606502/SER/C2. The final report on screening of waste management performance of EU member states was published in 2012 (BiPRO, 2012).

The list of the criteria was developed based on the LD 99/31/EC and WFD 2008/98/EC. The set of criteria is reflecting the main elements and legal requirements stemming from the Directives in the field of waste management. Criteria were divided on 5 groups: (1) compliance with the waste management hierarchy reflecting the real situation; (2) existence and application of legal and economic instruments to support waste management according to the waste hierarchy; (3) existence and quality of an adequate network of treatment facilities and future planning for municipal waste management; (4) fulfilment of the targets for diversion of biodegradable municipal waste from landfills and (5) number of infringement procedures and court cases concerning non-compliance with the EU waste legislation. For each from 16 criteria two, one or zero points could be achieved according with the table in ANNEX 1. Overall

TABLE 2: Waste generation in analysed countries in 2014

	Belarus	Russia	Kazakhstan	Ukraine	Moldova	Georgia
Waste generation, mln t	4	56,68	3,5	9,2	0,7	no data
Waste generation kg per capita	421,7	385,6	200	215,7	199,3	no data

score was received as a sum of all criteria score. Individual criteria points were defined empirically based on the data observation in BiPRO (2012). In current paper the meaning of the points were saved for better understanding the situation in MSW management in post-soviet countries in compare with EU. The initial data for the assessment was collected from available statistical data, analytical reports, and reviews for the period 2010-2014, as well as from the analysis of national regulative and normative documents. The list of used sources for the assessment is represented in ANNEX 2. The fifth group of criteria was not assessed (explanations in ANNEX 1), and the overall scores of the EU countries from (BiPRO, 2012) were re-calculated without the mentioned criteria group. Overall score was received as a sum of all criteria score.

3. MUNICIPAL SOLID WASTE SYSTEM IN ANALYSED POST-SOVIET COUNTRIES

Main performances of the MSWM system in the analysed post-soviet countries are represented in table 3. The assessment according to BiPRO approach and the interpretation of the physical performances of MSW system are represented in table 4. The scoring, sources and way of the calculation could be found in the ANNEX 1.

In all mentioned countries the waste generation is increasing on the background of the growth of consumption (NSC RB, 2017; Sycheva & Asadcheva, 2013; MEP Kz, 2015; SSS U, 2016; NBS RM, 2016). In Georgia data on waste generation and treatment are not collected systematically. The constant growth of waste generation is a common problem of all analysed countries and reflects a global trend of overconsumption and waste generation. The problem of outstripping growth of waste generation over consumption is typical for EU countries also, including leaders in the treatment of municipal solid waste. Only in such countries as Austria, the Netherlands, Denmark and Luxembourg the growth of MSW is the only indicator that is equal to zero amid significant progress in all other areas of improving the waste management system (BiPRO, 2012).

The waste quantity per capita in analysed countries

differs from about 200 kg in Ukraine, Moldova and Kazakhstan to about 400 kg in Belarus and Russia (table 2). There is no data on waste per capita in Georgia. We can't say, that mentioned figures on waste generation per capita reflect the real situation adequately. The common issue for analysed 6 countries is the lack of accurate estimations of the total waste generation and waste per capita due to specifics of statistic recording. Statistic recording takes into account only the amount of collected and removed waste by special enterprises; there is no 100-% coverage of waste collection system in all overviewed countries (especially in the rural areas); there is a lack of official data and assessment of waste flows in the informal and illegal sector. Moreover, in some cases data from local level are not transmitted correctly to the national level and may contain significant mismatching (see, for example SSS U, 2016 and MRDCH U, 2015).

Almost all MSW is landfilled in post-soviet countries: up to 100 % in Georgia and Moldova, 94 % in Kazakhstan and Ukraine, about 90 % in Russia and about 80 % in Belarus (table 3). The level of recycling in Ukraine, Russia and Kazakhstan is less than 8 %, and in Belarus is about 20 % (table 3). In the Republic of Moldova, the data on the volume of recycled waste is not under statistical monitoring. The data on the material recycling in Georgia is not available in open sources. There are a few incineration plants in Belarus, Ukraine and Russia built for energy production, but their capacity is not enough to play a significant role in the MSW treatment: according to statistic data the level of energy recovery is about 1-3 % (table 3). Kazakhstan is only planning to construct incineration plants. The widespread use of landfilling links, first of all, to very low fee for waste disposal, especially in comparison with recycling or energy recovery. The payment for removing MSW is less than 35 €/t in all analysed countries (table 3). The low tariffs are a legacy of old soviet approach to the payment for removing and treatment of solid waste. The approach is based on the "normative of waste generation per capita" and established tariffs for communal services. The growth of the service costs is based, as a rule, on the artificial increasing mentioned "normative per capita" because the tariffs on com-

TABLE 3: Performances of the waste management system of analysed countries*

Criteria Countries	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2
	Decoupling indicator	WPP in place	% Recycling	% recovery	% disposal	% recycling	Ban/Restrictions	€/t	PAYT	% coverage	WMP	WMP	WMP	% compliance	% target	% biodegrad.
Belarus	coupling	Yes	19	1	80	20	Restrictions	9	No	85	Yes	No data	Yes	76	No	No data
Russia	decoupling	Yes	7	3	90	3	Restrictions	Less 35	No	No data	Yes	Yes	Yes	8	No	No data
Kazakhstan	coupling	No	6	0	94	4	Restrictions	Less 35	No	Less 50	Yes	Yes	Yes	6	No	No data
Ukraine	decoupling	Yes	<3	<3	94	3	Restrictions	2	No	77	under-capacity	No	No data	less 75	No	No data
Moldova	decoupling	Yes	No data	no data	up to 100	No data	No	12	No	Less 60	under-capacity	Yes	Yes	0	No	No data
Georgia	NA	Yes	No data	0	up to 100	No data	No	No data	No	Less 70	under-capacity	No data	No data	less 75	No data	No data

* Conducted by authors as a result of the analysis documents, statistical data and analytical report (see ANNEX 2).

TABLE 4: The results of the assessment of the MSWM system in post-soviet countries.

Indicator	Belarus	Russia	Kazakhstan	Ukraine	Moldova	Georgia
1 Compliance with the waste management hierarchy reflecting the real situation						
Criterion 1.1: Level of decoupling	1	0	1	0	0	N/A
Criterion 1.2: Existence of own waste prevention programme	2	2	0	2	2	2
Criterion 1.3: Amount of municipal waste recycled	1	0	0	0	0	0
Criterion 1.4: Amount of municipal waste recovered (energy recovery)	1	1	0	1	0	0
Criterion 1.5: Amount of municipal waste disposed	0	0	0	0	0	0
Criterion 1.6: Development of municipal waste recycling	2	1	1	1	0	0
2 Existence and application of legal and economic instruments to support waste management according to the waste hierarchy						
Criterion 2.1: Existence of nationwide ban/restrictions for the disposal of municipal waste into landfills	1	1	1	0	0	0
Criterion 2.2: Total typical charge for the disposal of municipal waste in a landfill	0	0	0	0	0	0
Criterion 2.3: Existence of pay-as-you-throw (PAYT) systems for municipal waste	0	0	0	0	0	0
3 Existence and quality of an adequate network of treatment facilities and future planning for municipal waste management						
Criterion 3.1: Collection coverage for municipal waste	0	0	0	0	0	0
Criterion 3.2: Available treatment capacity for municipal waste in line with the EU waste legislation	1	0	0	0	0	0
Criterion 3.3: Forecast of municipal waste generation and treatment capacity in the WMP	0	1	1	0	1	0
Criterion 3.4: Existence and quality of projection of municipal waste generation and treatment in the WMP	1	1	1	0	1	0
Criterion 3.5: Compliance of existing landfills for non-hazardous waste with the Landfill Directive	1	0	0	0	0	0
4 Fulfillment of the targets for diversion of biodegradable municipal waste from landfills						
Criterion 4.1: Fulfillment of the targets of the Landfill Directive related to biodegradable municipal waste going to landfills	0	0	0	0	0	0
Criterion 4.2: Rate of biodegradable municipal waste going to landfills	0	0	0	0	0	0
Overall score	11	7	5	4	4	2

municipal services are socially sensitive component (especially in the situation of low incomes and significant share of poor in the country) and their increasing is regulated by the national governments. Such conditions do not allow developing recycling or energy recovery effectively, and moreover, the implementation of the PAYT systems is not profitable for service providers under existing tariff policy. It is no surprise that PAYT systems are not implemented in the analysed countries, and there is no ban on landfilling.

Many landfills do not meet modern environmental requirements or do not have all necessary documents and permissions. For example, in Russia only 8% of MSW landfills meet environmental requirements (IFC's the World Bank Group, 2010); 90 % of existing landfills are operated without a license (Ecoportal, 2015); in Kazakhstan there are 4284 landfills and dumps: and only 459 from this number meet environmental requirements and sanitary standards

and are provided with all necessary documentation (MEP Kz (2015)). In the field of landfilling next typical discrepancies are (on the example of Kazakhstan, MEP Kz (2015): 1) the lack of synthetic or clay liners at the majority of the waste disposal sites; 2) widespread disposal of MSW together with industrial, medical and others types of toxic and hazardous waste; 3) unsystematical compaction and interleaving of the stored waste with isolated layer (clay) or the lack of it; 4) the lack of system for collection of leachate and landfill gases (including methane); 5) excessive usage of many landfills and dumps which exceed their capacity; 6) lack of monitoring; 7) discrepancy of requirement of sanitary rules and sanitary protection zone. In Ukraine, municipal solid waste landfills are a source of contamination of the surrounding rural areas: as a result of their operation may deteriorate the sanitary state of soils, the quality of groundwater and air (Makarenko, Budak, 2017).

Current regulations for design, construction and operation of landfills as well as their enforcement significantly differ from the EU Landfill Directive. The national requirements are not comparable with EU regulations, that why the final score for this criterion is very low in all analyzed countries.

In all analyzed countries the capacity for MSW treatment and recycling is underdeveloped and the list of recycling technologies is short. For example, according to (Cleandex, 2010), there were 39 waste sorting plants in operation (beginning of 2010) in Russia. Their average capacity is about 180 000 tons per year, which is comparable with the amount of waste generated in a small town (IFC's the World Bank Group, 2010). Recycling plants in Russia, Kazakhstan, Ukraine, Moldova, Georgia are private, in Belarus they belong to state. Recycling plants in mentioned countries meet similar problems (on the example of Belarus, Ly-suho & Eroshina; 2011): (1) high cost of recycling products with relatively low quality; (2) poor quality of the waste for recycling due to the lack of effective waste sorting; (3) the prevalence of manual labor with involving marginal groups, (4) the competition with illegal recycling sector. In spite on noted problems, the recycling sector is fast developing in all analyzed countries. Its growth is particularly impressive in Belarus, where for the last five years the capacity of recycling plants has increased by almost 20 %. In Ukraine there is a huge recycling potential, waste treatment is provided both in formal and informal way. There are lots of companies dealing with waste recycling in Ukraine but with no official monitoring, accounting and control. Therefore, it could be observed the lack of statistical data in open sources. That was the reason of low scoring for Ukraine.

Biodegradable waste is not a point for MSW management in the analyzed countries. The generation, landfilling or treatment of the biodegradable waste is not controlled. Moreover, there is not definition of such kind of the waste in the national legislations (see documents in ANNEX 2). There is a lack of reliable statistical data on the biodegradable waste in the countries, that is why this criteria has score "0" in the overall scoring. Almost all biodegradable waste is landfilled in all analyzed countries. The share of the biodegradable waste varies from the place of their generation: its share is much larger in the multi-story apartments; and such kind of waste is practically not met in the waste from private households where biodegradable waste is traditionally used for composting or incineration (NSC RB, 2017; Sycheva & Asadcheva, 2013; MEP Kz, 2015; SSS U, 2016; NBS RM, 2016).

It should be noted that the system of the collection of "food waste" was established in the USSR. The "food waste" was collected at the multi-story apartments and then transported to the livestock breeding complexes for animal fattening. After the USSR collapse this system was destroyed due to reasons of hygienic and sanitary safety as well as due to changes in animal fattening technologies. The revival of such system for "food waste", of course in the modernized form adapted to modern conditions, could be greatly improved the MSWM system and decreased the share of the landfilling biodegradable waste.

Economic instruments for MSWM regulation are un-

derdeveloped in all overviewed countries. For example, in Russia it was recognized the special value of public-private partnership for the implementation of major infrastructure projects and programs. However, until now there was no even one integrated project united all components of MSW management (collection and removal, disposal, recycling, landfilling) at the level of urban agglomeration and / or the subject of the Federation (IFC's the World Bank Group, 2010). In Belarus under the President's Decree № 313 "On Some Issues of Consumer Waste Disposal", the procedure for implementation of EPR is established.

National programs, normative and regulative documents on MSW management are approved in Belarus (MHU RB 78, 2014), Ukraine (WMP U, 2004), Russia (MNRE RF 298, 2013), Moldova (NWMS RM, 2013). The National program of modernization of the MSWM system in Kazakhstan (MP Kz, 2014) was canceled in the September, 2016. It should be mentioned that approved national strategies on MSW management is one of the advantages of Belarus, Ukraine, Russia, Moldova and Georgia, since more than half of the EU members (17 States) do not have national documents on MSW management and use EU directives. From the other hand, as was pointed in report (BiPRO, 2012), approved national policy and legislative documents on MSW management do not guarantee an efficiency of MSWM system due to governance gaps and implementation deficits. All of these could be pointed in analysed countries: in spite of approved national strategies on MSW management, the situation with MSW was not radically changed (NSC RB, 2017; Sycheva & Asadcheva, 2013; MEP Kz, 2015; SSS U, 2016; NBS RM, 2016).

The weak component of the MSWM system in all countries is the forecasting and planning in the waste sector. As was already noted, the capacity of the recycling plants is underdeveloped. At the same time there is no clear strategy for developing of the recycling capacity due to the lack of the reliable assessment of the waste generation of different types as well as the forecasts of economically feasible recycling and extraction of the secondary raw materials (MHU RB 78, 2014; WMP U, 2004; MNRE RF 298, 2013; NWMS RM, 2013). Approved national strategies, programs and plans include, of course, elements of the forecasting and planning, but they are not detailed (ibid). In analyzed countries there are no established integrated plans of MSWM at the local level. As a result, it could be stated that the MSWM system in analyzed post-soviet countries is not effective.

4. COMPARISONS WITH EU COUNTRIES

The overall score of MSWM system in analyzed post-soviet countries is presented in Fig. 1 (analysed countries are showed by red bars). The results are corresponding with EU countries of the third group with the lowest score – Latvia, Cyprus, Romania, Lithuania, Malta, Bulgaria and Greece.

The analysis of the weakness of the MSWM systems in the EU countries of the third group highlighted the similar problems as in the analysed post-soviet states. The common features of the MSWM systems are (1) weak policy, especially with respect to the ban of the landfilling and reg-

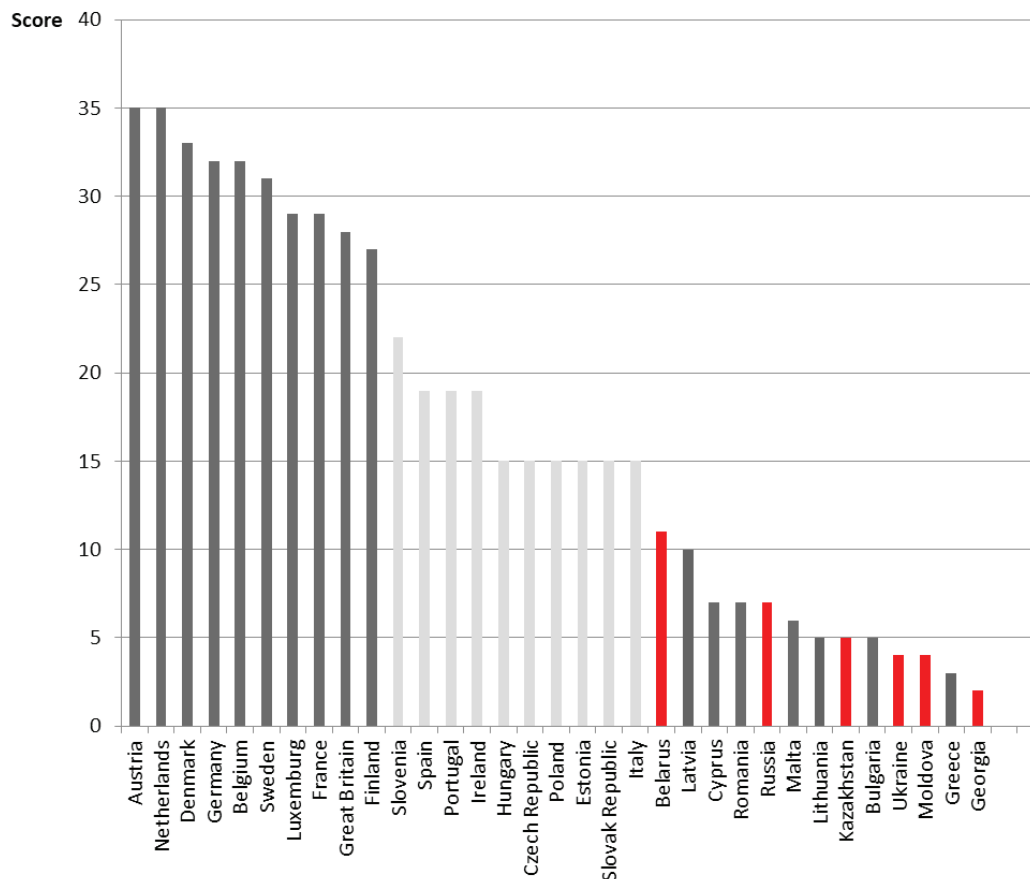


FIGURE 1: Comparative assessment of the municipal solid waste management system in European countries (drawn by authors based on own research (red bars) and BiPRO, 2012).

ulation of the biodegradable waste treatment; (2) the lack of the economic instruments for stimulating the reducing the waste generation and recycling; (3) not 100-% coverage by the formal system of the waste collection and removing; (4) governance gaps and implementation deficits of local waste management plans and programs.

Despite attempts to transfer to waste-to-energy, landfilling is still a problem in Greece (81%) and Latvia (79%), Lithuania and Spain (reaching 55% each), where landfilling is regarded the cheapest option in terms of investment (Malinauskaite et al., 2017) as well as in post-soviet countries. Authors (Malinauskaite et al., 2017) suggest, that if the government introduces a high tax and landfilling fee, it may just be that it is more economically viable to reuse waste in order to produce energy than depositing it in landfills as the example of Estonia proves. It seems, that the increase of the landfilling fee could be one of the solution for the increasing efficiency of waste policy in analysed post-soviet countries. For example, evaluation of the implementation of the landfill tax has shown a correlation between tax rate dynamics and the reduction in amounts of waste disposed in Latvia and Estonia (Klavenieks, Blumberga, 2017). All countries from the first group with the most effective waste policy in EU (dark grey bars with the highest scores in Figure 1) have landfill fee more than 80 €/t (BiPRO, 2012), it looks as one more proof of the efficiency this economic instrument.

The landfill tax is not the only way to reduce waste disposal. As was mentioned in EEA (2007), the most important policy tools used to reduce waste disposal in landfills are landfill ban, separate collection systems of MSW, and deposit refund schemes as well as landfill tax. The second waste policy option for analysed countries is the landfill ban. If we look at the results of BiPRO assessment (BiPRO, 2012), we could find, that the most impressive results of the solid waste policy implementation were achieved in the countries with ban on MSW landfilling (Austria, Netherlands, Germany, Denmark, Belgium, Sweden, Luxembourg) in contrast with results of Latvia, Cyprus, Romania and Greece where there is no the ban on MSW landfilling. It should be mentioned, (based on the example of the Netherlands) not only the tax is essential, but also the availability of technological alternatives (Klavenieks, Blumberga, 2017). If the first group with the highest scores demonstrates "sufficient treatment capacity" (BiPRO, 2012), then the third group of EU countries (as well as post-soviet states) are "highly depending on landfilling, other treatment options are rarely in place" (ibid). Based on the experience of EU countries, we could conclude that the development of the sufficient treatment capacity is a key point for successful implementation of MSW policy.

The main governance gaps and implementation deficits of waste policy in post-soviet and EU countries are political issues (Likhacheva, Skryhan, Shkaruba, 2017; Ma-

linauskaite et al., 2017). While waste management and prevention policies are defined in all countries, a further focus to consider waste as a source is lacking (Malinauskaite et al., 2017). The further improvement of waste policy should be linked to overcoming implementation deficits of the waste policy and articulating the goals of waste management system (for example, choosing the waste-to-energy or recycling strategy) and set up necessary legal, economic and financial tools and instruments.

After post-soviet period some effective tools and instruments of MSW management got lost (for example, treatment of biodegradable waste). Further improving waste policy in analysed countries should focus on the re-establishment of some elements of the soviet waste management system.

Significant disadvantages of the assessed the MSWM system in the post-soviet states are the lack of reliable data on the amount and composition of the waste. The overall score for the post-soviet countries could have higher values, if the relevant statistic data would be available in a comparable form. The changes in the statistic accounting and reporting could be considered as a measure to increase the efficiency of the MSWM system. During post-soviet period the legislation was changed as well as statistic forms and data. These changes were not always successful. For example, in Russia the term "MSW" was included in the definition of the "consumption waste". The result is the lack of statistic data or extremely generalized and insufficient information about MSW. It is even more difficult to find and compile information about recyclables because the statistic data is not separated recyclables from consumption waste and recyclables from production waste (SP RF, 2014). In Ukraine there are two different official sources of information about collected, treated and disposed waste amount: State Statistics Service and Ministry of Regional Development, Construction and Housing and Communal Services. State Statistics Service registers household and similar waste (household and similar wastes - wastes produced in the process of people activity in the inhabited and uninhabited buildings (solid, bulky, repair, liquid, except waste associated with the production activities of enterprises) and that are not used in the place of their accumulation) while Ministry of Regional Development, Construction and Housing and Communal Services accounts municipal solid waste generated in households and entities. Additionally, some data on waste management which can be different from above mentioned are published in regional reports of the Ministry of Ecology and Natural Resources of Ukraine (SSS U, 2016; MRDCH U, 2015). The difficulties in data interpretation can influence on the decision-making process, forecasting of future tendencies etc.

5. CONCLUSIONS

The MSWM systems in post-soviet countries have low efficiency. Their efficiency level is comparable with EU countries of the third group – Latvia, Cyprus, Romania, Lithuania, Malta, Bulgaria and Greece. Essential shortcomings of the MSWM systems in analysed countries are: (1) insufficient legislation and regulation: the lack of the ban

for landfilling, the lack of the regulation of the biodegradable waste, weak system of the forecasting and planning, outdated tariff policy and statistic accounting; (2) undeveloped capacity for recycling and treatment; (3) the lack of the effective economic instruments for the stimulating the recycling and reducing the waste generation.

During post-soviet period in analyzed countries the national strategies or other regulative documents on MSW management were developed and approved, but in general the MSWM system retains the list of soviet features (the service fees, the organization of the waste collection, removing, treatment and technic regulation). A number of effective soviet tools and practices have been lost (the collection system for recyclables, the collection of food waste, awareness raising activities, etc.). The establishment of the institutional instruments in the new social, economic and political conditions has not yet been completed, in consequence the governance gaps and implementation deficits can be observed.

BiPRO approach is based on the EU legislation and its aims, and obviously does not coincide with the objectives and legislation of the post-soviet countries. BiPRO approach is useful for brief screening and compare of MSWM systems in different countries, but it requires a list of quantitative data. Established forms statistical reporting in analysed post-soviet countries as well as open access to data do not allow to estimate correctly the BiPRO criteria. So we can not be sure that the worse situation in the field of MSWM in Georgia, and in Belarus it is much better than that in other analysed countries. The further step for the research will be the development of a methodological approach based on waste policy goals and statistical reporting of post-soviet countries for adequate analysis of MSWM system.

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ANNEX 1: Methodology of the assessment

Methodology was developed under implementation of the project "Support to Member States in improving waste management based on assessment of Member States' performance". The project aims at contributing to the improvement of the waste management practices in Member States in accordance with the principles of EU waste WFD (2008). Results of the assessment were represented in Bi-PRO (2012).

The set of criteria is reflecting the main elements and legal requirements stemming from the Directives in the field of waste management. All criteria were divided into 5 groups. The group 5 "Number of court cases or infringements concerning non-compliance with the EU waste legislation" was excluded from current assessment because analysed post-soviet countries are not a part of EU, that why EU legislation is not obligatory for countries and it is impossible to identify number of infringement procedures and court cases concerning non-compliance with the EU waste legislation. For each from 16 criteria two, one or zero points could be achieved according with the table below. Overall score was received as a sum of all criteria score.

ANNEX 2: Sources for the calculation and the assessment of the criterion

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TABLE: Indicators and its way of the calculation

Indicator	Scoring	Way of calculation / source of data
1. Compliance with the waste management hierarchy reflecting the real situation		
Criterion 1.1 Level of decoupling of municipal waste generation from household final consumption expenditure	Reducing of Waste generation – 2, increasing of consumption is slower, than waste generation – 1, waste generation is equal to increasing of consumption– 0 All 27 MS will be ordered descending (highest decoupling rate first) 9 MS with highest rate: 2 / 9 MS with medium rate: 1 / 9 MS with lowest rate: 0	Calculation according to methodology and decoupling indicator EC (2011). Evolution of (bio-)waste generation/prevention and (bio-) waste prevention indicators, Annex F, chapters 7.4 and 7.14. In order to take into account decreasing driving forces the formula has been adapted as follows: = the decoupling indicator for a time interval of five years from y-5 to y = the slope of the linear regression of the waste generation (environmental pressure) over the last five years EP expressed as an index with y-5 = 100 = the slope of the linear regression of the private consumption expenditure (driving force) over the last five years DF expressed as an index with y-5 = 100 D>0: decoupling D ~0: coupling D<0: reverse decoupling Source: Source: national statistical yearbooks and reports (ANNEX 2)
Criterion 1.2: Existence of own waste prevention programme (WPP) or equivalent existence in WMP or other (environmental) programmes	Does a waste prevention programme exist? Does an equivalent exist in WMP or other (environmental) programmes? YES: 2 / NO: 0	Source: analysis of national normative and regulative documents (ANNEX 2)
Criterion 1.3: Amount of municipal waste recycled (material recycling and other forms of recycling including composting)	How much municipal waste is recycled in a particular year (in %)? >39 % :2, 19-39 %: 1, <19 % : 0 All 27 MS will be ordered descending (highest % of municipal waste recycling first) 9 MS with highest rate (above 39 %): 2 / 9 MS with medium rate (between 19 % and 39 %): 1 / 9 MS with lowest rate (below 19 %): 0. Weighting is applied for the criterion; for overall scoring the received score is doubled.	Source: national statistical yearbooks and reports (ANNEX 2)
Criterion 1.4: Amount of municipal waste recovered (energy recovery)	How much municipal waste is recovered (energy recovery) in a particular year (in %)? >17 % :2, 1-16 %: 1, <0 % : 0 All 27 MS will be ordered descending (highest % of municipal waste recovery first) 9 MS with highest rate (above 17 %): 2 / 9 MS with medium rate (between 1 % and 16 %): 1 / 9 MS with lowest rate (below 1 %): 0	Source: national statistical yearbooks and reports (ANNEX 2)
Criterion 1.5: Amount of municipal waste disposed (deposit onto or into land and incinerated without energy recovery)	How much municipal waste was disposed of (deposit onto or into land and incinerated without energy recovery in a particular year in %)? < 49,5 % :2, 49,5-75 %: 1, >75 % : 0 All 27 MS will be ordered ascending (lowest % of MSW disposal first) 9 MS with lowest rate (below 49.5 %): 2 / 9 MS with medium rate (between 49.5 % and 75 %): 1 / 9 MS with highest rate (below 75 %): 0.	Source: national statistical yearbooks and reports (ANNEX 2)
Criterion 1.6: Development of municipal waste recycling (material recycling and other forms of recycling including composting)	What was the development of recycling of municipal waste during the last three years (in %)? Recycling rate increased min. 5 % or total rate is min. 40 % over the last three years: 2 Recycling rate increased over the last three years, but increasing rate is below 5 %: 1 Rate of recycling is decreasing or zero in last three years: 0	Source: national statistical yearbooks and reports (ANNEX 2)
2. Existence and application of economic instruments to support waste management according to the waste hierarchy		
Criterion 2.1: Existence of nationwide ban/restrictions for the disposal of municipal waste into landfills	Is a ban / are restrictions for the disposal of municipal waste applied? YES: 2 / Restrictions: 1 / NO: 0	Source: analysis of national normative and regulative documents (ANNEX 2)
Criterion 2.2: Total typical charge for the disposal of municipal waste in a landfill	How much is charged for landfilling municipal waste (€/t)? < 35: 0, 36-100: 1, > 100: 2 9 MS with highest rate (more 100 €/t): 2 / 9 MS with medium rate (between 36-100 €/t): 1 / 9 MS with lowest rate (less 35 €/t): 0	Source: analysis of national normative and regulative documents (ANNEX 2)
Criterion 2.3: Existence of pay-as-you-throw (PAYT) systems for municipal waste	Is a PAYT system for municipal waste in place? Yes, covering the whole territory: 2 / Yes, not covering all municipalities: 1 / No: 0 In case no information is available in the consulted reference document, a score of 0 applies.	Source: national statistical yearbooks and reports (ANNEX 2)

Indicator	Scoring	Way of calculation / source of data
3. Existence and quality of an adequate network of treatment facilities and future planning for municipal waste		
Criterion 3.1: Collection coverage for municipal waste	Is information about capacity available? / Does an under capacity exist? Under capacity: No: 2 / Partly 1 / Yes: 0 In case no information is available in the reference documents, a score of 0 applies.	Source: national statistical yearbooks and reports (ANNEX 2)
Criterion 3.2: Available treatment capacity for municipal waste in line with the EU waste legislation (including disposal and incineration)	Is information about capacity available? / Does an under capacity exist? Under capacity: No: 2 / Partly 1 / Yes: 0 In case no information is available in the reference documents, a score of 0 applies.	Source: national statistical yearbooks and reports (ANNEX 2)
Criterion 3.3: Forecast of municipal waste generation and treatment capacity in the WMP	Is under capacity to be expected according to information contained in the WMP? No: 2 / Partly 1 / Yes: 0 In case no information is available in the WMP, a score of 0 applies.	Source: national statistical yearbooks and reports (ANNEX 2)
Criterion 3.4: Existence and quality of projection of municipal waste generation and treatment in the WMP	Is information on the future development of municipal waste generation and treatment in the territory included in the WMP? Yes, in high quality: 2 / Yes: 1 / No: 0	Source: analysis of national normative and regulative documents (ANNEX 2)
Criterion 3.5: Compliance of existing landfills for non-hazardous waste with the Landfill Directive	Which percentage of landfills for non-hazardous waste is compliant with the requirements of the Landfill Directive (in %)? 100 %: 2 / at least 75 %: 1 / below 75 %: 0	Source: national statistical yearbooks and reports (ANNEX 2)
4. Fulfilment of the targets for diversion of biodegradable waste from landfills		
Criterion 4.1: Fulfilment of the targets of the Landfill Directive related to biodegradable municipal waste going to landfills	Is the first target on reducing biodegradable municipal waste disposed of in landfill reduced to at least 75 % fulfilled? Yes: 2 / No: 0	Source: national statistical yearbooks and reports (ANNEX 2)
Criterion 4.2: Rate of biodegradable municipal waste going to landfills	Rate of biodegradable municipal waste going to landfills: less 40 % - 2, 40-75 % - 1, more 75 % or the lack of data - 0	Source: national statistical yearbooks and reports (ANNEX 2)

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