# MUNICIPAL SOLID WASTE MANAGEMENT IN THE CITIES OF BELARUS AND UKRAINE: LOST SOVIET EFFICIENCY AND WEAKNESS OF MODERN GOVERNANCE INSTRUMENTS

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SUMMARY: In order to understand the weakness and strengths of post-soviet municipal solid waste management (MSWM) system the existing MSWM system in Mogilev (Belarus) and Derhachi (Ukraine) were analysed. Municipalities were chosen because of (1) common soviet legacy in the field of the municipal solid waste (MSW) management; (2) different current political and economic situation, especially with regards to EU integration; (3) different waste management policy and administrative procedures. An important starting point for the research was crucial change of the political system and economic conditions in Belarus and Ukraine that resulted in loss of the previous efficiency of basic approaches and official management procedures of the MSW management. At the same time new institutional mechanism and governance instruments are weak and don't provide the effective waste management. The aim of the research was to identify, assess and compare the MSWM system in Mogilev and Derhachi based on UN Habitat approach (Scheinberg et al., 2010). To pursue the research objectives, based on semi-structured interviews, statistic data, internet search, physical components and governance factors of the MSWM system in Mogilev and Derhachi were analysed. MSWM system in Mogilev has strong elements (waste collection coverage, quality of waste collection service, medium level of quality of the environmental protection of the waste treatment and disposal) as well as weak components (financial sustainability, local institutional coherence, provider and user inclusivity). MSWM system in Derhachi has strong elements (medium level of controlled treatment and disposal, medium level of quality of the environmental protection of the waste treatment and disposal). Weak elements of the MSWM system in Derhachi are low recycling rate and low quality of recycling, local institutional coherence, provider and user inclusivity. The comparison of results with other cities (Wilson et al., 2015) showed that efficiency of the MSWM system in Mogilev in general corresponds to medium-income cities, and efficiency in Derhachi is slightly lower than in lower-middle income cities. In all compared cities physical components have higher results of the assessment than governance elements. Particular attention in the further improvement of the MSWM system should be given to involving the population and non-governmental organizations in the decision-making process, raising public awareness and environmental culture, the forecasting, analyzing and developing an integrated waste management strategy at the local level. At the national level it is necessary to

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improve the national system of legislation on the MSW management, to change waste statistic and to implement financial and economic instruments for increasing the efficiency of the MSW management.

## 1.INTRODUCTION

A problem of the municipal solid waste (MSW) management is one of the greatest challenges of the environmental governance over the world. In Belarus, during last 25 years an amount of collected and removed MSW increased from 1 465 to 3 993 thous.tons (Demographic Yearbook, 2016); the waste generation per capita is closing to EU level (about 420 kg per cap. per year); while the main approach of the waste treatment remains a landfilling. The main features of MSWM system in Belarusian cities are (1) separated collection of the MSW at the places of its generation; (2) administrative regulation of the collection and recycling the secondary raw materials, (3) implementation the extended producer responsibility; (4) littering of the urban ecosystems; (5) undeveloped capacity of the recycling plants for electronic and hazardous waste; (6) development of informal and illegal sector of the waste collection and recycling.

In this study we try to analysis the MSWM system based on the UN-Habitat approach in two cities located in countries with transitional economy: Mogilev, Belarusian regional center, and Derhachi, a city in Kharkiv oblast (region), Ukraine. The settlements have different scale, legislative framework, etc. According to this approach the analysis of the MSWM system includes the assessment of physical components as well as the assessment of governance elements. Approach is based on a combination of quantitative and qualitative indicators, and the results are normalized according to a certain scale. The aim of the UN-Habitat approach is to increase the awareness of decision-makers, since the lack of objective information and timely analysis of the situation is the main obstacle in improving the MSWM system.

## 2.DATA AND METHODOLOGY

The methodological approach is a concept of integrated sustainable waste management in cities developed by UN-Habitat (Scheinberg et al., 2010). This concept includes six groups of indicators united into two triads: physical system and governance (Fig. 1). Each group consists of quantitative and qualitative benchmark indicators. The way of their calculation is described in (Wilson, D.C. et al., 2015a). The values of each indicator are divided into five levels (low, low/medium, medium, medium/high and high) and have standard color identification. Indicators have different threshold values depending on the way of the calculation. Qualitative indicators could have next meaning: 0, 5, 10, 15 or 20 points which are then summarized. The basic data for calculation of quantitative indicators is statistic data and analytical reports. The result of the assessment is represented in radar including all groups of the indicators. The assessment according to ISWM framework could help to identify weak components and governance gaps for the improvement of the MSWM system and to assess the performance of the MSW management and recycling system in a city, municipality or group of municipalities. Based on the framework the comparison of the MSWM system in different cities can be made.

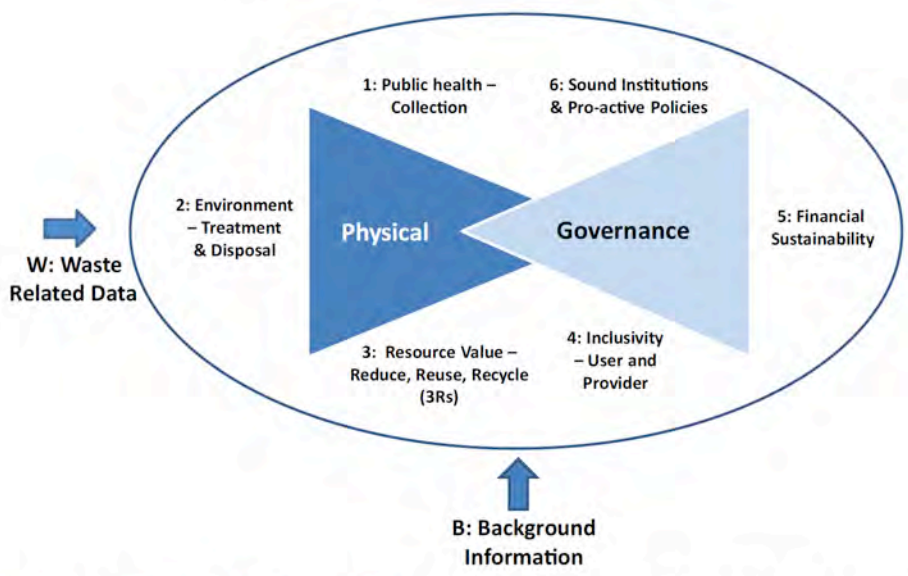


Figure 1 The Integrated Sustainable Waste Management (ISWM) framework used by the Wasteaware indicator set (Wilson et al., 2015)

## 3.ANALYSIS OF THE MUNICIPAL SOLID WASTE MANAGEMENT SYSTEM IN MOGILEV AND DERHACHI

According to the World Bank rating, Belarus refers to countries with up-middle level income, Ukraine has lower-middle income. The estimated waste generation for Mogilev is 181 425,1 t/year, for Derhachi – 5 658 t/year. The assessment of the annual waste generation based on "*normative of the waste generation*" for population and organizations, and additionally includes the separately collected recyclables at the special collecting points. The waste per capita is 484,25 kg/year or 1,33 kg/day in Mogilev and corresponds to the economically developed EU countries. In Derhachi the value is significantly lower and estimated as 288,4 kg/year or 0,79 kg/day per capita. The main waste related data are presented in the table 1.

Table 1. Waste-related data for Mogilev and Derhachi

| | Unit | Mogilev[1] | Derhachi |
|---|---|---|---|
| MSW per capita | kg/year | 484,25 | 288,4 |
| | kg/day | 1,33 | 0,79 |
| Waste composition[1]: | | | |
| Organic | % | 39,6 | 24 |
| Paper | % | 8,4 | 6 |
| Plastics | % | 3,1 | 17 |
| Metals | % | 1,71 | 2 |
| Solid waste density | kg/m$^3$ | 150-287 | 140 |
| Moisture content | | 20-60 | No data |

[1] Data on morphological composition is according Mogilev communal service plant

Results of the assessment of the MSWM system for Mogilev and Derhachi city are represented in the table below.

Table 2. Results of the assessment of the MSWM system in Mogilev

| City | | Mogilev | | | Derhachi | |
|---|---|---|---|---|---|---|
| Country | | Belarus | | | Ukraine | |
| B1 | Country income category | World Bank income category | *Upper middle income* | | *Lower-middle income,* | |
| | | Gross National Income (GNI) per capita | $ 16 840 / capita | | *2660* | |
| B2 | Population | Total population of the city | 374655 | | *19618* | |
| B3 | Waste generation | Total municipal solid waste generation (t/y) | 181425,1 | | 5658 | |
| | | | | | | |
| **No** | **Category** | **Data/ Benchmark Indicator** | **Results** | **Code** | **Results** | **Code** |
| ***Physical Components*** | | | | | | |
| 1 | Public health - Waste collection | 1.1 Waste collection coverage | *100 High* | | *50% Low/Medium* | |
| | | 1.2 Waste captured by the system | *59,69 Medium* | | *50% Medium* | |
| 1C | | Quality of waste collection service | *79,22 Medium / High* | | *33% Low/Medium* | |
| 2 | Environmental control - waste treatment and disposal | Controlled treatment and disposal | *59,69 Low/ Medium* | | *100% High* | |
| 2E | | Quality of environmental protection of waste treatment and disposal | *50,04 Medium* | | *75% Medium/ High* | |
| 3 | Resource Value - 3Rs: Reduce, Reuse, Recycle | Recycling rate | *26,07 Medium* | | 0 % Low | |
| 3R | | Quality of 3Rs - Reduce, reuse, recycle - provision | *37,53 Low/ Medium* | | *13 % Low* | |
| ***Governance Factors*** | | | | | | |
| 4U | Inclusivity | User inclusivity | *54,2 Medium* | | *29% Low/Medium* | |
| 4P | | Provider inclusivity | *29,19 Low/ Medium* | | *50 % Medium* | |
| 5F | Financial sustainability | Financial sustainability | *37,53 Low/ Medium* | | *63 % Medium/High* | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6N | Sound institutions, proactive policies | Adequancy of national solid waste management framework | *50,04 Medium* | | | *42 % Medium* | |
| 6L | | Local institutional coherence | *50,04 Medium* | | | *17 % Low* | |

### 3.1 Public health - waste collection

*Public health - waste collection* includes three indicators, two of them are quantitative, and one - qualitative. *Waste Collection Coverage* – percentage of households in the city that receive a reliable waste collection service. For Mogilev waste collection coverage is 100 %. At the same time the formal system captures only 59,69 % from total amount of generated waste. From total amount of the generated waste were excluded waste treated (composting and burning) by population in private households as well as recyclables in informal sector and illegal dumps. Total amount of self-composting and self-burning was calculated according to (Mihai & Ingrao, 2016). The amount of the illegal dumps and informal sector of recyclables were calculated as a difference between calculated generated waste and collected and landfilled MSW due to the lack of the statistic data and analytical assessment of the illegal dumps.

There is no reliable information about the waste collection coverage and the waste amount captured by the solid waste management and recycling system in Derhachi city. In Derhachivskyi rayon the total percentage of population covered by the waste collection (‘door to door’ system or by deposit into a community container) can be roughly estimated as 55-60 % according to the interview with representatives of Housing and Communal Department of the rayon. ‘Reliable’ waste collection coverage is lower than the assessment of the local authority and is likely to be about 50 % (medium level).

*Quality of waste collection service* was estimated on six criteria: appearance of waste collection points, effectiveness of street cleaning, effectiveness of collection in low income districts, efficiency and effectiveness of waste transport, appropriateness of service planning and monitoring, health safety of collection workers.

The quality of waste collection service was estimated as medium/high in Mogilev. All city area is covered by collection and transportation services, all households have access to these services. Areas for temporary waste storage are cleaned according to the special schedule. In most cases, number of the containers and the frequency of the waste disposal are sufficient to prevent the overfilling of the containers. The waste, usually, is not carried by the wind in the adjoining areas. Sometimes residents observed the overfilling the containers and local communal service plants received complaints about late removal of the waste. The city center is timely cleaning and the waste is removed from streets regulary. All private households according to Belarusian legislation must have an agreement with Mogilev communal service plant about the transportation of the waste. Some of the owners do not have such agreement because they state that organic waste are composted, other waste are burned and recyclables are collected for the follow treatment, so there is no a reason to have agreement with service plant and pay money. Obviously, not all owners completely dispose their waste, some part of the waste goes illegally to the containers near multy-story apartments or thrown up to bushes and ravines. This littering is a source of the illegal dumps which are removed by service plant as soon as they observed.

All MSW generated by residents goes to a sorting station, and then a ballast is compressed and transported to the landfill. All technological operations are carried out with the necessary frequency and with vehicles maintained in proper technical condition. Requirements of the health safety is

monitoring constantly. Nevertheless, the deviations from the established requirements is observed from time to time (often through the fault of the workers themselves).

The MSWM system is planned at the level of the enterprises and organizations. Local authority develops and implements special programs on the recyclables collection. A control of the implementation such programs is carried out by the territorial offices of the Ministry of housing and utilities and Ministry of the environment as well as city administration. It should be noted that in spite of the established procedure for the development, implementation and control MSWM programs, instruments of the forecasting, strategic planning and adaptive management are not applied. Aims and goals as well as quantitative indicators for local MSWM plans come from documents of the national level and do not take into account local specific.

In Derhachi the indicator is estimated at medium level: container sites in the city are not equipped properly, their number is insufficient, some litter can be found along roads, near bins in the suburbs. Informal waste burning is occurred in the backyards. Specially equipped vehicles for the waste transportation have a significant degree of deterioration, number of vehicles are not sufficient for providing qualitative service. There is no detailed specification of the service and effective monitoring system of the collection system. Some protection clothes and equipment can be used by workers, regular health-checks must be provided for drivers.

### 3.2 Environmental control - waste treatment and disposal

*Environmental control - waste treatment and disposal* includes one quantitative and one qualitative indicator. *Controlled treatment and disposal* – percentage of the total MSW destined for treatment or disposal in either a state-of-the-art, engineered facility or a ‘controlled’ treatment or disposal site. In Mogilev the indicator is estimated at 59,6 % because collected waste is sorted and partly primary treated, but not all waste is captured by the MSWM system.

In Derhachi the collected waste is disposed at Derhachivskyi landfill which also stored the waste from Kharkiv and several settlements of Derhachivskyi rayon. The landfill is equipped with pipelines for the leachate collection, weights, etc. The owner of the landfill is Municipal Enterprise "Municipal waste management company" of Kharkiv City Council. Recently a new project of the construction of the modern waste treatment complex at the landfill site is being under implementation. Taking into consideration that Derhachivskyi landfill is equipped with controlling system of the waste disposal; the indicator for Derhachi can be scored as 100 %.

*Quality of environmental protection of waste treatment and disposal* includes the assessment of the following indicators: degree of control over waste reception and general site management; degree of control over waste treatment and disposal; degree of monitoring and verification of environmental controls; efficiency of energy generation and use; degree of technical competence in the planning, management and operation of treatment and disposal, occupational health and safety.

The indicator has “medium” value in Mogilev. Sorting lines and treatment facilities are located on the southern outskirts of the city. The landfill is situated in 28 km from the city. Several asphalted roads with sufficient capacity support the effective waste transportation. Garbage trucks are not a reason of the traffic jams. Landfill is fenced, has a checkpoint where workers control the access to facility. All coming cars must have accompanying documents that are checked and marked. The landfill is equipped with weights, each garbage truck is weighed and visually inspected. The waste at the landfill is pressed for storage, periodically is scattered with soil and fire is monitored. The landfill is not protected from waving by wind and from birds. There are no treatment facilities at the landfill; control of groundwater pollution is minimal. At the sorting lines all technological process are controlled and monitored. At the same time, hazardous waste could be

observed in the waste because such kind of the waste are not collected separately in Belarus. All facilities (landfill, sorting lines, composting line) have necessary permits and documents required by Belarusian legislation. Control of greenhouse gas emissions from the landfill is not carried out. Energy from the waste is not extracted.

Workers of treatment facilities and landfill are qualified but they need to upgrade their skills, to know about the best practices, to participate in seminars and round tables on MSW management. Requirements on occupational health are applied and constantly monitored. There are a lot of technological operations used the manual labor. It means, that contact with hazardous substances and bacteria is possible. The usage of the conveyers, unpleasant smell and low air temperatures in the room aggravate working conditions.

In Derhachi quality of environmental protection of waste treatment and disposal is assessed as medium/high value. Waste transported to the landfill is registered, weighted, compacted with the special equipment, covered with inert material, vehicle tyres are disinfected. Leachate is collected and transported for the treatment. Newly built parts of the landfill comply with the environmental legislation, have conducted an Environmental Impact Assessment (EIA), have permitting documents. Highly qualified specialists is likely to be involved in the work due to the implementation of the project on construction of the waste treatment complex. Safe operating procedures and regular health-checks take place, protection clothes and equipment are used by workers.

### 3.3 Resource Value - 3Rs: Reduce, Reuse, Recycle

*Resource Value - 3Rs: Reduce, Reuse, Recycle* was assessed by one quantitative and one qualitative indicator. Recycling rate for Mogilev is 26,07 % and has medium value. According the official data there is not “official” recycling in Derhachi. The ‘informal’ recycling sector can not be estimated because of the lack of the information. Therefore the value for the indicator is taken as 0 % (low level).

*Quality of 3Rs - Reduce, reuse, recycle* – provision is a composite indicator and was estimated by following criteria: source separation of ‘dry recyclables’; quality of recycled organic; focus on the top levels of the waste hierarchy; integration of the community and/or informal recycling sector (IRS) with the formal solid waste management system; environmental protection in recycling; occupational health and safety. This indicator in Mogilev has medium level. About 1 % of the MSW is collected separately at the places of its generation and about 5 % of the recyclables are extracted from the mixed waste at the sorting lines. Including recyclables collected at the special points, the share of the extracted recyclables is 14-15 % from total amount of the collected MSW. Organic waste is not collected separately at the places of its generation (except for some private households, partly collected food waste for composting or feeding pets). Local residents and informal sector of recyclables are involved into MSWM system minimally. Locals must follow to Belarusian waste legislation, they could pick up recyclables and transported them to special collecting points, could participate in the special cleaning actions (“*subbotnik*”) for collecting littering at the city area, and they could complain and make requests to the local authority.

Governmental policy and implemented measures in the MSWM system are aimed at a maximizing involvement of the recyclables in the economic turnover, the extraction of the secondary raw materials from the waste, the implementation extended producers’ responsibility in regards to package and electronic waste. It should be noted that the list of recycled and collected separately secondary raw materials are quite short, many kinds of raw materials are not collected separately because there are no treatment technologies and recycling plants for them in Belarus.

*Quality of 3Rs - Reduce, reuse, recycle* is astimated at a low level (13 %) in Derhachi. There is

no official separate collection of recyclables in Derhachi. Official recycling the organic materials is not exist, some waste separation could be observed in private houses. The need to focus on higher levels of the waste hierarchy is declared, but almost no practical steps are carried out; applied measures are implemented unsystematically. In the city there is the informal sector of the collection and recycling of the secondary raw materials (individual entrepreneurs, etc.), but the interaction is not systematic. There are difficulties in the accounting and control of the turnover of the MSW and recyclables. The usual practise for the locals is to burn the waste which is strictly prohibited by the Ukraine law. There is no separate collection of hazardous waste, WEEE.

### 3.4 Inclusivity

*Inclusivity* was assessed by two qualitative indicators: user inclusivity and provider inclusivity. *User inclusivity* was estimated by next indicators: equity of service provision; the right to be heard; level of public involvement; public feedback mechanisms; public education & awareness; effectiveness in achieving behavior change. In Mogilev user inclusivity is assessed as medium level. All citizens have equal opportunities to get services on the waste collection, disposal, treatment and landfilling. Belarus is the side of the Aarhus Convention, but often its requirements are met formally and only partially. The level of the public involvement into the MSWM is very low and consists of the participation in the Public board of the Ministry of the environment where strategic documents are discussed. All other stages of the decision making process are not include the public participation. Feedback mechanisms include only the ability to complain or to send request to the local authority or service plants, or Ministries. In Derhachi user inclusivity is estimated as low/medium. Quality of the service may vary depending on the distance from the city center, households types. Ukraine has requirements on the organization of the public debate, public participation in decision-making on issues that have or could have a negative impact on the environment. Usualy social activity of the population in the public hearings are low.

The environmental awareness of the population both in Belarus and Ukraine is relatively low. From one hand, there are established behavior patterns, for example in regards of composting the organic waste at the private households, collection of the metals, papers and glass at the special points. From the other hand, the separated waste collection at the places of its generation is ineffective, because residents use special containers for recyclables to fill up them by mixed waste. The littering of the green city area and suburbs is the next large issue of Mogilev. New behavior models on separate waste collection are gradually being introduced through information campaigns, but their efficiency is not very high.

*Provider inclusivity* was assessed by the following criteria: legal framework; representation of the private sector; role of the ‘informal’ and community sector; the balance of public vs. private sector interests in delivering services; bid processes. Provider inclusivity in Mogilev has low/medium level. Belarus has well-developed waste management legislation. Nevertheless, the confusion in the definitions, the lack of the regulations of some kinds of the waste, the lack of the enforcement instruments are observed. In Belarus the implementation of the extended producer responsibility was started only three years ago, the mechanisms and instruments of the implementation are not well-developed, there are a lot of governance gaps in this field. Private business in the waste sector is almost non-existent. Private-state partnership is not applied in the real life. Informal waste sector is almost ignored by governmental bodies. State institutions look at informal waste sector only from point of view of the offenses and punishment. Public is not involved into decision-making process, local communities do not play any role in the waste management sector. Moreover, local communities are not recognized as powerful actor on the part of the authorities. Thus, we could state that there is no balance of the interests in the MSWM sector, both

between the private and public sectors, and between the public and local authorities. The level of the corruption (in Belarusian understanding of the term) is low. Formally, the playing conditions are equal for everyone, but at the same time, the waste sector in Belarus is not open for all stakeholders and the lobbying for interests is usual practice.

In Derhachi *provider inclusivity* is estimated at medium level (50 %). Regulatory framework in Ukraine is represented by a wide range of documents aimed at the efficient waste management. There are clear rules and guidelines for contracts, but their implementation faces various problems especially at the local level. Target values for the waste management system improvement are not set. The private sector participates in the waste management activities, but interaction with other actors is not coordinated. Informal sector provides its activity without recognition by the city authorities. Public and private sectors are not related to the effective reliable system. Long-term investments are not usual in the field of the waste management. The mechanism of bid processes is clear and transparent, but corruption and lobbying in business in Ukraine is widespread phenomenon.

### 3.5 Financial sustainability

*Financial sustainability* was estimated by next indicators: cost accounting; coverage of the available budget; local cost recovery – from households; affordability of user charges; pricing of disposal; access to capital for investment. The situation in financial sphere in Ukraine and Belarus is quite similar. The cost of the waste landfilling is very low, and does not cover the maintain costs of the landfill as well as environmental protection measures. The low price of the landfilling does not induce to change landfilling to other kind of the waste treatment. Economic instruments aimed to induce the recycling, to decrease or prevent the waste generation are not applied. There is a cross-subsidizing of the services on the waste collection and disposal. The tariff policy is not transparent. The budget money barely covers the necessary current expenses. Investments in the sector are predominantly state-owned and small. The participation of private and foreign companies is insignificant.

In Mogilev the charges from population cover 85 % of the MSWM system costs (Survey..., 2016), the MSW sector is subsidized. Tariffs for the waste collection and disposal are acceptable for the majority of the residents. In the most cases the population pays for the services in a timely manner. The share of non-payers does not exceed a quarter of the population. *Financial sustainability* has low/medium level in Mogilev.

*Financial sustainability* is estimated as medium/high in Derhachi. According to the Ukrainian legislation, the tariff calculation must be approved by local authorities. There is no reliable information about the coverage of the available budget. Tariff on the waste services is more likely covers current operating costs. There is no reliable information about local cost recovery from households, but according to the interviews with experts, the waste collection services do not cover all the population, the percentage of the total number of households is likely to be about 50 %.

### 3.6 Sound institutions, proactive policies

*Sound institutions, proactive policies* includes the assessment of two qualitative indicators: adequancy of national solid waste management framework and local institutional coherence. *Adequancy of national solid waste management framework* has a medium level in Mogilev and Derhachi. It was estimated by the next criteria: legislation and regulations; strategy/policy; guidelines and implementation procedures; national institution responsible for implementing solid waste management policy; regulatory control / enforcement; extended producer responsibility

(EPR) or product stewardship (PS).

As already noted, Belarus has well-developed waste legislation, which, nevertheless, has several of shortcomings. MSW management is regulated by national strategies and programs developed by the Ministry of housing and utilities and the Ministry of the Environment. The programs are not consistent each other. The forecasting and strategic planning are not applied, all programs and strategies based on the previous programs and results of their implementation. Programs do not take into account current conditions and driver forces of the waste sector development. Technical requirements and guidelines for the waste management sector are developed and applied in practice. The main issue of the program implementation is their poor enforcement. The responsibilities for the waste management and control of the MSWM system have several agencies: the Ministry of the housing and utilities, the Ministry of the environment, local authority.

In Ukraine legislative framework is well-developed too, there are numerous laws and rules concerning the waste management, but their implementation is not complete, no target values are setted in the regulations. National Waste Strategy is under development yet. Concept of the waste management program for 2013-2020 was developed and adopted. Several agencies are responsible for MSW management (departments of the Ministry of Housing and Communal Services, and the Ministry of Environment and Natural Resources). There is no effective schemes of the extended producer responsibility or product stewardship in Ukraine. The forecasting and strategic planning are not applied.

*Local institutional coherence* has a medium level in Mogilev and low level in Derhachi and was assessed by the following indicators: organisational structure / coherence; institutional capacity; city-wide solid waste management strategy & plan; availability and quality of solid waste management data; management, control and supervision of service delivery; inter-municipal (or regional) cooperation.

The level of the integration between different Belarusian regions in the waste sector is very high. The organizational structure of the waste sector has already developed at the city level. The communal services enterprises provide a lot of different services to population, the waste collection, disposal and treatment is not the main focus of their activity. It leads to decreasing the efficiency of the MSW management. An integrated waste management plan at the local level is not being developed, the city's goals in MSW management are not setted up and approved. The current statistic data is scattered, does not cover all aspects of the MSWM system. The information is stored in different organizations in incomparable form with use of the different units of the measurement. A lot of data is unavailable or completely absent. The situation in Ukraine is very similar to Belarus, but the inter-municipal cooperation is lower. Quality of the waste-related data is poor, data is an incomplete. There are significant differences in the information at different levels or provided by different agencies.

## 4.DISCUSSION AND CONCLUSION

ISWM framework developed by UN-Habitat was tested in 25 cities; the results for 22 of them were published in (Scheinberg et al., 2010; Wilson et al., 2012; Wilson et al., 2015). The cities from different continents and with different incomes were selected for the assessment. The comparison of the results has highlighted unpredictable and interesting results including the high recycling level in the low-income countries through the informal sector, and significant diversity in the assessment of the governance components even in the high-income countries (Scheinberg et al., 2010; Wilson

et al., 2012).

Fig. 2 depicted a comparative assessment of the MSWM systems in cities with below-middle, above-middle and high incomes. Cities assessed according to the approach (Wilson et al., 2015a) were selected for the comparison. As Fig. 2 shows, the efficiency of the WMSM system in Mogilev generally corresponds to the results of the middle-income cities in other countries. It could be observed that in all analysed countries the physical components of the MSWM system have higher scores in compare with governance components. The requirements of the public health are met at the high level in all cities. The waste collection coverage is 100 % in all cities excluding Lahore and Maputo.



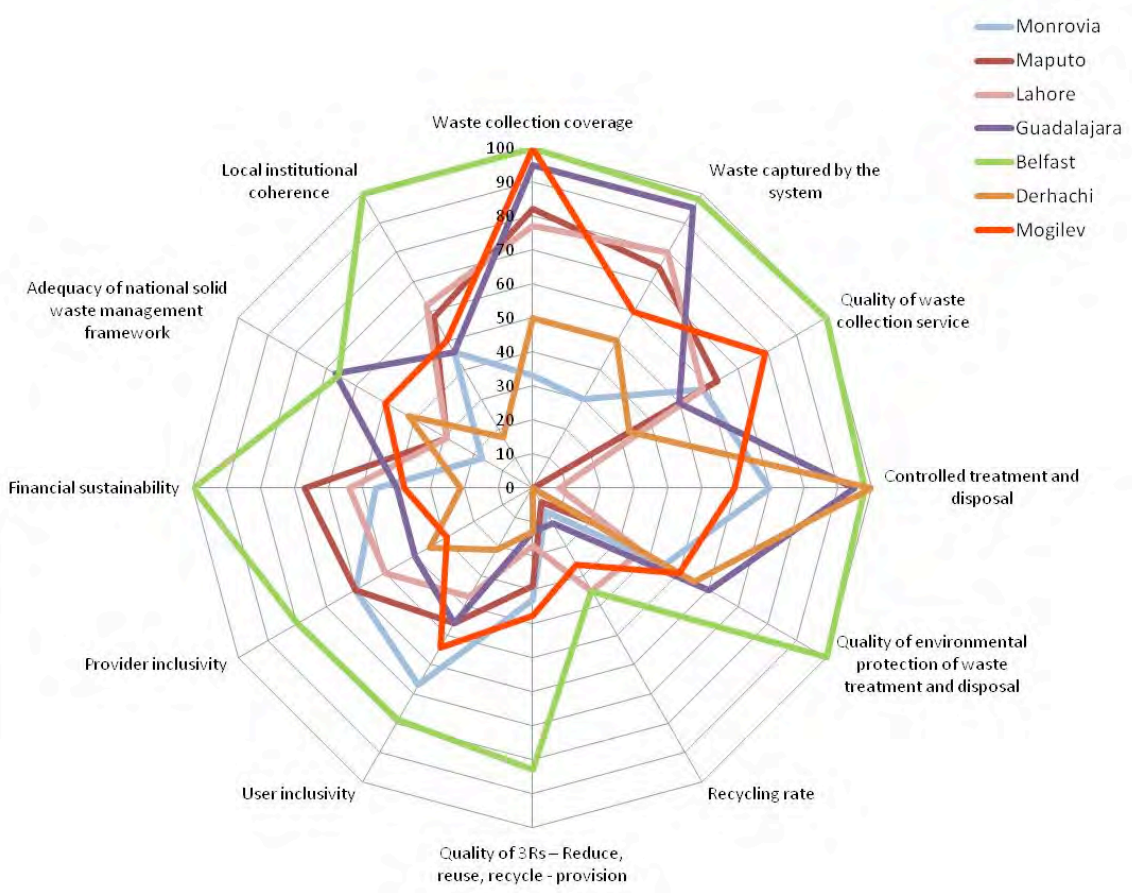


Fig. 2. Comparative assessment of the MSWM system in the cities with different incomes

The share of the waste captured by formal system is the minimal in Monrovia, Drhachi and Mogilev. The result (Mogilev and Derhachi) partly links to the lack of the statistic data on all sources of the waste generation and its amount as well as excluding recyclables from total calculation of the waste generation. Additionally, there are no the assessment of the illegal dumps. Thus, the result of the assessment is not accurate and has lower meaning in compare with other

cities. The quality of waste collection service in Mogilev is higher than in Derhachi, Lahore and Guadaliara, but lower than in Belfast.

Controlled treatment and disposal varies from 8 in Lahore to 100 in Derhachi. Mogilev has a middle level. Quality of environmental protection of waste treatment and disposal varies from 37 in Lahore to 100 in Belfast. Guadaliara, Derhachi and Mogilev have the middle level of this indicator. The waste recycling was selected as a main way of the waste treatment in all analysed cities, but the level of the recycling is relatively low and varies from 0 to 35 points. The quality of the recycling has the best marks in Belfast (83), Lahore and Guadaliara are characterized by the low score (17 and 13 points respectively), Mogilev has a medium level (37,5) and Derhachi has 0 points. In Belarus a policy on the maximizing the involvement of the recyclable into the economic turnover is implementing. As a result, a lot of the waste are collected and recycled, but governance gaps and implementation deficits are decreasing the total level of the recycling.

The assessment of the governance components corresponds to the medium level. Belfast has higher score for almost all indicators. User inclusivity varies from 22 in Derhachi to 79 in Belfast and has middle value in Mogilev (54,2). The low results link to the low environmental awareness of the population, low level of the public involvement in decision-making process. Provider inclusivity varies from 34 in Derhachi to 54 in Lahore, Guadaliara and Mogilev and in general has lower points in compare with the user inclusivity. Relatively low score of the provider inclusivity causes with the underdevelopment of the national legislation or with the lack of the strategic documents or (as in Belarus) with small share of the private business in the waste sector.

Financial sustainability is the weakest indicator for Mogilev and Derhachi. Financial sustainability has a medium score in other cities and varies from 40 to 50 points. The low result in Mogilev and Derhachi links to low tariffs on services of the collection, disposal and landfilling as well as the cross-subsidizing of the population.

Adequacy of national solid waste management framework and local institutional coherence are the other weak point of the waste governance in the cities. These indicators have low values in all analysed cities. The main causes of the low results are inconsistency and contradictions in normative documents, implementation deficits, overlapping of the responsibility of different agencies, the lack of reliable statistical data on the MSWM system.

MSWM system in Mogilev has both strengths (waste collection coverage, quality of service collection service, level and quality of the waste recycling) and weak (financial sustainability, local institutional coherence, user inclusivity and provider inclusivity) sides. MSWM system in Derhachi has strong elements (medium level of controlled treatment and disposal, medium level of quality of the environmental protection of the waste treatment and disposal). Weak elements of the MSWM system in Derhachi are low recycling rate and low quality of recycling, local institutional coherence, provider and user inclusivity. Special focus in the further improvement of the MSWM system should be given to involving the population and non-governmental organizations in the decision-making process, raising public awareness and environmental culture, forecasting, analyzing and developing an integrated waste management strategy at the local level. It is necessary to improve the waste legislation at the national level. The improvement of the local institutional coherence could be linked with the organization of the special national agency concentrated all power and responsibilities in the waste sector, including the collection and recycling of the secondary raw materials. The crucial point of the improvement of the MSWM system is the setting up new statistic reporting documents and the implementation forecasting and strategic planning tools for the calculation of the formal and informal waste sector as well as illegal dumps and recycling.

The implementation of the ISWM framework for the assessment of the MSWM system showed its applicability for the evaluation of cities with different income levels, different institutional systems

and in conditions with the lack of the detailed quantitative data. The lack of the up-to-date and detailed data on the MSWM system is a typical problem for cities in developing countries. In practice, this can become both a barrier to action, and the cause of incorrect assumptions leading to actions in the wrong direction (Wilson D. C. et al., 2015). The results of the assessment can serve as a starting point in the search for ways to improve the MSWM system, and it is also a working tool for monitoring the MSWM system, which allows to observe progress success of the implementation of the integrated MSW management plan.

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