NALAS

Network of Associations
of Local Authorities
of South-East Europe

Good Practices

of Waste Quantity and Morphology Determination in the Region of South East Europe

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Implemented by:

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Network of Associations
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CONTENT

1. INTRODUCTION

The Project **Solid Waste Data Collection in South East Europe** started in 2014 and has been implemented by three partner networks: NALAS, SeSWA and Aquasan in 16 pilot municipalities, in four project countries – Macedonia, Serbia, Bosnia and Herzegovina and Montenegro. The Project is financially supported by the German Federal Ministry for Economic Cooperation and Development (BMZ) and Swiss Embassy through its Open Regional Fund for Modernization of Municipal Services (ORF MMS).

Municipal public utility companies providing the services of collection, treatment and disposal of communal waste in the countries of South East Europe most often do not possess reliable and accurate data on the quantity and composition of communal waste. The poor quality of available information prevents utilities to adequately plan their activities, accurately assess their investment needs and report properly to municipalities and competent national institutions. Besides that, the availability of information on services offered by these utilities is also reduced. All this leads to insufficiently effective service provision and insufficiently effective planning in the sector of waste management. Poor quality of data on communal waste represents a challenge for public utility companies providing services in this sector, municipalities responsible for the waste management sector, as well as institutions relevant for development of legal and planning framework in the sector of waste management and implementation of monitoring at the national level.

Thus, the overall project objective is to enable public utility companies and municipalities in SEE to build up better data on the communal waste collected and processed. In close cooperation with solid waste management associations and competent national environmental protection institutions/agencies, project partners tested the methodology for determining the quantity and composition of communal waste in selected pilot municipalities and public utility companies.

Within the Project, an **Exchange and Dissemination Platform** on solid waste data collection will be established. The purpose of the Platform is to strengthen the capacity of pilot municipalities in solid waste data collection through exchange of experience and benchmarking.

One of the activities in this regard was the collection of modern and distinctive good practices in solid waste data collection for waste quantity and morphology determination in the region of SEE. The aim of good practices collection is to capitalize the experience and knowledge, in order to contribute to the improvement of local governments and public utilities' performance in the area of solid waste management.

Information on good practices was collected by NALAS Secretariat through its network of LGAs and particularly, the Task Force Members. The List of countries and cities on which examples of good practices are collected is given in Table 1.

Table 1. Good practices collected from SEE countries

Country	Number of good practices collected	Municipalities covered
Albania	1	**Shkoder region:** Municipalities of Shkoder and Vau Dejes, Communes of Bushat, Dajc, Hajmel, Rrethina, Velipoje. **Region of Lezha:** Municipality of Lezhe, Communes of Balldre, Blinisht, Dajc, Shengjin, Shenkoll, Fushe-Kuqe, Milot.
Bosnia and Herzegovina	1	**Zenica region:** Municipalities of Zenica, Travnik, Nova Bila, Visoko, Žepče and Busovača
Bulgaria	1	53 municipalities
Macedonia	1	**Kumanovo region:** Municipalities of Kumanovo, Lipkovo, Kratovo, Rankovce, Kriva Palanka
Moldova	1	District of Soldanesti and Rezina that consists of 26 rural administrative units (municipalities/communes)
Montenegro	1	Municipality of Bar
Serbia	3	Municipalities of Aleksandrovac, Bajina Bašta, and Svilajnac
Turkey	1	Kocaeli Metropolitan City

2. DATA COLLECTION METHODOLOGY

Based on the information provided, the most frequently used methodology for analysis of solid waste is the SWA-Tool methodology developed in 2004 within the 5th Framework Program Project **SWA-Tool: Development of a Methodological Tool to Enhance the Precision & Comparability of Solid Waste Analysis Data.** The methodology is widely used in the EU.

Of the 7 countries that submitted their case studies, only Serbia and Turkey legally prescribed their sampling methodology based on the SWA-Tool, while other countries did not regulate this matter. In the countries where the methodology is not legally prescribed, some modifications and differences in the methodological approach were observed, such as the sampling location, sample size, selection of waste types to be analyzed, equipment used (e.g. the grid opening on metal sieves), number of samplings per year, etc.

Sampling locations vary from disposal site to curbside sample collection where distinction is made between urban and rural zones; primarily with households or commercial waste generators or based on household income. Sample sizes range from 150 to 500 kg.

The selection of waste categories to be recorded was made in line with the categories proposed in the European Waste Catalogue mainly transposed in the national legislation across the region. However, the number of waste categories analyzed in 10 case studies varies from 7 in Albania and Montenegro to 20 in Macedonia.

The equipment used is standardized and includes electronic scales, waste bins, grids, wheelbarrows, and accessory tools (shovels, nylon, scissors, knives for cutting bags, etc.). The only difference is in the number of grids used and grid opening sizes.

3. USING IT SYSTEMS FOR DATA COLLECTION

The data collected were mainly recorded using simple spreadsheets created by MS Office programs Word or Excel.

Only in the cases of Serbia and Bulgaria, software solutions were used to store and process data for different purposes such as reporting.

Serbian cases used the data obtained through sampling and measurement campaigns to test the functionality of Municipal Solid Waste Information System—SWISS developed by NALAS. It was concluded that SWISS Model was not up to the current legal standards and that it had to be upgraded in order to overcome technical problems and be in line with the current practice and legal framework in Serbia.

The Bulgarian case presented the use of the Waste Management Information System DepoInfo developed by the Bulgarian Association of Municipal Environmental Experts – BAMEE. Originally, DepoInfo was designed to serve regional waste management systems (regional landfills) but in 2009, it was expanded to satisfy the need of the packaging waste collection system.

4. CONSTRAINTS

Most of the cases reported that the main challenges in terms of data collection and analysis were related to public companies' insufficient capacities related to several aspects:

- development of a sampling protocol based on EU standards that is applicable to local conditions,
- lack of knowledge to implement the protocol,
- inability to provide adequate working conditions on harsh weather days,
- lack of finances to implement a sampling campaign.

These challenges were overcome in most of the cases by engaging consultants who developed the protocol and performed the first analysis together with the company staff. In Serbia, the methodology is prescribed by law, but companies prefer to hire consultants.

Related to lack of finances, in most of the cases, sampling campaigns were initiated and financed by the donor community. Only in 3 cases, public utility companies financed the activities from their own budgets.

Another aspect reported as a constraint is related to outside factors that do not support and force utility companies to perform regular analysis of waste quantity and morphology. The reason why utilities do not perform regular analyses is also the poor enforcement of the "polluter pays" principle and penalties system, as well as insufficient cost recovery, which makes any investment in a solid waste system impossible.

The Bulgarian case also reported that municipalities have difficulties to accept and enforce the existing waste management information system due to their lack of knowledge, human and technical capacities.

The Macedonian case also reported that no inter-sectoral collaboration and cooperation between the central and local governments in terms of data presentation and accessibility exists, although it is required that such a system be operational and used for benchmarking.

5. LESSONS LEARNED

The key lesson learned reported in most cases was related to understanding the importance of having exact, reliable, and regular up-to-date data on solid waste that directly impact the economic performance of the company as well as its annual budgeting activities. It helped in understanding the potential and opportunities to maximize business performance and reduce costs.

The information obtained was used to determine for example, the landfill disposal fee, make decisions about the waste management system at the regional level, decide on the establishment of a recycling plant, and make other business related decisions.

What would certainly make the decision-making easier is a good database for data storage and processing that would enable reporting based on different criteria (per type of waste, per season, per year, etc.) and improve the process of sustainable waste management planning and its implementation.

On the other hand, reliable data can be used by local governments to initiate a proactive approach to waste management in all communities that dispose waste at regional landfills. For this to happen, local governments should be well acquainted with the benefits of the system and opportunities it provides. They have to envisage the whole picture of waste management operations – planning, implementation, modification, control, reporting, and communication.

In order for data collection to become part of a regular practice, strong and constant political support imbedded in local decisions and documents is needed. Application of simple methods is welcomed as an opener of the process, while it is strongly recommended to regulate the methodology at the national level.

For any further implementation of decisions made, broad public support should be ensured through organized public campaigns, for example.

6. CONCLUSIONS

This activity of collecting case studies has shown that countries in the SEE region have experience in the implementation of the SWA Tool and its modified versions for the purpose of determining the quantity and morphology of municipal solid waste. However, data collection is not part of regular practice and is usually initiated by donors in the framework of some projects.

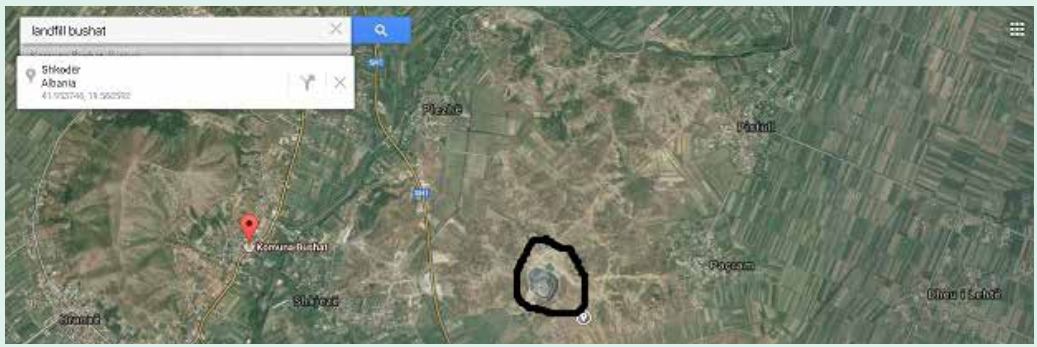
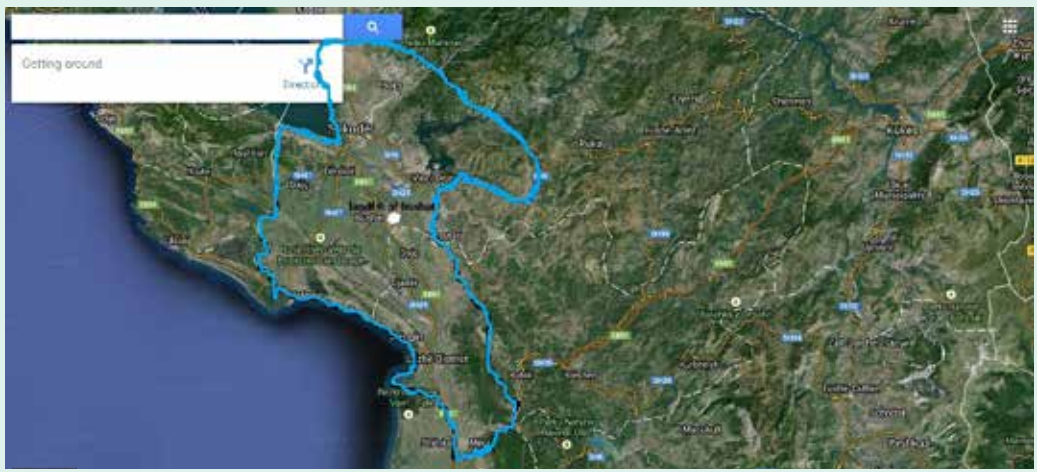
Practical examples prove that exact and reliable data on waste quantity and morphology are indispensable in better waste management planning at both local and regional levels, especially in terms of assessing the potential for waste recycling. Proper information can help LGs to bring adequate decisions about steps to be taken toward the introduction of a separate collection system. Economic and environmental benefits are also present where, if proved to be feasible, diverting the waste from landfills reduces operational costs related to transport and disposal, and saves precious space at existing landfills, thus avoiding generation of biogas and leachate that cause negative environmental impacts.

The SWA Tool and its modified versions can be easily replicated in other LGs and waste management utilities with the precondition of training company staff who will continue to perform analyses. Knowledgeable and motivated staff needs to be available in order to ensure implementation sustainability. Another important factor is the availability of equipment and a solid waste information system that will enable the appropriate analysis and calculation of indicators to be used for benchmarking and decision-making purposes.

ALBANIA-Landfill of Bushat- Environment Impact and Waste Composition

7.

1) General Information on Good Practices

Title of the Good Practice	Landfill of Bushat- Environment Impact and Waste Composition
Location/ Geographical Coverage	Regional Landfill of Bushat, Bushat, Region of Shkodra, Albania  Geographical Coverage of the Landfill 

Implementing Institution/ Organization	Commune of Bushat
Contact Person	
Publication Date	February 2015
Author(s)	Albanian Association of Communes

2) Good Practice Specific Information

Period of Implementation	**Waste Composition Analysis: Autumn, 2014**
Introduction	Bushat Commune is located in North Albania and is part of the Shkodra Region. It has an area of 100 square km, with 6,000 ha of agricultural land. It has 14 villages, and a population of 25,000 inhabitants. There are 350 businesses operating in this area with the most important Ashta Hydropower Plant. The regional landfill of Bushat has a capacity of 1 million m^3, and it was built to serve two regions in the north of Albania, Shkodra and Lezha. The population of these two regions benefiting from the landfill is 200,000 inhabitants. The duration of this landfill is calculated to reach 20 years. The construction of the landfill became a necessity for the Commune of Bushat, but especially for the Municipality of Shkoder and other surrounding LGUs. Therefore, cooperation between these LGUs was important. Discussions with the community were conducted to decide on the best possible location for the landfill. 10 spots were considered as possible options for its location and after a lot of meetings and discussions, it was concluded that the current place where the landfill was build was the most suitable. It should be emphasized that it is the first landfill in Albania that fulfills all the environmental criteria regarding the legislation of Albania. For selecting the spot where the landfill would be built, the following factors were considered: ◢ Geological composition, ◢ Distance from the places the landfill will serve, ◢ Distance from national roads, housing etc. Prior Memoranda of Understanding and Individual Contracts were signed with the LGUs from the two regions that would make use of the landfill. The same procedure included the businesses operating in the area. For the calculation of the amount of waste, the landfill management referred to the National Plan of Solid Waste Management. Also, in collaboration with CO-PLAN, we undertook a study on waste production per inhabitant in the Commune of Bushat and composition of waste with the aim at waste management planning in the Commune of Bushat to be entirely accurate. Meanwhile, we are involved in a project with JICA, an organization from Japan in the field of environment.

Statistical Information	**The area of the Municipality involved in SW data collection in km² is:** ◢ **Region of Shkoder:** Municipality of Shkoder– 16.45, Municipality of Vau Dejes– 98.5, Commune of Bushat– 100, Commune of Dajc–31, Commune of Hajmel–30.6, Commune of Rrethina–47, Commune of Velipoje–72.4. ◢ **Region of Lezha:** Municipality of Lezhe– 5.5, Commune of Balldre– 91.2, Commune of Blinisht– 38.1, Commune of Dajc– 35.2, Commune of Shengjin–53.4, Commune of Shenkoll–32.4, Commune of Fushe-Kuqe–62.6, Commune of Milot–111.7. ◢ **The total area is 711.1 km².** Number of inhabitants: ◢ **Region of Shkoder:** Municipality of Shkoder–113,350; Municipality of Vau Dejes–12,312; Commune of Bushat – 25,000; Commune of Dajc – 8,710; Commune of Hajmel – 6,300; Commune of Rrethina–23,418; Commune of Velipoje – 8,718. ◢ **Region of Lezha:** Municipality of Lezhe – 29,214; Commune of Balldre – 10,918; Commune of Blinisht – 5,732; Commune of Dajc – 7,096; Commune of Shengjin – 11,497; Commune of Shenkoll – 15,068; Commune of Fushe-Kuqe – 8,797; Commune of Milot – 3,063. ◢ **The total population is 163,531 inhabitants.** Number of households: ◢ **Region of Shkoder:** Municipality of Shkoder – 35,883; Municipality of Vau Dejes – 1,798; Commune of Bushat – 6,200; Commune of Dajc – 2,154; Commune of Hajmel – 1,628; Commune of Rrethina – 5,668; Commune of Velipoje – 2,185. ◢ **Region of Lezha:** Municipality of Lezhe – 8,397; Commune of Balldre – 2,196; Commune of Blinisht – 1,384; Commune of Dajc – 1,817; Commune of Shengjin – 3,050; Commune of Shenkoll – 2,907; Commune of Fushe-Kuqe – 2,141; Commune of Milot – 3,063. ◢ **The total number is 42.790 households.** **Percentage of coverage** with services related to solid waste management: In the Region of Shkodra, municipalities and communes mentioned above account for 90%, whereas in the Region of Lezhe, municipalities and communes mentioned above account for 80%. ◢ Number of vehicles (trucks, tractors etc.) ◢ Collection system employed? ◢ Number of metal/plastic containers (capacity in liters/m3) ◢ Number of household plastic bins (capacity in liters/m3) ◢ Type of waste collection (door-to-door; curb collection; common street containers…) ◢ Frequency of collection ◢ Number of recycling bins? Green Islands? ◢ Use of collection bags? The data above are not relevant about landfill performance as those are under the responsibility of individual communes and municipalities.
Stakeholders and Partners	The main stakeholder was the community of Bushat, protecting the environment especially after the start of landfill operation, since before this, waste was thrown out in the streets, in the river etc. and nowadays, all the waste is collected in the landfill. Other stakeholders in the Good Practice are the Local Government Units of Lezha and Shkodra and businesses that are part of these two Regions. For the management of the landfill, the Commune of Bushat has set up a public enterprise. In addition, regarding the issue of waste management, we have collaborated with different partners such as: COSPE, USAID, DLDP, IPA Adriatic, JICA etc., where their assistance has served to improve the management and also train landfill staff. We had occasional assistance from the Environment Ministry and Region of Shkodra.

Methodology

Solid waste generated by households, businesses and road cleaning for which municipalities and communes are responsible are subject of this study. Other types of waste such as construction waste, industrial, agricultural and livestock waste or other hazardous wastes that are not considered urban waste under the "Albanian Waste Catalogue" are not considered in the study.
Waste studied was collected for a period of one month, from the two sources of its generation, i.e. households and businesses.
The waste composition analysis was applied in accordance with the European Commission's "SWA-Tool" methodology and based on the instructions and additional literature developed for this process, such as:

- European Commission—Development of a Methodological Tool to Enhance the Precision & Comparability of Solid Waste Analysis Data,
- European Standard EN 14899—"Characterization of Waste—Sampling of materials—Framework for the preparation and application of a Sampling Plan".

Literature proposes two methods of sampling: the first one is taking into consideration the volume of the container and providing information not only on the composition of waste but also its quantity (volumetric weight), and the second is the method taken directly from truck waste collection, where from the entire weight of waste, only a representative sample is taken. The latter method generates data only on waste composition.

Factors

As expected, municipalities and communes from the districts of Shkodra and Lezha, show similar characteristics in terms of waste generation per inhabitant and composition of waste generated, but differences may be expected in terms of the economic development level, nature and development of agriculture and livestock in the region or the extent and nature of local business activities. Other factors can be the season, climate, population density, local (religious) holidays, population movement and tourism, the analysis of which is not subject of this study.
A very important factor expected to influence the composition and rate of generation is also the topological characteristics of Local Units, such as: rural areas, partially rural and urban or purely urban areas. Although municipalities show similar characteristics, there are differences related to the degree of their urbanization. This factor is expected to be analyzed by considering the different characteristics of municipalities in the study.
Based on the type of information required for representative municipalities and the volume of waste studied, the waste taken directly when the waste truck unloads at the landfill was taken for analysis. In both cases, complete information about waste composition, volumetric weight and waste production units for each category (households or businesses) was obtained.
The process of waste separation and weighing was done strictly in accordance with the "SWA-Tool" methodology, following the procedures, tools and rules.

Equipment used for this process consisted of:

- 3 metal grids size 40mm and 10mm;
- Electronic scales with a capacity of up to 300kg;
- 12 plastic bins with a capacity of 100 liters;
- A large plastic garbage container with about 300-350 liter capacity; and
- Working tools such as plastic trays, work gloves, masks, shovels and brooms, etc.

Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS

For collecting data on solid waste deposited at the Landfill of Bushat, the excel spreadsheet was used. Obviously, the system has its strengths and weaknesses.

The strengths are:

- It is based on sampling in theory known as aforesaid.
- The method used in this study comes very close to reality as the residues are taken directly at the source.

The weaknesses are:

- The measurements were done for one month, September. It might have been better to do the measurements in two different periods of the year, because the waste produced in summer varies in amount and composition compared to the waste produced in winter.

Waste Analysis

Waste composition analysis done in the period from 1 September 2014 to 31 September 2014

(Categories)	Kg	%
Organics	1,835,873	97.81
Plastic bags	21,205	1.13
Hard plastic	2,096	0.11
Glass	550	0.03
Metals	3,357	0.18
Metals- aluminum cans	1,151	0.06
PET bottles	12,768	0.68
Total	1,877,000	100

The result of this study shows that the highest percentage of urban waste composition is organic waste. As seen from the table, urban waste deposited in landfills also contains waste that can be re-used. This has led to the rise in waste selection lines of Bushat Landfill with the intention that these scraps should be recycled and also that the level of waste deposited in landfills should be as low as possible, in order to increase landfil life. It has brought its benefits to the environment, as well as in monetary terms.

Innovation and Success Factors

The practice to examine the quantity and composition of waste deposited at the Landfill of Bushat has resulted in better waste management due to the income generated from trading in recyclable materials, and also has led to the selection line increased capacity. This has directly lessened the negative impact on the environment and reduced waste deposit in the landfill.

Constraints

Landfill's staff in collaboration with COSPE and COOPLAN overcame the main challenge of sampling based on EU standards. This challenge was successfully resolved through the cooperation with these organizations, as they also trained landfill's staff to adopt a practice of continuous sampling.

Sustainability

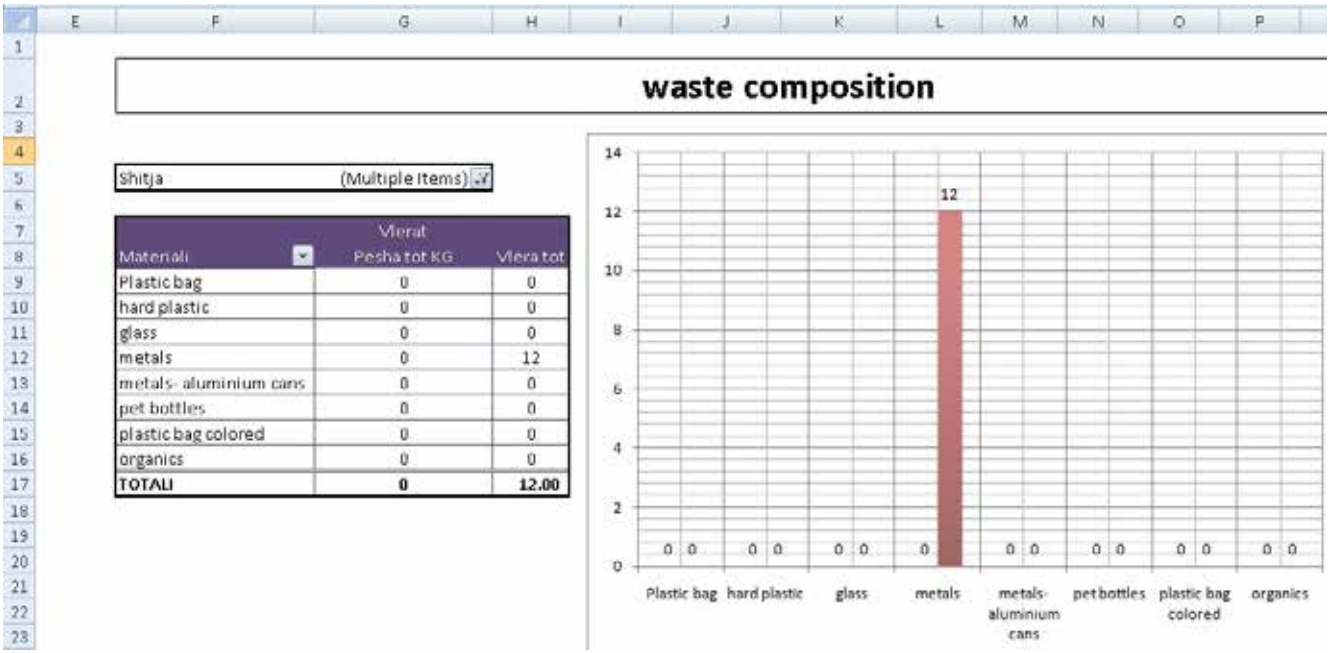
With the aim to make the service sustainable, we must match costs with fees, which in other words would mean increasing the rates for this service.

Impact	Acceptance to have a landfill constructed in the municipality necessarily leads to problems because waste is deposited and the costs of these problems (no matter how small they are) burden the people around this landfill. However, once these problems are solved, the impact on environmental protection is positive. We achieved: ◢ Cleaner and more cultivated environment. ◢ Better management of drainage and irrigation by not blocking them with debris. ◢ The best presentation of environment for tourism ◢ We are in harmony with EU directives.
Gender Aspect	To meet the expectations we had, we coordinated our work with different interest groups. We have collaborated with various associations, the education, healthcare, business, etc. As women and girls are more interested and more aware, in our meetings, women prevailed as participants. We also had the help of some gender associations and the Municipality of Shkodra.
Lessons Learned	A significant factor for this to be a successful practice is the community partnership. For example, in 2014, we made a visit to the city of Korca and among other things, something that impressed us was that the streets in front of buildings were not cleaned by the Municipality but by the residents. We are concerned about littering the bins. Liiter is often thrown on the ground, which means that we should work again on residents' awareness. The problem of waste and its management is a priority for us.
Replicability	This practice in the Commune of Bushat managed to achieve: ◢ organized cleaning service ◢ transportation of waste and adequate tools (a compactor machine, a washing machine and road sweepers) ◢ an organized collection system and its tariff The replicability of such experience would require significant investments and community involvement, but it could be considered for a better regional waste management.

Recording incoming waste at the Landfill of Bushat (excel sheet)

	A	B	C	D	E	F	G	H	I	J	K
1	No	incoming from	Month	Date	time	name of the driver	license plate	gross weight kg	Tara kg	net weight Kg	weighing
2		B. SHKODER	JANAR	1	2.44			26,180.00	15,140.00	11,040.00	
3		B. LEZHE						-	-	0.00	
4		K. FUSHE KUQE						-	-	0.00	
5		K. SHENKOLL						-	-	0.00	
6		K. DAJC						-	-	0.00	
7		K. DAJC						-	-	0.00	
8		K. BALLDREN						-	-	0.00	
9		B. VAU I DEJES						-	-	0.00	
10		MILOT						-	-	0.00	
11		K. BUSHAT						-	-	0.00	
12		K. KALLMET						-	-	0.00	
13		K. POSRIBE						-	-	0.00	
14		K. SHENGJIN						-	-	0.00	

Recording waste composition data (excel sheet)



waste composition

Shitja	(Multiple Items)

Materiali	Vlerat Pesha tot KG	Vlera tot
Plastic bag	0	0
hard plastic	0	0
glass	0	0
metals	0	12
metals- aluminium cans	0	0
pet bottles	0	0
plastic bag colored	0	0
organics	0	0
TOTALI	**0**	**12.00**

8. BOSNIA AND HERZEGOVINA- Waste Composition Analysis at Mošćanica Regional Landfill in Zenica

1) Good Practice General Information

Title of the Good Practice	Waste Composition Analysis at the Regional Landfill of Mošćanica in Zenica (Bosnia and Herzegovina)
Location/ Geographical Coverage	Regional Landfill of Mošćanica in Zenica, Federation B&H, B&H
Implementing Institution/ Organization	Regionalna deponija Mošćanica d.o.o. Zenica
Contact Person	Emir Zukić, Director Mošćanica bb., 72000 Zenica, B&H Phone: 00 387 32 446 360 Fax: 00 387 32 446 634
Publication Date	January, 2015
Author(s)	Irem Silajdžić

2) Good Practice Specific Information

Period of Implementation	**Autumn waste composition analysis: 27 September 2010 – 13 October 2010** **Spring waste composition analysis: 24 March 2010 – 4 April 2011**
Introduction	Mošćanica Regional Landfill has been in operation since June 2008. Waste is received from 5 municipalities: Zenica, Travnik, Nova Bila, Visoko, Žepče and Busovača. These municipalities have incomplete and unreliable data on the composition of municipal waste, so the composition of waste received in Mošćanica is unknown. According to the Law on Waste (Official Gazette 33/03, 72/09) and accompanying bylaws, landfill operators are obliged to obtain an operator license and accordingly report to the Ministry about waste quantities and waste composition they manage/dispose. Determination of waste morphological composition is performed in order to obtain specific information about municipal waste from municipalities that gravitate to the location of Mošćanica Regional Landfill. The first sampling campaign was done in the autumn of 2010 and spring of 2011. Since then, both spring and autumn sampling campaigns have been performed each year on a regular basis. Obtained data are used for planning and setting long-term waste management techniques at both municipal and regional levels. The results presented in this case study are related to the first waste sampling campaign done in 2010-2011.
Statistical Information	◢ Area of municipalities involved in SW data collection at the time of project implementation in km2: Zenica – 558.5 km2, Travnik including Nova Bila – 529 km^2, Visoko – 230.8 km^2, Žepče – 281 km^2 and Busovača – 158 km^2 ◢ Number of inhabitants: Zenica – 115,134; Travnik including Nova Bila – 57,543; Visoko – 41,352; Žepče – 31,582; and Busovača – 18,488 ◢ Number of households: Zenica – 38,784; Travnik including Nova Bila – 16,641; Visoko – 12,953; Žepče – 8,901; and Busovača – 5,657 ◢ Percentage of coverage with services related to solid waste management at the time of project implementation: Zenica – 53%, Travnik including Nova Bila – 45%, Visoko – 50%, Žepče – 25% and Busovača – 35% ◢ Amount of waste collected and disposed at Mošćanica Regional Landfill in 2010: ◢ Zenica – 20,873.63 t; Visoko – 7,463.86 t; Travnik – 6,075.32 t; Žepče – 613.92 t; Busovača – 1,194.24 t ◢ Amount of waste collected and disposed at Mošćanica Regional Landfill in 2011: ◢ Zenica – 22,906.86 t; Visoko – 7,282.21 t; Travnik – 5,935.66 t; Žepče – 560.73 t; Busovača – 1,081.44 t ◢ Collection system employed: door-to-door collection and curb collection ◢ Number of vehicles (trucks, tractors etc.): Not relevant (due to the fact that the Good Practice is related to a Regional Landfill) ◢ Number of metal/plastic containers (capacity in liters/m3): Not relevant ◢ Number of household plastic bins (capacity in liters/m3): Not relevant ◢ Frequency of collection: Not relevant ◢ Number of recycling bins? Green Islands? Not relevant ◢ Use of collection bags? Not relevant
Stakeholders and Partners	The beneficiary of the Good Practice, and at the same time, the user of the results is Regionalna deponija Mošćanica d.o.o. Zenica. The end users are also 5 LGs and their communal utilities whose waste is disposed at the regional landfill. The Good Practice was implemented with the assistance of the consulting company Enova d.o.o. Sarajevo which developed the methodology and trained Regionalna deponija Mošćanica d.o.o. Zenica's staff.

Methodology	The methodology for determining the quantity and morphology of solid waste was based on the existing standards of the waste classification ASTM standard for determining the composition of unprocessed municipal solid waste—U.S. standard and SWA Tool and the European standard for the characterization of municipal solid waste—the European Commission. This methodology is not legally prescribed. **Selection of waste categories to be recorded** was made in line with the categories proposed in the European Waste Catalogue and also transposed in the national legislation. The categories selected were: organic waste— garden waste, organic waste— other biodegradable wastes, paper, glass, cardboard, composite materials— cardboard with aluminum, metal— and other packaging, metal— aluminum cans, PET bottles, plastic bags, hard plastics, textiles, leather, diapers, fine elements (sieved residue), construction waste. **Estimation of conditions (economic and social)** which affect composition and quantity of waste. This process gives a better insight into the applicability of the proposed sampling method and helps in understanding the results obtained. This stage is concerned with the provision of necessary background information on: (i) general description of the area under investigation, (ii) general population information including number of inhabitants, number of households, income (such as GNP per capita) and types and proportions of residential structures, and (iii) waste management information including: ◢ General description of the waste management system organization (actors, responsibilities etc.) ◢ Type of waste streams produced and collected, especially mixed residual household waste and co-collected household and commercial waste ◢ Description of waste container systems in use such as household bins, communal bins and bin storage capacities ◢ Average numbers of households and/or persons using bins ◢ Total bin volume; spatial distribution of bins; collection intervals ◢ Method of waste collection such as open truck or refuse collection vehicles, compactor and types of waste collected ◢ Description of collection rounds ◢ Weighing the data of collection vehicles ◢ Disposal methods such as landfilling, energy from waste, reuse/recycling and types of waste and quantities involved. In case of regional landfills, this information should be provided on all municipalities that dispose their waste at the regional landfill. **Establishment of a materials sorting protocol.** The protocol contains all the elements of sampling and material sorting. Key aspects of the protocol include dependence of waste composition on the time of the season, waste generators, method and frequency of sampling (defined so that a sufficient number of representative samples for a given period of observation exist). **Sampling, registration of data and measurements** were carried out by measuring the amount of waste deposited at the landfill in a period of seven days, and by determining the morphological composition of waste. Measurement of the amount of waste is done by measuring the gross weight of each truck that comes to the landfill (when the truck has a full capacity) and the tare weight of each truck on its way out, after the truck unloads its waste. Truck measurements are performed on a scale located at the landfill entrance. Before the start of the sampling procedure, it was required to provide favorable conditions at the location of the landfill. The location for performing waste analysis and sorting was covered and protected from adverse external conditions (rain, wind) and large enough to allow samples analysis. The surface was flat and covered with nylon not allowing contact with any other waste. In order to carry out the sorting process (Figure 1) and determine the morphological composition, the following equipment was used (Figure 2): ◢ Electronic scale (measuring range 150 kg, platform width 400x500 mm, with LED display and the ability to work with the battery pack, Figure 3), ◢ Waste bin (volume of 85 liters, in which waste is sorted by category), ◢ The grid (used for easier and faster sorting and separation of waste, contains three sieves of 130 mm, 75 mm and 20 mm, respectively, Figure 4), ◢ A wheelbarrow for transportation of the selected waste sample, ◢ Accessory tools (shovels, nylon, scissors, knives for cutting bags, etc.).

Methodology

The method of waste sampling and analysis can be described as follows:

- Waste samples for analysis are taken after the truck unloads its waste at the landfill working area.
- Workers load the wheelbarrow for transportation of the selected waste sample with waste from selected trucks and transport it to the location for selection and analysis.
- The waste sample is transferred on the grid where it is manually sorted and sieved through all three grids, until fine residue remains.
- After sorting, each fraction is being scaled separately. The result of this analysis is the amount of waste in every category.
- The results are registered in a special form that contains: the sampling date, waste origin (the municipality from which the waste was admitted), the total amount of waste in the truck, information on the net weight of each waste fraction.

Figure 1. Waste sorting process

Figure 2. Equipment

Figure 3. Electronic scale

Figure 4. Grid for waste sorting

Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS	A simple excel spreadsheet is used to store data on solid waste quantities and composition. SWIS Model was not used to determine the quantity and morphology of solid waste, because the management of Regionalna deponija Mošćanica d.o.o. Zenica was not aware of its existence.
Waste Analysis	Table 1. Absolute and percentage shares of individual waste components in the sample observed for testing the typical composition of waste during the autumn waste analysis at the Regional Landfill of Mošćanica (a total sample volume of 3.353 tons)

No.	Waste category	Absolute shares (kg)	Percentage shares (%)
1.	Organic waste-garden waste	398	11.87
2.	Organic waste-other biodegradable waste	551.37	16.44
3.	Paper	204.44	6.10
4.	Glass	219.12	6.54
5.	Cardboard	223.66	6.67
6.	Composite material-cardboard with Al	138	4.12
7.	Metal (packaging)	68.18	20.3
8.	Metal–aluminum cans	90.94	2.71
9.	PET bottles	173.92	5.19
10.	Plastic bags	257.68	7.69
11.	Hard plastic	207.02	6.17
12.	Textile	148.36	4.42
13.	Leather	38.54	1.15
14.	Diapers	184.66	5.51
15.	Fine elements (sieved residue)	418.96	12.49
16.	Construction waste	30.16	0.9

Table 2. Absolute and percentage shares of individual waste components in the sample observed for testing the typical composition of waste during the spring waste analysis at the Regional Landfill of Mošćanica (a total sample volume of 3.157 tons)

No.	Waste category	Absolute shares (kg)	Percentage shares (%)
1.	Organic waste-garden waste	336.48	10.66
2.	Organic waste-other biodegradable waste	597.52	18.92
3.	Paper	187.7	5.94
4.	Glass	232.3	7.36
5.	Cardboard	143.02	4.53
6.	Composite material-cardboard with Al	113.86	3.61
7.	Metal (packaging)	61.68	1.95
8.	Metal–aluminum cans	92.28	3.02
9.	PET bottles	175.28	5.55
10.	Plastic bags	249.72	7.91
11.	Hard plastic	192.67	6.1
12.	Textile	162.96	5.16
13.	Leather	60.42	1.91
14.	Diapers	173.02	5.48
15.	Fine elements (sieved residue)	368.42	11.67
16.	Construction waste	7.24	0.23

The results of waste composition analysis indicate large amounts of organic substances in waste. The amount of organic waste-garden waste ranges from 77.87% in the autumn to 10.66% in the spring period, while the amount of other biodegradable waste ranges from 16.44% in the autumn to 18.92% in the spring period. With regard to the European Union regulations, the maximum amount of organic waste that can be disposed at the landfill may not exceed 5%. This leads to the conclusion that the municipalities disposing waste at the Regional Landfill of Mošćanica will have to make some effort to reduce the amount of organic components present in their waste.

The amounts in the conducted analysis showed that significant usable components (paper, glass, cardboard, PET bottles, hard plastic) are found in municipal waste streams. This leads to the conclusion that building a waste sorting line at the Regional Landfill of Mošćanica for extracting the useful components from the incoming waste might be a feasible option. A waste sorting line should bring both economic and environmental benefits. The economic benefits are reflected in the marketing of secondary raw materials and the financial gain from their sale. The ecological benefits are reflected in the recovery of recyclable materials and saving of usable space at the landfill.

Innovation and Success Factors

The practice of determination of municipal waste quantity and composition significantly improved the waste management at Regionalna deponija Mošćanica d.o.o. Zenica in terms of getting a better insight into the economic feasibility of the establishment of a recycling center at the landfill and diverting recyclable waste from the landfill.

Constraints	The main challenge was the development of a sampling protocol based on the EU standards applicable to local conditions, as well as the knowledge on how to implement the protocol. The challenge was overcome by engaging consultants who developed the protocol and performed the first analysis together with the company staff. Following the first analysis, the company staff continued to perform the same analysis twice a year for the last 5 years.
Sustainability	In terms of institutional sustainability, knowledgeable and motivated staff needs to be available in order to ensure implementation sustainability. Another important factor is the availability of equipment including both cheap and easily available equipment such as electronic scales, waste bins, grids, wheelbarrows and accessory tools, as well as expensive equipment such as a truck scale. In terms of economic sustainability, once the initial investment in equipment is made, the subsequent use of the Good Practice does not bring any additional cost to the company. The staff regularly employed by the company is engaged to work on this task within their regular working hours and for their regular salary. In terms of environmental sustainability, the practice itself can help to decide on the implementation of recycling activities and diversion of waste from the landfill. Thus, the existence of a recycling facility (regardless of its owner) is a key precondition for the practice to be environmentally sustainable. Social sustainability factors are not identified.
Impact	Positive impact on beneficiaries, who are at the same time the end users, was reflected through better waste management planning, especially in terms of assessing the potential for waste recycling. A waste sorting line was constructed at the landfill which provided additional economic benefit for the company. In the first year of sorting, 302.38t of PET bottles, 176.55t of paper and cardboard, 73.79t of hard plastic and 24.38t of metals were separated for recycling. The extraction of these materials from the incoming waste stream saved 13,966.21 m^3 of landfill space. On the other hand, it is expected that municipalities disposing their waste at the landfill will make use of the information obtained for the purpose of developing Municipal Waste Management Plans. Proper information can help LGs to bring adequate decisions about steps to be taken toward the introduction of a separate collection system.
Gender Aspect	The responsible engineer employed by Regionalna deponija Mošćanica d.o.o. Zenica is a female. She was responsible for organizing the process of waste composition analysis each year and managing the team of 3 people performing the analysis. She is also responsible for data analysis and reporting.
Lessons Learned	The key lesson learned was related to understanding the importance of having exact and reliable solid waste data that directly impact the economic performance of the company, as well as its annual budgeting activities. Based on the information obtained, the landfill disposal fee was determined, as well as the decisions on the waste management system at the regional level. On the other hand, reliable data enable making important business decisions related to solid waste management and initiate a proactive approach toward waste management in all communities that dispose their waste at the regional landfill. The public utility has been using the same methodology since 2010 on a regular basis every year.
Replicability	The methodology itself can easily be replicated in other LGs and waste management utilities with a precondition of training the company staff that will continue to perform the analyses.

Recording Sheet – Template

Number:	Date:	Vehicle registration plate:		Municipality:	Operator:	
	Waste type		Net weight			Total:
Organic waste		Waste from gardens				
		Other biodegradable waste				
Paper						
Glass						
Cardboard						
Composite material		Cardboard with wax				
		Cardboard with aluminum				
Metals		Packaging waste (other)				
		Aluminum cans				
Plastics		PET plastic and packaging waste				
		Plastic bags				
		Hard plastics				
Textile						
Leather						
Diapers						
Fine elements (sieved residues)						
Other						
Batteries						
Electronic waste						
Construction and demolition waste						
Notes:					Total	

9. BULGARIA- Waste Management Information System-DepoInfo

1) Good Practice General Information

Title of the Good Practice	Waste Management Information System in Bulgaria – DepoInfo
Location/Geographical Coverage	DepoInfo was implemented in 10 regional waste management systems in Bulgaria – Vraca, Silistra, Dobrich, Plovdiv, Razgrad, Targovishte, Yambol, Oriahovo, Haskovo and Lovech and has recently served 53 municipalities out 265 in Bulgaria
Implementing Institution/Organization	Bulgarian Association of Municipal Environmental Experts—BAMEE in partnership with DataMplant – IT company
Contact Person	Nikolay Sidjimov, Executive Director of BAMEE, +359878577973, sidjimov@bamee.org
Publication Date	In October 2007, the system was implemented for the first time and we continue its development, update and further implementation.
Author(s)	Nikolay Sidjimov, Executive Director of BAMEE Ivan Georgiev, Manager, DataMplant Constantin Iliev – Manager, DataMplant

2) Good Practice Specific Information

Period of Implementation	The implementation started in 2007 and was upgraded in 2009. Recently, it has been used in 53 municipalities and a modified version of the Information System has been implemented by EPR (Extended Producer Responsibility Organization) – Ecobulpak, dealing with packaging wastes.
Introduction	Mayors of municipalities organize the management of waste generated on the territory of the respective municipality in conformity with the WMA provisions and requirements and the Regulations pursuant to Art. 19 of the WMA, ensuring conditions under which every owner of municipal waste shall be served by persons with whom a written Service Contract has been effected in the order stipulated by the Public Procurement Act. The mayors also organize, jointly with other municipalities, waste disposal on a regional basis. The lack of waste management planning at the regional level and the insufficient co-operation among the municipalities within one region, where regional waste management planning and implementation of activities could be accomplished, additionally affect the effectiveness of waste management activities. This is a significant problem especially for small-size municipalities, which are not able to allocate adequate resources to waste management planning and preparation of projects scheduled. Regular operation and management of regional facilities is implemented by relevant organizational management structures based on the regional principle. For these purposes, a unified waste management data base has been designed and implemented in the municipalities of the pilot regions and a data acquisition system has been established as required by WMA and Ordinance No. 9 (SG No. 95 /26.10.2004), as well as data submission to the institutions concerned with waste management at both regional and national levels for the municipalities included in the pilot regions. This is the first integrated Waste Management Information System in Bulgaria. It was developed under a PHARE project and was designed to serve Regional Waste Management Systems (Landfills). Later, it was expanded according to the needs of PRO for packaging wastes.
Statistical Information	In Bulgaria, the percentage of coverage with services related to solid waste management is 99.2%, app. 110,000 km^2. Municipalities that have implemented the DepoInfo System (53) are covering over 25,000 km^2. The number of inhabitants in these municipalities is approximately 1,560,000 (out of 7,284,552 total population in Bulgaria) Number of households – appr. 710,000 Number of vehicles (trucks, tractors etc.) – not applicable Collection system employed? – all types of collection Number of metal/plastic containers (capacity in liters/m^3) – NA Number of household plastic bins (capacity in liters/m^3) – NA Type of collection (door-to-door; curb collection; common street containers…) – all types of collection Frequency of collection -NA Number of recycling bins? Green islands? NA Use of collection bags? NA

	Accumulation rate
Over 150,000	410.3
50-150,000	349.6
25 – 50,000	334.9
3 – 25,000	295.5
Less than 3,000	241.7

Stakeholders and Partners	The beneficiaries of the Good Practice are BAMEE, MoEW, municipalities, waste management companies, NGOs. The users of the system are Local Administrations, managers, NGOs
Methodology	1. The regional waste landfill (RL) is the main unit around which the system for waste management (WM) was built. All other landfills, no matter to which municipality from the region they belong, are already closed or are being closed. 2. Primary attention is given to domestic waste. Other kinds of waste are not excluded (construction waste, for example). 3. The key workplace is the electronic scale(s) at the entrance and exit of RL. The complete information about the source, the carrier, quantitative, qualitative (and other) characteristics of waste, the place where it is delivered in RL, whether it is to be subject of additional treatment or it has been treated beforehand, is easily gained on that workplace. The automated way of registration of information and correct administration exclude the subjective factor. This guarantees the accuracy of information received from entities participating in and supervising the process of WM to a large extent. 4. Information must be sufficient to generate Appendixes 1, 7, and 9 of Order No. 9. 5. In a natural way, the RL also received extra information, which has a wider range and can be used by the entities participating in and supervising the process of WM. 6. The information system can also work at landfills which are not regional but are still functioning and have the capacity. The electronic scale is obligatory in order to guarantee the accuracy of information. 7. In order to have an existing database with current and useful information about the entities participating in and supervising the process of WM, it must not only be well structured, but also completed daily by the Information System (IS). This IS should facilitate the daily work of entities (mainly of RL), and increase the possibilities for control, limiting the corruption practices. It should aid the process of WM. 8. In addition, the structure of the database can be granted as an XML scheme or UML static diagrams. 9. The system optimizes the daily work of the landfill and improves the communication between waste transporting firms and the landfill. Waste transporting firms receive information on the quantity and type of waste they have transported. On the basis of this information, the Municipality pays them off. 10. It also improves the communication between the Municipality and the landfill. On the basis of the information coming from RL, the Municipality either pays, if an external or internal (municipal) firm services the RL, or controls, if the RL is serviced by its personnel. There is also improvement in the service of accidental or seasonal clients that pay the landfill for the service. 11. The minimum data that the IS has to collect are the specifications from Appendix 1 (or the Daily Report), Appendix 7 (Annual Report), Appendix 9 (Annual Report) and Appendix 11 (Identification Card – an inseparable part of Annual Reports) with their additional Lists. 12. Provision of a wide range of reference reports on current and past years, in which the system has functioned. The reports are to be used through the Internet by all entities participating in and supervising the process of WM through respective access rights but not through a browser for security reasons. 13. If necessary, the system replicates data in the regional WM structure or municipalities. 14. It allows generalization of the information generated at landfills with electronic scales that are still functional on the territory of the region in order to allow general check-ups and reports. Attached files with examples of reports from the system.

Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS

DepoInfo was developed with MS Visual Studio and based on post-relatonal database Cache' of InterSystems Corporation USA. It has:

- Unified end-user interface and very simple operation.
- The Security System has well-structured access rights and provides protection against unauthorized access and illegal copying, but has Intranet and Internet accessible references with well-structured access A
- Automatic receiving of information from the electronic scale, and magnetic installation of IS rights (landfill manager, head of department, municipality operator, RIOEW, transporters, citizens, if the information is public, etc.) on cards without any possibility of editing the records by anybody including the landfill manager
- An opportunity to trace all loads (not only waste) that are going in and out
- A possibility to perform additional services with the electronic scale
- An opportunity to issue and print all documents related to the activity of WM
- If necessary, it allows connection with other IS working on the territory
- Optional possibility to observe the process of burying the waste and
- Optional possibility to observe the technical servicing of operation
- Integrating a security and tracking system (cameras mounted around)
- A journal on a system and application level
- A system for archiving and recovering data on an application level
- Archiving and recovering data on a system level
- A possibility to summarize the data from a number of landfills in a uniform way
- An opportunity to replicate data

Information flows

a. The information in the IS could be entered through static forms

b. The information is actual and dynamic when entities participate in the RL, and it concerns the economic activity. It is paid for at the RL in the form of scale notes, pro-forma invoices, invoices, etc. The RL can monitor the RL machinery (and the scales) if such is already available.

Waste Analysis	A very large proportion of municipal waste in Bulgaria is landfilled. The amount of municipal waste deposited into landfills was 3 million tons in 2010, accounting for 98% of the amount generated (3.1 million tons). In 2005, a significantly smaller proportion of the generated amount was landfilled; the landfilled amount was 3.1 million tons and accounted for only 85% of the amount generated (3.7 million tons). The difference between the generated and landfilled amount (that in accordance with the Eurostat statistics equaled the treated amount of municipal waste) was 536,000 tons in 2005. It can be assumed that it equals the estimated amount to be generated in regions without MSW collection services. No material and organic recycling of municipal waste was reported in Bulgaria from 2001 to 2010. Packaging waste is not included in the reporting to Eurostat on the recycling of municipal solid waste in Bulgaria. Even if packaging waste were included under the reporting of MSW recycling, it would require an exceptional effort for Bulgaria to fulfill the recycling target of 50% by 2020. Considering the trends in the development of amounts of landfilled biodegradable MW from 2007 to 2010, substantial efforts will have to be undertaken if Bulgaria is to fulfill the 50% and 35% targets of the EU Landfill Directive for diverting biodegradable municipal waste from landfills by 2013 and 2020. Mechanical biological treatment was introduced recently in Bulgaria. A National Strategic Plan for diversion of biodegradable waste going to landfills 2010-2020 was adopted recently. The legal framework on bio-waste management is being developed under an international project. Any organization, whose activity is related to the collection, transportation and temporary storage of household waste or disposal of waste, should keep account books and annual reports. Annual Reports on waste are provided in RIEWs and contain information on: Catchment area, including the Municipality, settlements, sites for separate collection, types of waste; Containers used for waste collection; Information about the origin of wastes (A—from households, offices, commerce, B – from production activities; C—from streets and parks; D—from health facilities), type, code and quantities of waste collected and delivered for recovery and/or waste disposal; Information on quantities collected and delivered for recovery/waste disposal separate collection systems, including paper and cardboard; glass; textiles; plastics; metals; biodegradable waste from kitchens and catering; batteries and accumulators; fluorescent lamps; bulky waste; electronic waste; composite materials, etc.; List of facilities and quantities delivered for utilization of waste disposal. Determining the quantities of various streams is based on reporting documents of operators managing different waste streams. When determining the quantities of mixed waste from operators of regional systems is not done by the weighting method, than expert assessments should be used. Determining the morphological composition of mixed household waste is based on well planned analyses. The analysis should determine as minimum the following fractions: Food Waste; Paper and Cardboard; Plastics; Textile; Rubber; Leather; Green/Garden Wastes; Wood; Glass; Metals; Inert Wastes; Hazardous; Other – Undefined.

Waste Analysis

Average municipal morphological composition:

Morphological fraction	Mass in kg	Content in %
Food	10.8	7.91%
Paper	4	2.93%
Cardboard	5.1	3.74%
Plastics	37.9	27.77%
Textile	11.6	8.50%
Rubber	0.2	0.15%
Leather	0.9	0.66%
Green/garden wastes	0.8	0.59%
Wood	0.5	0.37%
Glass	3.8	2.78%
Metals	0.2	0.15%
Inert wastes	25.8	18.89%
Hazardous	0.4	0.29%
Other – undefined	34.5	25.27%
Total	136.5	100%

Number of minimum samples for morphological analyses, according to type of settlement		
Generated wastes, in t/year	Number of samples per season	Number of samples per year
5,000	1	4
8,000	2	8
12,000	3	12
18,000	4	16
28,000	5	20
40,000	6	24
52,000	7	28
65,000	8	32
80,000	9	36
100,000	10	40
130,000	11	44
170,000	12	48
220,000	13	52
280,000	14	56
350,000	15	60
430,000	16	64
500,000	17	68
over 500,000	18	72

Innovation and Success Factors	The system provides immediate access to waste management data and a possibility for correct planning and good management. All parties involved in waste management can have a clear picture of the situation and precise detailed data on all waste components, transportation, individual operators and all processes implemented on site. The public access module provides an opportunity for the public to monitor and control the amounts of waste and operators that have accesss to the facilities, as well easily integrated summarized information.
Constraints	The system is well accepted by the Ministry of Environment and Waters and municipalities, but is not spread in all municipalities.
Sustainability	It is required that such system be implemented by all waste management operators, including recycling centers, separation units and others, including bio-waste treatment facilities. It should provide public access to the quantity data and a possibility for aggregating information. ◢ Facilitating the entering and processing of accurate and consistent data (information) at the place and time of its creation (composting plants, etc.). ◢ Avoiding the exchange of information between involved institutions in non-compatible and varying formats (e.g. by "manual" transposing and copying, i.e. not electronically generated). ◢ Introduction of an electronic format of record books in compliance with the Regulation № 2 of 22 January 2013. ◢ It is thus necessary to define the electronic format of record books and annual reports as XML schemes, to be easily presented and made available electronically, generalized, collated and used. ◢ The XML schemes are defined in such a way that software developers can create software products suiting the daily data entering and allowing them to automatically prepare and send record books and annual reports in the required structure, for further assessment (aggregation, calculations, different types of reports etc.) by the competent Authority (ExEA, RIEW etc.). ◢ All kinds of reports can be done by remote access online, on the part of operators of CP and authorities, if they have the appropriate user rights.
Impact	The municipalities that have implemented the system can organize their waste management plans efficiently and cooperate easily with their partnering bodies. Public access to information provides an opportunity to citizens to be involved in the decision-making and control the work of public bodies. Based on advanced IT technologies enabling aggregation of information through standard protocols, the information from the composting plant can be transferred to the control body or to ExEA for the certain period of time required (e.g., monthly, yearly). The accuracy of this information can be highly guaranteed, because the information is registered at the place and time of creation and the IS has enough and accurate data fields. It can be filtered and aggregated in a certain way and be used for reporting in compliance with national and European requirements (e.g. EUROSTAT reporting schemes, Recycling targets etc.).
Gender Aspect	NA
Lessons Learned	Authorities should be well acquainted with the benefits of the system and opportunities it provides. They have to envisage the whole picture of waste management operations – planning, implementation, modification, control, reporting, and communication.
Replicability	The system is easily replicable and implantable. It is advised to have a weighting module and distance control equipment, but it may operate even without such attributes. It is also advisable to be network connected, to provide day to day access. Very easy for remote administration.

MACEDONIA- Waste Composition Analysis in North East Region

10.

1) Good Practice General Information

Title of the Good Practice	Waste Composition Analysis in North East Region–Macedonia
Location/Geographical coverage	Municipality Landfill "Krasta" – Kumanovo; Municipality Landfill "Nikushtak" – Lipkovo; Municipality Landfill "Mechkin Dol" – Kratovo; Municipality Landfill "Chombardino" – Rankovce; Municipality Landfill "Konopnica" – Kriva Palanka;
Implementing Institution/Organization	Center for Development of North East Planning Region–Kumanovo
Contact Person	Dragan Chungurski – Waste Management Department Mail: dchungurski@gmail.com Phone: 00 389 75 434 900
Publication Date	March, 2015
Author(s)	Boban Bojkovski

2) Good Practice Specific Information

Period of Implementation	1st August to 10th September 2013
Introduction	In the Republic of Macedonia, since 2 October 2012, there has been a regional approach to the waste management system in order to realize national waste management strategic goals. The Republic of Macedonia is divided into eight development regions. Each region has developed its Regional Waste Management Plan in the frame of the National Waste Management Strategy. The North Eastern Planning Region and the Eastern Planning Region developed their Regional Waste Management Plans in 2014. Other Regions are in the process of drafting Regional Waste Management Plans. Waste composition analyses are the main part of these documents. Public Utilities managing communal waste in these five municipalities have their data on the amount of deposited waste expressed in its volume without any analyses of waste composition. Apart from the EU and national waste legislation and strategy, there are a number of significant parameters which influence regional planning and they take into account the following: • Waste quantity and composition; • Geographic origin of waste; and • Current situation regarding waste collection and treatment, including waste tariffs and affordability. Despite the existing legal basis for collecting, recording and reporting on wastes that enter/exit waste management, there is no environmental monitoring capacity for waste management, while the system of functional data recording, data accessibility and reporting is not yet fully operational. The system for collecting data/information must include data on the sources, nature and quantities of municipal solid waste.
Statistical Information	◢ Area of the municipality involved in SW data collection in km2 : ◢ Number of inhabitants: 178 ,000 in the Region ◢ Number of households: 46,295 in the Region ◢ Percentage of coverage with services related to solid waste management: 62% at the regional level ◢ Number of vehicles (trucks, tractors etc.): 40 ◢ Collection system employed? 300 in the Region ◢ Number of metal/plastic containers (capacity in liters/m3): not relevant ◢ Number of households plastic bins (capacity in liters/m3): not relevant ◢ Type of collection (door-to-door; curb collection; common street containers…): door-to-door, curb collection ◢ Frequency of collection: not relevant ◢ Number of recycling bins? Green Islands?: 0 ◢ Use of collection bags?: not relevant (Note: One sentence per question is required)
Stakeholders and Partners	The beneficiaries of the Good Practice and analysis results are LGs and Public Utilities in the North-East Region. The Good Practice was implemented during the process of preparation of the Regional Waste Management Plan for this Region. The good practice was financially supported by GIZ and implemented by the Faculty of Technical Science from Novi Sad, the Republic of Serbia.

Methodology	Before the waste analysis process began, public companies had to perform certain actions to provide the necessary tools for the process. The place where the measurement activities were realized had to be covered to prevent the external conditions such as rain or snow, etc. from affecting the process. It was necessary to provide a minimum of 4 to 6 workers and protective clothing, gloves, glasses. It was necessary to provide electronic scales and grids for sorting the waste. It was required to provide 15 bins of 12 liters that would take the waste according to the catalog. Also, additional tools like scissors, knife blades, gardening forks etc. were provided. 1. Process of measurement: The analysis of waste morphological composition started by taking three samples weighing 300 kg from three different areas in the city. The first area was a collective housing area (residential buildings), the second area was family accommodation and the third zone was in the rural parts of the Municipality. The sample for analysis had to be randomly selected from different streets in a sector of randomly selected containers from the area that would best represent waste composition of that area. The desired mass of 300 kg was reached when 30 bins of 80 liters, 20 containers of 120 liters or 3 to 5 containers of 1.1 m^3 were collected. This waste selected from bins and containers came to the location for waste selection and analysis by truck. It should be noted that each sample analysis was analyzed separately in relation to the sector from which the sample was taken. For the waste selection process and morphological analysis, 3-5 workers were needed, a technician and an engineer responsible for oversight of the process. The waste from the sample was manually separated into 20 different fractions and each fraction was measured separately. As a result of the analysis, the amount of waste was extracted under the specified waste category in the catalog and expressed in kg and the total volume of the sample, and then the sample volume was given in m^3 or liters. For better visibility of the data analyzed, the presence of each waste fraction was given in percentages or presented graphically.

The following table is a catalog of the type of waste analyzed.

	Type of waste	Sample
1	Garden waste	Grass clippings, weeds, flowers, twigs, branches, leaves, remnants of hedges and the like
2	Other biodegradable waste (kitchen waste)	Food waste—all kinds (bread, meat, vegetables, fruits...), dead chickens, animal organs and the like
3	Paper	Old newspapers, classifieds and advertisements on paper, envelopes, computer printings, old mail, diaries, posters, books, notebooks, bus tickets, invoices, letters, etc.
4	Glass	Bottles (for wine, beer, spirits, mineral water, juices, etc.), glass jars (for pickles, jams, etc.), flat glass, light bulbs, mirrors, etc.
5	Cardboard	Cardboard boxes of all kinds, packaging of electrical appliances, food packaging, beverage cartons for beer, boxes of biscuits, toys, flat cardboard, etc.
6	Composite materials (cartons)	Tetra Pak for yogurt, milk, juices, etc. depending on the manufacturer
7	Metals (ferrous)	Canned food (sardines, pates, sliced meat), tools, car metal parts, domestic wire lines, kitchen accessories
8	Metals (non-ferrous)	Cans for beverages (beer , coca-cola , energy drinks) and so on
9	Plastic packaging waste	Plastic boxes for various products...
10	PET bottles	Plastic bottles for water, juices, beer, oil, vinegar, etc.
11	Plastic bags	Bags from stores, garbage bags, plastic bags (black, green, gray), bags of chips, sandwich bags, bags for frozen vegetables, bags for cookies and the like
12	Other plastics	Boxes for margarine, yogurt , ice cream, phone cards, plastic toys, rulers, pencils, toilet lids, tooth-brushes, plastic boxes, containers for cleaning liquids
13	Textile	Natural and man-made fibers: clothing made of natural fibers (cotton, wool, linen), and synthetic fibers (trousers, socks, bags, linen), dish cloths...
14	Leather	Leather pieces of clothing, wallets, belts, leather shoes, leather bags, leather balls, etc.
15	Diapers	Baby diapers, sanitary napkins and the like
16	Wooden items	Parts of furniture, doors, moldings
17	Construction waste	Waste from fires, bricks, concrete, stones
18	Electronic and electrical waste	Parts of electrical and electronic devices, motherboards, parts of TV sets, mobile phones
19	Household hazardous waste	Batteries, detergents, fluorescent tubes, sprays, varnishes
20	Fine elements	All waste residues undergoing the final sieve of 20mm, soil, dust, ash, sand, glass fragments and the like

Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS

During the analysis, only an Excel table was used.
The stakeholders involved in the analysis had not been informed about SWIS Tool and its purpose and benefits.

Waste Analysis

	Type of waste	Percentage
1	Garden waste	11.21
2	Other biodegradable waste (kitchen waste)	38.01
3	Paper	2.84
4	Glass	3.63
5	Cardboard	4.32
6	Tetra Pak	0.83
7	Metal (ferrous)	0.57
8	Metal (non-ferrous)	0.48
9	Plastic packaging waste	2.16
10	PET bottles	5.84
11	Plastic bags	6.11
12	Other plastics	1.45
13	Textile	4.36
14	Leather	0.41
15	Diapers	4.47
16	Wooden items	0.03
17	Construction waste	2.61
18	Electronic and electrical waste	0.11
19	Household hazardous waste	0.32
20	Fine elements	10.25
	Total	**100**

Innovation and Success Factors

/

Constraints

Although the Plan for Solid Waste Management indicates the need for measurements to improve environmental monitoring and management data and access to information, there is no inter-sectoral collaboration and cooperation between central and local governments in terms of presentation and accessibility of data.

Sustainability	The methodology applied for measurement of solid waste quantities and morphology should be regularly performed according to the prepared programs for waste management, in accordance with the national legislation in the field of waste management. Having in mind the regional approach which involves 10 municipalities, there is a clear need for training of the main stakeholders, so that all can participate fully in the process of solid waste measurement and data exchange on a local level between the public utility and local government, as well as on an inter-governmental level.
Impact	Development of a Regional Waste Management Plan in the frame of the National Waste Management Strategy. In addition, it will allow the application of efficient and cost-effective techniques for collection, transport, separation and treatment/processing of separate waste fractions. Precise data on municipal solid waste will lead to the application of an integrated waste management system as a way to control a significant number of types of waste generated and reduce the quantities and potential hazardous waste. The improved data generation system resulting from the methodology implemented will allow the development of local policies with more accurate data and thus influence the development of the National Waste Management Plan with quality input data on waste quantities and composition.
Gender Aspect	Explain how gender was taken into account in both the challenge being addressed and the good practice itself. A gender perspective was not integrated in the assessment, planning, implementation and monitoring of the Solid Waste Measuring Project.
Lessons Learned	What are the key messages and lessons learned to take away from the good practice experience? The methodology will include activities that are not covered, such as obtaining reliable data on waste and generators as well as the characteristics and composition of waste. This would facilitate the qualitative and quantitative representation of the real problem of waste at its source. Improved capacity of local authorities (including public utilities) to apply a gender analysis in waste management will improve specific activities' compliance and help to ensure that women's needs are met. Consultative processes and participatory planning mechanisms require an explicit consideration of both women's and men's needs and ability to participate.
Replicability	What are the conditions (institutional, economic, social, and environmental) that need to be in place for the good practice to be successfully replicated (in a similar context)? The methodology could be easily replicated within the rest of the Regions in Macedonia, but also wider, in the region of SEE. Of course, modification and adaptation to the particular local context is necessary.

General Waste quantity in LGs: _____, Type of housing :_____, Area: _____

Type of waste:		Bruto mass (kg):									
Organic waste	Garden waste										
	Rest of biograda-ble waste										
Paper											
Glass											
Cardboard											
Compose materials											
Metal	Pakige waste										
	Aluminium can										
Plastika	Plastic pakige waste										
	Plastic bags										
	Hard plastic										
Tekstile											
Skin											
Dipers											
Fine materials											

• Date: _____

• notice: _____

summ: _____

1. Location

2. Scale for measurement

3. Bins

5. Protective personal equipment

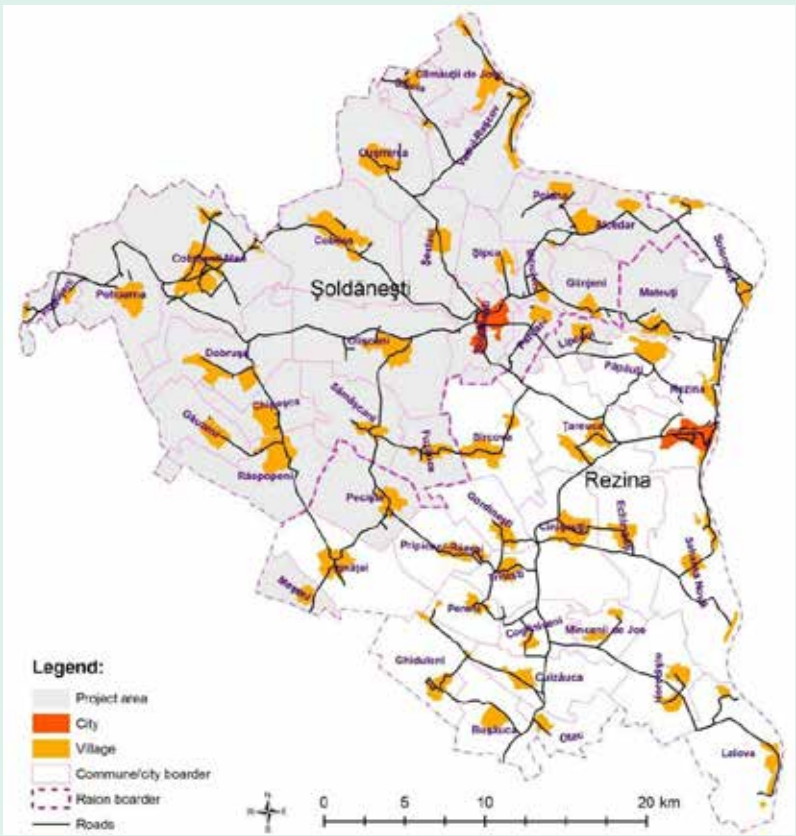
4. Waste sorting process

MOLDOVA- Waste Composition as a Key Element to Establish an Integrated Solid Waste Management System in Soldanesti

11.

1) Good Practice General Information

Title of the Good Practice	Waste Composition as a Key Element to Establish an Integrated Solid Waste Management System in Soldanesti, Moldova
Location/Geographical Coverage	Geographical area of the study comprises the city of Soldanesti and 26 surrounding rural administrative units (municipalities/ communes) in the district of Soldanesti and Rezina



Implementing Institution/ Organization	GIZ Program "Modernization of Local Public Services in the Republic of Moldova"
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Publication Date	2013
Author(s)	GIZ Program "Modernization of Local Public Services in the Republic of Moldova"

2) Good Practice Specific Information

Period of Implementation	Summer 2013
Introduction	The waste composition activity was undertaken as input to the Feasibility Study for an inter-municipal solid waste management center in Soldanesti. Within the Program "Modernization of Local Public Services in the Republic of Moldova" GIZ is supporting the city of Soldanesti and 26 surrounding rural administrative units (municipalities/communes) in the districts of Soldanesti and Rezina to establish an enhanced state-of-the-art Integrated Solid Waste Management System (ISWMS). The Project aims at improving the overall environmental situation by means of reducing pollution and emissions in the greater area known as Ciorna river basin. The final component of the ISWMS to be established is the inter-municipal solid waste management center consisting of a material recovery facility (MRF), a composting plant, and an enhanced landfill which will serve as an intermediate waste disposal site for the service area in accordance with the Regional Waste Management Plan. After the transitional period, the disposal site is expected to be replaced by a regional landfill serving four districts (Soldanesti, Rezina, Telenesti and Orhei).

Statistical Information	◢ Area of the Municipality involved in SW data collection: The area includes 27 administrative units: all 23 administrative units (one city and 22 rural municipalities) from Soldanesti district with an area of about 59,646 ha; and 4 administrative units (4 municipalities) from Rezina district with an area of 7,364 ha ◢ Number of inhabitants: The total population of Soldanesti district in 2014 was estimated at 37,774. Only 16% of the population live in urban areas (i.e. Soldanesti City), while the majority of population (84%) live in rural areas. According to statistical data (statistica.md), in Soldanesti City, 52.1% of the population is represented by women, while in the villages, women represent about 51% of the total population. The population of the 4 municipalities of Rezina District included in the project area is 5,994, which represents 12% of the total population of the rayon. According to statistical data, about 50.6% of the rural population in Rezina Rayon is represented by women. ◢ Number of households – N/A ◢ Percentage of coverage with services related to solid waste management– 18% of Soldanesti District. At the moment, only the city of Soldanesti and 4 municipalities from the Soldanesti District have organized systems for household waste collection in place; the rest do not have any organized solid waste management systems. ◢ Number of vehicles (trucks, tractors etc.) – trucks – 4; tractors- 3; trailers – 7. ◢ Collection system employed?–N/A ◢ Number of metal/plastic containers (capacity in liters/m3) – 220 containers – 20 liters, 1,814 containers–0.24m3 and 808 containers - 1.1 m3 ◢ Number of household plastic bins (capacity in liters/m3)?- N/A ◢ Type of collection – collection from platforms for containers ◢ Frequency of collection – in rural areas–once a week and in Soldanesti City – 3 times a week. ◢ Number of recycling bins? Green Islands?- N/A ◢ Use of collection bags?- N/A
Stakeholders and Partners	2 Public Utility Companies, 27 municipalities and the inter-municipal solid waste management center that is now being established
Methodology	Waste Composition Analysis–Methodology The evaluation of the feasibility of a material recovery facility (MRF) requires comprehensive data on waste composition, waste types and waste amounts. Waste types and amounts are investigated during weighing campaigns, if weighbridges are available; waste composition is studied during a waste analysis. Waste composition analyses are carried out to take account of different levels of affluence within different residential areas (high/low income, urban/rural, single house/apartment blocks). The sampling methodology takes account of variations between and within residential areas. The areas are selected to give a good geographical spread across the city/region in order to ensure a statistically significant sampling methodology. Sampling for the waste composition analyses is carried out from three different sources: Samples are collected from each household (curbbside) randomly from the selected areas. Samples are collected from open collection trucks or from central collection points Samples are collected from municipal compaction trucks (at the disposal site). In order to ensure that collected samples are representative at each sampling point, selected sample quantities exceed 150 kg.

For the waste composition analyses, an iron mesh with a size of approximately 2x2m is taken with a pore size between 25-40 mm (whatever is available). The mesh is placed at a height of 75 cm above the ground by using for example, old tires as columns. The height of the mesh is arranged reaching the waist of the personnel assorting the waste in order to minimize bending over. Assorted waste materials are collected in bags and sorted into 13 different waste fractions. A foil is placed below the mesh during sorting of the different waste fractions to collect the screenings, i.e. that fraction that has passed through the mesh/sieve and that cannot be allocated to any of the sub-categories. The collected samples are placed on the iron screen. To safeguard the health and safety of the personnel involved, all workers are given synthetic gloves.

Once all the samples have been collected, bags are opened and the waste is sorted into the different categories using the sorting methodology described above. Each category of the waste is placed in a separate bag and weighed using a hanging scale. The waste that is unsortable for various reasons is collected and weighed separately. The scale used is accurate to 0.1 kilograms. The weight of the waste collected in each category is recorded.

The following waste fractions are regularly assorted:

Mixed Paper, White Paper, Cardboard

PET Bottles

Polystyrene

Mixed Plastic Foils

Other Plastics

Glass

Metals

Organic (food, vegetables)

Green Waste (garden waste, leaves)

Nappies

Unsorted Waste (clusters, lump)

Screening/Fine Fraction (< 25 mm) see figures below

To extract maximum information from the data, it is important to understand what the organic portion of those fractions is. Thus, organic content is determined by means of measuring the loss of ignition (LoI) and/or organic dry substance (oDS) in the laboratory. If laboratory testing is not available, organic content can be taken from literature.

Waste Assorting (Moldova)

Fine Fraction (Moldova)

The household waste fractions in the project area:

Mixed paper

Plastics

Metal

Glass

Residual waste: mixed organic & inorganic

Residual waste: inert

Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS	Excel spreadsheets were used for data collection and sorting for solid waste quantity and composition. The SWIS Model was not used, probably because the experts involved in the feasibility study were not aware of this model.

Waste Analysis

Main solid waste streams generated and collected in the area, year 2013

Waste stream:	Generated tons	Collected tons
Household/commercial waste, including:	9,020	2,290
Household waste from population	8,650	2,140
Commercial waste from economic entities/public institutions	372	150
Agricultural/manure waste	68,622	2,400

Detailed household waste composition in the project area and description of the waste composition analysis methodology

Waste components	Urban area	Rural
Mixed paper	5.5%	5.0%
Tetra Pak cartons/boxes	0.1%	0.0%
Plastics	9.1%	8.4%
Metals	0.7%	0.6%
Glass	3.5%	3.7%
Hygiene/diapers	8.4%	9.1%
Medical	0.1%	0.1%
Textiles	4.0%	3.7%
Inert (stones, ceramics)	2.2%	1.9%
Organic	20.2%	21.9%
Screening < 25 mm	46.2%	45.7%
Total:	100%	100%
Recyclables	18.9%	17.7%
Organic total	56.2%	58.4%
Useless	24.9%	23.9%
Household density in the container:	220 kg/m^3	230 kg/m^3

Notes:

1. The samples for analysis represented full containers at collection points.
2. The organic content of the screening for urban area is 78% and for rural area—80%.

According to the household waste composition analysis carried out in Soldanesti Rayon during the summer of 2013, about 18-19% of household waste is composed of recyclable materials. The density of household waste in the containers was 220 kg/m^3 in urban areas and 230 kg/m^3 in rural areas.

Innovation and Success Factors

The aim of the feasibility study is a detailed analysis of the investment envisaged for the inter-municipal solid waste management center, considering all components of the entire ISWMS as a whole (including waste collection and composition).

Constraints

This feasibility study exclusively refers to the single investment plan for an inter-municipal solid waste management center. Scopes beyond this task were not addressed.

Sustainability

N/A

Impact	A new inter-municipal waste management company is being developed at the moment in the studied area. As shareholders of the new company, municipalities have already received waste management equipment at a total cost of about MDL 22.87 million (EUR 1.35 million). The activity of the company will contribute to local economy development and to developing the waste management sector in the project area. Simply the returning of valuable recyclables into the economic circle will generate revenues of about MDL 9.6 million (EUR 0.56 million) by 2020, which flow into the service area from outside. Indirect economic development effects are expected for agricultural sector, in particular for the subsistence farmers with their small strips of land. The compost produced at the SWM center can become an affordable alternative to mineral fertilizers and can improve the profitability of micro farming, which suffers from low yields due to the lack of fertilizers and machinery.
Gender Aspect	The provision of waste management service to the population within the project area is a social and environmental project rather than a commercial one. With the Project implementation, the access of population in the area to organized waste management services will increase from about 28-33% in 2013 to more than 95% in 2014. Taking into consideration that women and children are usually more involved in household activities, including the activities related to waste disposal, the increase of access of the population to organized waste management services will mostly benefit these groups of citizens.
Lessons Learned	Waste composition analysis should be an activity undertaken on a regular yearly basis in order to provide reliable data that PUs and LGs can use to improve their performance in SWM.
Replicability	N/A

12. MONTENEGRO- Waste Composition Analysis at PUC Communal Services—Bar

1) Good Practice General Information

Title of the Good Practice	Waste Composition Analysis at PUC Communal Services—Bar, Montenegro
Location/Geographical Coverage	Municipality of Bar, Montenegro 42° 6′ 0″ N, 19° 6′ 0″ E  Google map image of the location/geographical coverage is recommendable.
Implementing Institution/ Organization	Municipality of Bar, Montenegro, PU Communal Services—Bar

Contact Person	Predrag Ristović, Director of Communal Services Department Bulevar revolucije bb, Poslovni centar, Kula A Phone: +38230313957 jp.komunalno.bar@t-com.me
Publication Date	February 2015
Author(s)	Danijela Djurovic

2) Good Practice Specific Information

Period of Implementation	The waste composition analysis was performed once in January 2014, within a period of 5 days
Introduction	PUC Communal Services—Bar has been reorganized and functioning this way since 1991. There are several departments within the PUC: Communal Services, Housing, Public Services, Public Transportation, Greenery and Service Area. PUC Bar does not have its own sanitary landfill, but it uses the nearby regional sanitary landfill financed by the World Bank, for two municipalities—Bar and Ulcinj. This sanitary landfill has been in operation since July 2012. The Law on Waste Management of Montenegro, first adopted in 2005 with strict deadline for municipal sanitary landfills to be constructed (end of 2008), has produced lots of problems for the Municipality of Bar and its citizens. Within the period from 2009 until July 2012, PUC Bar collected all waste from the city and transported it to the regional sanitary landfill in the capital of Montenegro – Livade in Pogorica, traveling the distance of 55km one direction. Also, the tipping fee (gate fee) for all waste disposed at Livade Landfill was 72 €/t, which was an enormous expense not just for PUC but the whole Municipality. In this period, the Law was amended and some deadlines were postponed, making a new window of opportunities for the Municipality of Bar that grasped the possibility and jointly with the Municipality of Ulcinj constructed a new sanitary landfill Možura, in operation since July 2012. Insufficient data regarding waste quantity and morphology, as well as the obligation of waste disposal at regional landfills accompanied by transport and disposal fees has raised in-company awareness. The idea was to roughly determine the morphology of waste, respecting recyclables especially, i.e. the percentage of recyclable waste out of the whole waste collected, and to estimate possible cost reduction with cost benefit and the market for recyclables. That was the main reason for implementing the PUC decision to organize waste analysis in January 2014. The waste analysis was conducted by five-day sampling at determined locations respecting the differences in the whole city, as well as the population's numbers and structure within the area. The sampling was conducted at 3 locations: Topolica, Bar city center – 2 underground containers with a capacity 3m^3 each and one sampling location in Virpazar, a rural area, or more likely a suburban area—1 container with 1.1m^3 capacity.

Statistical Information	◢ The area of the Municipality involved in SW data collection is 285 km2, out of the total Municipality area of 598 km2 ◢ The Municipality of Bar has a population of 40,037 according to the 2011 Census. ◢ Number of households covered by SW services – 24,238 ◢ The percentage of coverage with services related to solid waste management is 47% ◢ Amount of waste collected and disposed at the regional landfill Možura in 2014 – 22,273t. ◢ Number of vehicles (trucks, tractors etc.) – 23, but details are not available ◢ Collection system employed: door-to-door collection and curb collection ◢ Number of metal/plastic containers (capacity in liters/m3) a) Containers of 1.1m^3 – 675 b) Containers of 5-7m^3 – 81 c) Containers of 3m^3 (undergound)—5 ◢ Number of household plastic bins (capacity in liters/m3) – not in use ◢ Type of collection is door-to-door & curb collection & common street containers ◢ Frequency of collection 1) Winter time – city center twice a day, rest of the Municipality once a day 2) Summer time – whole urban part of the Municipality twice a day, as well as tourist areas such as Sutomore, Čanj, Šušanj, Veliki Pijesak and Utjeha ◢ Recycling bins in use are for plastic (PET), AL cans and paper & cardboard, all together 80 pcs. There is a total of 7 Green Islands, 5 in the urban part of Municipality, 1 in Virpazar old settlement and 1 in Utjeha – suburban area ◢ Use of collection bags – not in use
Stakeholders and Partners	Beneficiaries of the Good Practice are all the citizens of Bar Municipality covered with SW services, Bar Local Government and PUC Communal Services—Bar. All the analysis and implementation of the Good Practice was organized and performed by PUC Bar.
Methodology	The Methodology used for determining the quantity and morphology of solid waste could be considered as based on SWA—Tool - European standard for the characterization of municipal solid waste—the European Commission or ASTM standard for determining the composition of unprocessed municipal solid waste—U.S. standard, but the representatives of PUC Bar were not fully aware of the existence of any of these methodologies. The methodology is not legally prescribed. Waste categories proposed in the European Waste Catalogue are partially transposed in the national legislation. According to the National Waste Management Plan, these categories are recognized: ◢ Organic waste (food leftovers, yard waste, leaves, grass, branches, trees) ◢ Paper and cardboard (newspapers, books, commercial prints, archives, packaging paper, cleaning paper, etc.) ◢ Plastic (packaging material, boxes, bottles, bags, foils and other products made of plastic) ◢ Glass (bottles, jars, drinking packages, flat glass) ◢ Metal (metal cans, aluminum cans, drinking cans, aluminum, steel and other metals) ◢ Textile and leather ◢ Other (dirt, ash, street cleaning residue, dust, unidentified materials) There is a new National Waste Management Plan still in draft, waiting to be adopted for 2 years now. The new NWMP will have a better selection of waste categories according to the EU legislation. Selection of waste categories in PUC Bar is done in accordance with NWMP but mainly focusing on possible recyclables with available close markets. Therefore, these categories of waste were selected: organic waste and other, metal – aluminum cans, plastic – PET bottles and nylon & foils, glass, paper and cardboard, tetra packs and combined materials (packaging).

Regarding the socio economic status, when determining the sampling process in terms of areas and population, this background information was considered:

General Description of the Area Under Investigation

- Identification of the area or portion of the area to be assessed, its location and surface area;
- Identification of various relevant geo-political districts and levels at which relevant waste management data may be available.

General Population Information

- Number of inhabitants
- Number of households
- Income (such as GNP per capita)
- Types and proportions of residential structures

General Waste Management Information

- General description of the organization of the waste management system
- (actors, responsibilities etc.)
- Type of waste streams produced and collected, especially mixed residual
- Household, and co-collected household and commercial waste
- Description of waste container systems in use such as household bins
- Communal bins and bin storage capacities
- Average numbers of households and/or persons using bins
- Total bin volume; spatial distribution of bins; collection intervals
- Method of waste collection, such as open truck or refuse collection vehicles
- Compactor and types of waste collected
- Description of collection rounds
- Weighing data of collection vehicles
- Disposal methods, such as landfilling, energy from waste, reuse/recycling and
- Types of waste and quantities involved

PUC Bar uses the regional landfill, and all waste delivered to the landfill by truck is weighed. PUC Bar has all records of waste produced and delivered to the landfill on monthly and yearly bases. However, the analyses of waste measurements are done separately from the landfill and only for the purposes of PUC Bar. Therefore, the sampling, registration and measurements were conducted on the PUC Bar premises respecting mostly the above mentioned criteria for sampling. The location for performing the waste analysis and sorting was covered and protected from external conditions and was sufficient enough for the waste collected. Only the sorting and analysis at one location in Virpazar was conducted in an open area with no coverage which was proven not to be good because of the bad working conditions.

The following equipment was used:

- electronic scales
- waste bins (of 120l for sorting the waste in categories)
- a wheelbarrow for moving the sorted waste within the location)
- accessory tools (shovels, nylon, scissors, knives for cutting bags, etc.)

Sampling locations were selected respecting the above mentioned preconditions. 3 locations for the entire Municipality of Bar were selected; 2 were in the urban part of the Municipality and 1 in the rural-suburban part. 2 urban parts reflected the population differences, where one part has consistent population all year long, a number of citizens with very few commercial premises, and the other part is a more commercial and tourist oriented area. Respecting the differences and characteristics of the entire Municipality, these 3 locations were selected for sampling, supposing they would provide an insight into the entire Municipality. The location in Virpazar (the rural-suburban area) has 3 1.1m^3 containers. 2 urban locations have 1 underground 3m^3 container each.

The method of sampling and analysis of waste can be described as follows:

- An empty truck collects the waste from underground containers and delivers it to the location for sorting
- Workers with wheel barrows move the waste within the location for sorting
- Workers manually select each category of waste and deposit it in separate waste bins
- After sorting, each fraction is scaled separately. The result of the analysis is the amount of waste in every category
- Results are registered in a form that contains the date of sampling, the total amount of waste and information on the net weight of each fraction of waste.

Figure 1. Waste sorting, Virpazar

Figure 2. Emptying an underground container

Figure 3. Underground container of $3m^3$

Figure 4. Underground container of $3m^3$, second location

Figure 5. Green Island in Bar

Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS

In Bar PUC, regarding the IT system for data collection, there are only Microsoft office tools in use, mainly excel, except for the Accounting Department. There is no database or any records of a waste management system different from the old-fashioned paper and filer. Representatives of PUC did not have any knowledge of the SWIS Model or CFM Model and thus, did not have any experience with their implementation or usage. Representatives of PUC do not have direct contact with the Association of Municipalities (UoM) since the communication goes through municipality members. They were very surprised and interested when they were introduced to the NALAS Tools SWIS & CFM. It is expected that these Models will be used by the representatives and employees of this PUC.

Waste Analysis

The total volume of sampling material was 675 kg of waste. Since the analysis is conducted mainly to find out the percentage of recyclables which have a regular market, the waste categories are paper/cardboard, aluminum cans, plastic bottles, hard plastic, nylon and foils, tetra-pack, glass and organic material and the other alltogether. Biodegradable waste was not taken as a separate category. The results of the analysis are shown in the table.

Waste category	Absolute shares (kg)	Percentage shares (%)
Organic waste and the other	319.55	47.35 %
Metal -Aluminum cans	8.37	1.24 %
Hard plastic	105.96	15.70 %
Nylon and foils	6.02	0.89 %
Glass	48.96	7.25 %
Paper and cardboard	129.20	19.15 %
PET bottles	41.85	6.20 %
Tetra-pack and combined materials (packaging)	14.98	2.22 %

The analysis has shown that a large amount of waste could be easily recycled and thus recovered from the waste stream (50.43% has markets already established within the region). Therefore, PUC Bar has obtained 100 containers for recyclables (80 pcs in use at the moment). Also there are 7 Green Islands throughout the Municipality. Benefits are already seen, as around 1,200 tons of waste were separately collected and marketed (mostly paper, cardboard and plastic bottles) in the year 2014. The reduction in waste sent to the landfill obtained cost cuts for gate fee (of around 15,000 Euros).

Innovation and Success Factors

The analysis of waste quantity and morphology conducted in PUC Bar could be considered as an initial attempt for good practice and it is the only one available in Montenegro's waste companies. To my knowledge, similar analysis was conducted for the purpose of preparing the National Waste Management Plan by a consultant in Podgorica, but the data were not available. The representatives of PUC Bar have found differences in waste morphology between their measurements and the recommendations written in the old National Waste Management Plan, as well as with the data usually used by the Ministry Department for Environment. The quality of data retrieved from the analysis in Bar is questionable, but also the old National WMP contains estimated data.
The plan of PUC Bar is to conduct similar analyses during 2015 in the months of: March, July and November, considering that these monts (periods of the year) are most recomendable, keeping in mind the differences and fluctuation of population (tourist season; dry seasons, etc). They are hoping to have better and more reliable data after that. Such data should help them to start a program of better recycling and as a result reduction of landilled waste.

Constraints

At the location in Virpazar suburban area, the analysis was conducted in an open space with no cover, during quite a cold day. Therefore, there was some reluctance and uneasiness of the workers.

Sustainability	Keeping in mind that the waste analysis conducted in PUC Bar is an initial attempt of "Good Practice", the question of sustainability could be addressed in a better organized analysis. If we consider institutional sustainability, then the existing stuff needs to be motivated and well informed to conduct the analysis properly. Also, all the measurement is done with the company's resources in stuff and equipment, with some initial expenses for an electronic scale and grid. Also, economic and environmental sustainability could be obtained when considering waste analysis as a precondition for employing or improving the recycling as an activity. There are benefits for the market of recyclables, but also cost cuts for lower quantity of waste disposed at landfills and paid for as a gate fee.
Impact	At this point, there is not enough impact on the end users – citizens, through the practice conducted, since it needs to be quite improved. However, this practice has ensured an initial starting point for waste analysis and the potential for better organization of waste recycling in the Municipality. Also, this analysis could be used by the Local Government to establish a better Waste Management Plan, as well as a LEAP, i.e. Local Environmental Action Plan.
Gender Aspect	The General Director of Communal Services Company is female, responsible for managing 297 employees.
Lessons Learned	The key messages learned are that there is great potential in waste and there are lots of opportunities to maximize work performance and reduce costs. Rising environmental awareness as a part of everyday work, but also better organization within the company and implementation of an organized recycling regular activity is a long-term but necessary goal to improve the company's performance. Previous practice with estimates, done by all waste companies in Montenegro, has proven not to be reliable, and therefore, not good enough a base for planning.
Replicability	Since it has been explained before that this practice is an initial attempt for good practice, there is no use of describing a potential model for replicability. However, the basic preconditions that could apply are: organized waste collection in the Municipality, willingness and awareness of stuff and management to perform similar activities, as well as training of workers for the activities.

SERBIA- Analysis of Waste Quantity and Morphological Composition, Municipality of Aleksandrovac

13.

1) Good Practice General Information

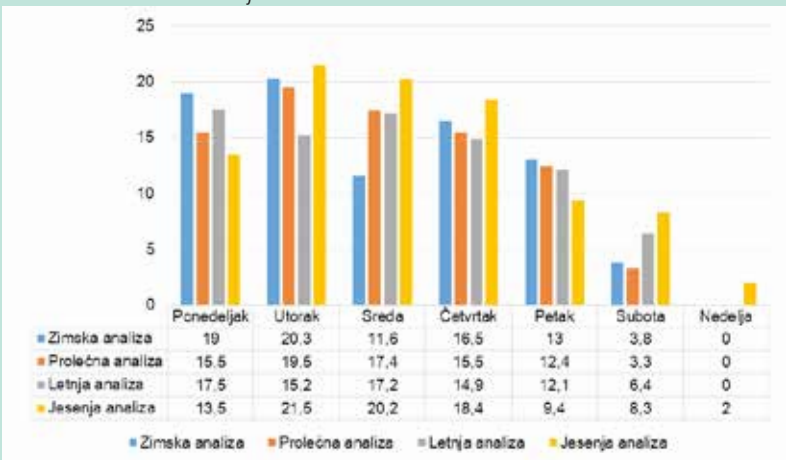
Title of the Good Practice	Analysis of Waste Quantity and Morphological Composition, Municipality of Aleksandrovac
Location/Geographical Coverage	Municipality of Aleksandrovac, Serbia
Implementing Institution/Organization	State the full name of the local government and public utility involved in the realization of the good practice.
Contact Person	Milan Crnoglavac, PUC Aleksandrovac
Publication Date	2 March, 2015
Author(s)	Zoran Jakovljev, PM – Project GIZ IMPACT Miodrag Gluščević, Head of the Department for Communal Services, Urban Planning and Environment, SCTM

2) Good Practice Specific Information

Period of Implementation	From 1 January 2014 to 31 December 2014
Introduction	The Ministry in charge of Environmental Protection engaged the Faculty of Technical Sciences, Department of Environmental Engineering and Safety and Health from Novi Sad in 2008 to realize the Project named "Determination of Waste Composition and Estimates of Waste Quantity" in order to define the Strategy on Secondary Raw Materials in the Sustainable Development of the Republic of Serbia. The aim of the Project was to define the Methodology for determining the amounts and composition of municipal waste. Based on the measurements from 10 representative municipalities in 4 different seasons, as well as the extrapolation of results to the entire country, the first real indication of the quantity and composition of waste generated in Serbia was obtained. The Methodology for assessment of generated amounts and determination of morphological composition of municipal waste in Serbia was developed in cooperation between the Faculty of Technical Sciences from Novi Sad and the German Organization for International Cooperation-GIZ through analyses of methodologies and experiences from other countries, which were then made applicable to Serbian conditions. Based on the Methodology and the Law on Waste Management of the Republic of Serbia („Official Gazette of RS", No. 36/09, 88/10) the Government adopted **The Rulebook on the Methodology for Collection of Data on Composition and Quantities of Municipal Waste at the Territory of Local Self-Government Units** ("Official Gazette of RS", No. 61/10). The specific case of Good Practice has emerged as part of the IMPACT Project which has been implemented in Serbia since 2012. IMPACT Project is encouraging the use of resources from waste and wastewater in selected pilot municipalities and is supporting local authorities in Serbia by introducing circular economy principles. The aim is to demonstrate that an adapted environmental policy can become a valuable economic factor. The Project supports partnerships between local authorities through regional solutions. It also helps local authorities to develop investment projects that are ready for bank financing or are designed to attract private investment. It encourages the development of circular economy strategies in combination with municipal environmental communication and public participation activities. Engaging the public in all steps of planning aims to make people more interested in environmental protection at the local level. The Project also tends to send a strong message to other municipalities in Serbia through its activities in the pilot areas. In five pilot municipalities, the Project strengthened the management skills of local authorities and public utilities, enabling them to measure quantities and morphology of waste, plan, implement and introduce new waste systems. The Project was the first in Serbia to systematically support the use of material flow analysis (MFA) at the local authority level and develop adapted scenarios for new waste management systems.

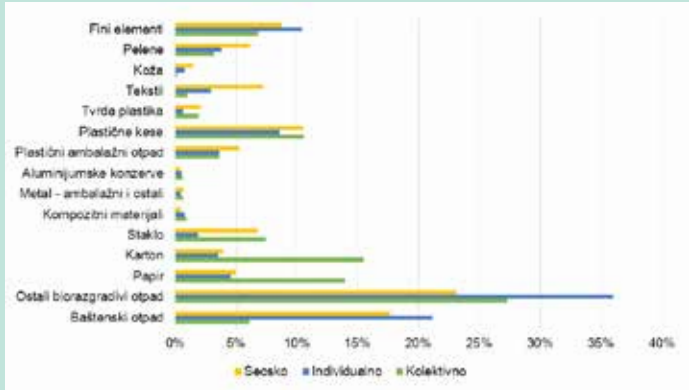
Statistical Information	◢ Area of the Municipality involved in SW data collection in km² **387 km²** ◢ Number of inhabitants **15,905** ◢ Number of households **4,762** ◢ Percentage of coverage with services related to solid waste management **57% in total—81% urban area and 53% rural area** ◢ Number of vehicles (trucks, tractors etc.) **6 vehicles** ◢ Collection system employed? **40 employees** ◢ Number of metal/plastic containers (capacity in liters/m3) **245 containers, 1.1 m³ each** **38,245 containers, 5 m³ each** ◢ Number of household plastic bins (capacity in liters/m3) **1,879 bins of 120l** ◢ Type of collection (door-to-door; curb collection; common street containers…) **curb collection; common street containers** ◢ Frequency of collection **Once a week** ◢ Number of recycling bins? Green Islands? **20 PET wire containers** ◢ Use of collection bags: no
Stakeholders and Partners	Who are the beneficiaries of the Good Practice? **Municipality of Aleksandrovac, public administration, citizens** Who are the users of the good practice? **PUC Aleksandrovac** Who are the institutions, partners, implementing agencies, and donors involved in the Good Practice, and what is the nature of their involvement? **GIZ – financier** **FTS – conducting the waste sorting analysis**

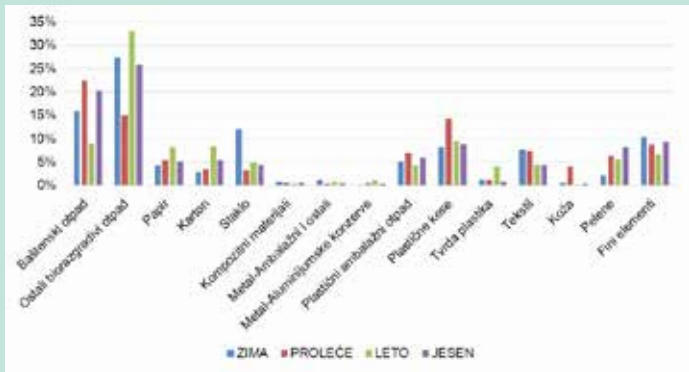
Methodology	**The Rulebook on the Methodology for Collection of Data on Composition and Quantities of Municipal Waste at the Territory of Local Self-Government Units** ("Official Gazette of RS", No. 61/10). Please provide short presentation of the methodology/process (related, but not limited to: Determination of waste categories; Material sorting protocol—dependence of waste composition on the time of the season, waste generators, method and frequency of sampling; Sampling, registration of data and measurements; etc.) The Methodology itself comprises two segments: The first segment is to perform measurements of generated waste quantities in a selected municipality of Serbia. In agreement with the utility company from the Municipality, weighing will be performed by firstly weighing the tare weight of all waste trucks used for waste collection, i.e. before sending them out to collect waste. This will be followed by weighing the same trucks while covering their regular routes of waste collection, and when their capacity is full (gross weight). All weighing is to be done using a weighbridge. It is important to mention that weighing is done in the period covering waste collection for each household in the Municipality (mostly one week). The obtained net weight of waste collected is important for further analysis. The collected waste is then transported to the official disposal site, and the procedure is repeated until every waste truck has finished collection, weighing, and disposal envisaged for the day according to the regular collection schedule within the utility services in the given municipality. Thus, the key items for the process of determining the quantity of municipal waste generated can be expressed by the following theses: 1. Utility companies should provide all necessary conditions for weighing of generated waste (provide a weighbridge, monitoring of measurement, recording the results); 2. Measurement of truckloads for waste transportation is carried out on the weighbridge; 3. If the PUC does not possess a weighbridge, it needs to provide conditions for measurement of trucks on a weighbridge at other economic entities within the Municipality; 4. First, it determines the weight of empty trucks (tare weight). Measurement of empty trucks is done only once, weighing of empty trucks is also possible to be done after discharge; 5. Then, trucks collect waste in accordance with their regular routes and established programs; 6. When a truck for waste collection is filled to its full capacity, it goes to the location where there is a weighbridge; 7. Conducting the measurement of its gross weight and recording the data on a special form; 8. The form includes the date of truck measurement, trucks' tare weight and gross weight obtained by the measurement of the given trucks that day; 9. After the measurements and data recording have been carryied out, the truck is driven to the landfill, where it empties its contents; 10. The truck then continues its waste collection as scheduled, and the measuring cycle is repeated using the previous steps until the truck ends its waste collection from all locations planned by its daily schedule; 11. The same procedure is performed in the same way, measuring the mass of all trucks collecting waste that day; 12. Weight measuring of municipal waste is carried out for a period of 7 days. The second segment represents the sampling and analysis of waste morphological composition for the given municipality. For this purpose, it is necessary to bring waste samples of approximately 300-500 kg in weight to the site for analysis (preferably covered). Samples shall be taken from two types of urban zones (individual and collective housing), as well as rural parts of the Municipality. 1) Urban zone – individual houses (settlements with houses that own a yard/garden, situated in the urban zone) 2) Urban zone – collective housing and commercial areas (settlements with blocks of residential buildings); 3) Rural zones within the Municipality (settlements with houses that own a yard/garden, situated in a rural zone of the Municipality) Ideally, analyses should be performed on a weekday on which the trucks are weighed and the total amount of generated waste is determined, to make the timelines similar and data comparable. Samples from each sector are to be taken randomly, by choosing different streets from different sectors, and then, by randomly choosing the bins/containers to be analyzed which will be representative of the sector selected. The desired volume of 500 kg is reached by collecting waste from about 50 bins of 80l, 35 bins of 120l, or 6-8 containers of1.1 m^3. Having collected the samples from bins and containers, the waste truck takes them to the site determined for sorting and analysis.

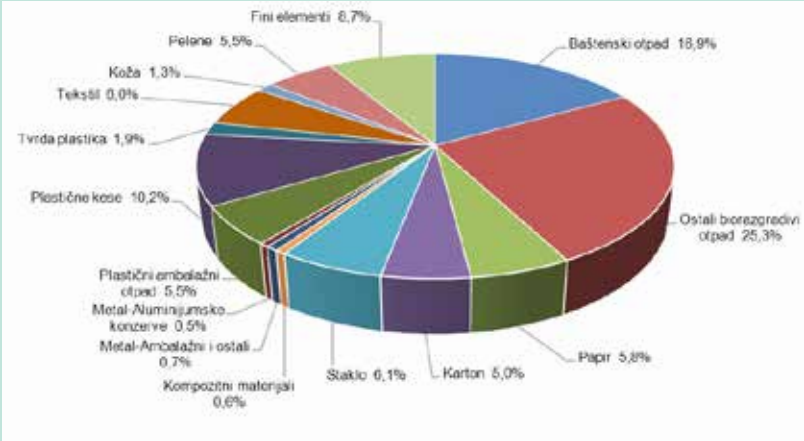
	It should be mentioned that each sample is analyzed individually, depending on the sector observed. Operations of sorting and analysis of waste morphological composition would take no more than 3-5 workers, a technician, and an engineer in charge of supervision of the process. Waste is separated manually in 15 different fractions, i.e. each fraction is weighed separately, according to the proposed waste catalogue. As a result of such analysis we get the amount of waste categories listed in kg, and the total quantity of the sample, then the sample volume in m^3 or in l, and also for the purpose of clarity and ease of access to the data obtained, usually the share of each type of waste is given in percentages, which is usually graphically displayed. It should be noted that each sample is analyzed separately in relation to the zone observed. In this way, the process of determining the quantity and morphological composition of waste per municipality in the preferred zone is completed. Data obtained are analyzed and their evaluation is performed thus helping local authorities to carry out effective treatment and management of such waste. Forms used in the process and photos are attached.
Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS	Not in usage. SWIS was tested with data gathered through measurements. It is not applicable. Table "Origin of Waste by Type" is not in line with the current record keeping practice of the PUC – there is no data on quantities of waste generated by companies and institutions, because waste collection systems of PUC are integrated for all service users. GIZ IMPACT Project started with the development of a methodology for commercial waste analysis. Two test sampling campaigns were conducted in 2014. Please present the recommendations for improvement of the model/system. Recommendations from GIZ IMPACT are attached to this document. If you did not use the model/system at all, please specify the reasons behind. Based on our assessment and detailed analysis of SWIS Model, it can be concluded that there is a need to upgrade it, as it is not in line with the current practice and legal framework in Serbia. The tool was developed in 2007 and the Law on Waste Management and accompanying regulations were adopted in 2009 and 2010. In order to establish a local information system which is compatible with the national one, which is the responsibility of SEPA, it is necessary to harmonize the existing model. It will contribute to the improvement of reporting on waste from the local to the national level. Moreover, several technical errors were detected. However, by manual entering the changes in the system, certain limitations could be overcome, but not completely.
Waste Analysis	Please provide the final results on quantity and morphology of the waste of the last measurement over the year (from all measurement seasons) related to waste categories in kg and % shares. The results of waste weighing using the truck scales in the Municipality of Aleksandrovac within all four cycles of analysis indicate that the amounts collected on a weekly level amount to somewhat more than 86 tons of waste. 

Projection of the results obtained in all four cycles of truck weighing using the truck scale helps conclude that the amount of waste collected by PUC Aleksandrovac on an annual level amounts to about 4,500 tons. Having in mind that the rate of coverage of the population by the service in this Municipality amounts to 57.2%, it can be concluded that at the level of the entire Municipality, the generated amount of waste surpasses 7,880t/y. Thus, the difference between the total amounts of waste generated and collected, i.e. 3,376 tons of waste ends up in illegal dumps. Regarding the results obtained in relative values, i.e. per inhabitant per year, i.e. per day, it can be concluded that an average inhabitant of the Municipality of Aleksandrovac generates some 298 kg of waste a year, or 0.82kg a day, which is somewhat less than the average national figure obtained after the recent research.

Municipality of Aleksandrovac	Winter analysis	Spring analysis	Summer analysis	Autumn analysis	AVERAGE
Amount of waste collected by the PUC (t/p.a.)	4,412	4,378	4,367	4,890	4,512
Total number of population in the municipality			26,522		
Number of population covered by collection services			15,170		
Percentage of coverage by organized collection			57.2%		
Generated amount (kg/per capita/year)	291	289	288	322	298
Generated amount (kg/per capita/day)	0.80	0.79	0.79	0.88	0.82
Total for the entire Municipality (t/y)	7,714	7,654	7,636	8,549	7,888





	Taking into consideration the results of all analyses conducted and having observed all average values, it may be observed that the organic fraction, comprising garden and other biodegradable waste, has the largest share, with a total mass share of 42.2%. Fine elements also have a significant share in the composition of waste, with almost 9%, which is an unfavorable result having in mind the fact that this component of waste is not suitable for any kind of treatment. When it comes to recyclable fractions, the ones with the largest shares were plastic bags with 10.2%, glass (6.1%), paper (5.8%), plastic packaging waste (5.5%), and cardboard with 5.0%. It needs to be noted that textile is also present with a rather large share of 6.0%, and diapers with 5.5%, as well as leather which, with its 1.3% share surpasses the regular values. The remaining components of waste do not have significant values and range within the expected. 
Innovation and Success Factors	Data collected through measurements contribute to better planning and improvement of the new waste management system in the Municipality of Aleksandrovac. The data were used as a basis for MFA – Material Flow Analysis. MFA was also conducted by GIZ IMPACT Project. Using STAN software, four scenarios for a future waste management system were developed. Scenarios foresee the introduction of waste separation at source, recycling, composting and anaerobic digestion as treatment methods within the municipality aiming to use waste as a resource and to reduce amount of waste that is going to be disposed at landfills.
Constraints	Insufficient capabilities of PUC and local administration
Sustainability	Sustainability of the action should be ensured through a participatory process that includes all relevant stakeholders from the public, civil and commercial sector as well as consultations with citizens. Furthermore, an appropriate waste management scenario should envisage appropriate cost covering fees for the waste collection. The scenarios should be covered by appropriate local decisions and documents.
Impact	• Improved quality of communal services • Improved planning skills of local authority representatives • Improved level of public participation and awareness of environmental issues
Gender Aspect	The gender aspect was not covered specifically but rather indirectly through workshops and consultations with various citizen groups like children and retired people.
Lessons Learned	The success of such an approach relies on strong and constant political support imbedded in local decisions and documents. Broad public participation is needed through organized campaigns. The cost covering principle is essential. Application of simple methods is welcomed as an opener of the process.
Replicability	Replicability is possible especially in municipalities of similar size but also with some modifications in others, as well. Certain preconditions need to be met, like strong and constant political support imbedded in local decisions and documents, broad public participation, the cost covering principle applied.

14. SERBIA- No More Dumpsites! Municipalities of Bajina Bašta and Sjenica

1) Good Practice General Information

Title of the Good Practice	No More Dumpsites!
Location/Geographical Coverage	Municipalities of Bajina Bašta and Sjenica, Republic of Serbia
Implementing Institution/Organization	PUC "12 Septembar" Bajina Bašta, PUC "Vrela Sjenica".
Contact Person	Ivan Marković, Local Coordinator Dušana Višića 28, 31250 Bajina Bašta, Serbia Phone: 069 825 9805 mail: klerbb2011@gmail.com
Publication Date	May 2015. Final Report of the Project.
Author(s)	Velimir Mitrović, Exchange 4 Project Coordinator Miodrag Gluščević, Head of the Department for Communal Services, Urban Planning and Environment, SCTM

2) Good Practice Specific Information

Period of Implementation	Introduction of primary selection of waste in the Municipality of Bajina Basta and completion of the first phase of restoration of the Municipal Landfill "Okučije". 3 February 2014–3 February 2015.
Introduction	Local communities in rural areas of Western Serbia do not have adequate capacity to manage waste in accordance with applicable international standards and national regulations, which came into force in the year 2010. Before the Regional Waste Management Center and Landfill Duboko were opened in 2011, there was no comprehensive system of collection and treatment of waste for the entire territory of the Municipality of Bajina Basta, especially in rural and mountainous areas, as well as for most of other municipalities in the region. As a consequence, municipalities in the region had a significant number of illegal dumps on their territories of undefined size and waste composition. Furthermore, an additional problem was the large amount of floating waste which is trapped and collected in the artificial lake Perucac on the Drina River upstream from the Municipality of Bajina Basta. The floating waste comes from the territory of Montenegro and Bosnia and Herzegovina originating from dumpsites on the Drina River banks and is particularly voluminous with high waters. Until the Regional Waste Management Center and Landfill Duboko were opened, waste was deposited at dumps that do not meet safety standards. In accordance with the National Strategy on Waste Management, Bajina Basta and Sjenica have been part of the Regional Waste Management Systems Duboko (RWMS Duboko) since 2005 and started depositing waste there after the opening of the Landfill. The sustainability of the systems in this region depends on the maximization of primary selection of certain waste fractions at the source and its treatment. A key reason for intervention in these municipalities was the necessity for development of a methodological model of primary waste selection in accordance with the needs and standards of the Regional Waste Management System (RWMS) Duboko and local communities. The Good Practice was implemented with the help of the EU funded Project Exchange 4. The success of the intervention relayed heavily on skilled workers from PUC "12 Septembar", volunteers and citizens of the Municipalities of Bajina Bašta and Sjenica. The overall budget of the Project was € 176,206.21 with a contribution of donor funds of € 151,378.70.
Statistical Information	◢ Area of the Municipality involved in SW data collection in km2 at the time of Project implementation: Bajina Bašta Municipality - 673 km2; Sjenica – 1,059 km2. ◢ Number of inhabitants: Bajina Bašta Municipality – 26,022; Sjenica – 34,500. ◢ Number of households: Bajina Bašta – 3,014; Sjenica–3,643. ◢ Percentage of coverage with services related to solid waste management ◢ Number of vehicles (trucks, tractors etc.): Bajina Bašta – 2 tractors with trailers and 4 AB ROL containers for collection and proper transport of selected waste. ◢ Collection system employed: 9 new posts (collecting workers in the transport of selected waste) ◢ Number of metal/plastic containers (capacity in liters/m3): 90 containers of 1.1m3 and 7 containers of 5m3 in Sjenica. ◢ Number of household plastic bins (capacity in liters/m3): Not relevant ◢ Type of collection (door-to-door; curb collection; common street containers…): Not relevant ◢ Frequency of collection: Not relevant ◢ Number of recycling bins: Green Islands: Not relevant ◢ Use of collection bags: 261,000 polyethylene bags in Bajina Bašta.
Stakeholders and Partners	The beneficiary of the Good Practice, and at the same time, the user of the results is the Regional Landfill Duboko and citizens. The Good Practice was implemented with the help of the EU funded Project Exchange 4, skilled workers from PUC "12 Septembar", volunteers and citizens of the Municipalities of Bajina Bašta and Sjenica.

Methodology	The quantity and morphology of waste are determined by measuring the weight using calibrated scales in newly built centers for waste management. In cases where such resources are not available, the method of estimation is applied based on the extrapolation of data from the centers that have the means to measure and have similar socio-economic parameters. These issues are regulated by the Law on Waste and accompanying regulation, Law on Packaging Waste and a set of environmental laws from the year 2010. In Bajina Basta, the primary selection of waste on site is organized by PUC "12 Septembar", including separation of dry and wet fractions which are accepted in special shipping containers for loading onto trucks for transport to RMMS Duboko. The wet fraction is sent for sanitary disposal, and the dry fraction is directed to the Center for final selection of secondary raw materials. Residual waste safe for disposal goes to the Landfill. Waste quantities and morphology are documented in the Book of Daily Waste Reception; Diary of the SWMS for final selection of fractions (metal, plastic, rubber, paper and cardboard, textiles...) Currently, Sjenica has no means of measuring quantitative and qualitative parameters of waste from its territory, except the amount of ash that is obtained on the basis of official data on the amount of fuel coal produced from the Mine Štavalj. The Mine Štavalj is the sole supplier of the Municipality of Sjenica. With the purchase of containers of 1.1m^3, the separation of ash began, which prevents ignition of containers in the streets.
Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS	PUC "12 Septembar" has software which performs the extraction of financial indicators of waste management, synthetics and their analytics and enables the creation of annual financial plans with different scenarios and cash flows. It enabled perennial monitoring of the performance of designed and planned monetary and material flows in the waste management business. In this way, the harmonized monitoring of waste streams is possible at RWMS Duboko, which consequently provides the data useful for creating high quality business relationships between PUC "12 Septembar" and the regional system. SWIS is not used.
Waste Analysis	**Quantities of selected dry fraction per month, in tons** October 2014 — 3.06 November 2014 — 20.16 December 2014 — 33.02 January 2015 — 32.05 February 2015 — 31.20 March 2015 — 52.50 April 2015 — 51.35 May 2015 — over 55.00 Increase in quantities per month is due to the increase of the service scope.
Innovation and Success Factors	The practice of determination of municipal waste quantity and composition significantly improved waste management. Citizens of Bajina Basta have no longer problems with the dump at the bank of the river.

Constraints	The major challenges faced by LG and local PUC in the introduction of selection are of financial and legal nature. "Polluter pays" and "extended producer responsibility" principles envisaged by the laws of 2010 are not sufficiently recognized, developed and introduced. For the moment, revenues collected in this way are not properly directed to the areas where greatest costs for waste primary selection are incurred. Evaluation of financial saving related to additional landfill space as a consequence of the reduced amount of waste by primary selection is not performed. This means that there is no adequate fund depreciation. The cost of removal and disposal does not include costs of landfill construction, thus not providing the funds to build a new one after the current one is exhausted. Penal policy is not in place. Inspectors have the right to impose fines on violators' sites under the otherwise well-conceived legal provisions on obligations of legal entities. Court proceedings in this regard are ineffective or completely inapplicable.
Sustainability	As a consequence of the decision to enter into primary waste selection, the removal, transport and disposal of waste has been increased. Additional fees related to this increase of service are to cover the extra costs. In addition, in the Municipality of Bajina Basta, the financial viability of the Project is ensured by inclusion of additional sources of income and business models. Institutional sustainability is ensured by adopting legal acts (Waste Management Plan, municipal decisions on waste, Medium-term Development Plan of PUC "12 Septembar").
Impact	Citizens of Bajina Basta were given the opportunity to actively participate in solving the common problem of waste management. Results were achieved through obtaining free plastic bags for selection and through clear guidelines for separation. This significantly improved the system of acquisitions and disposal. During the Project, 112 t of selected waste was collected, with a growing trend after the completion of the Project.
Gender Aspect	Not applicable
Lessons Learned	The Municipality of Bajina Basta reformed its system of waste collection within a calendar year, by the introduction of primary selection for all persons in the urban part of the Municipality. Eligibility selection of over 95% for legal entities and over 80% for individuals. The key lesson learned: Citizens accept the action of waste selection at source in high numbers, and quickly acquire this habit; Higher resistance to change exists in institutions responsible for improvement of the system; The key point of the reform is to establish direct communication between the PC and citizens using door-to-door and continuous repetition of information through the local media; Volunteers are an important engine of action.
Replicability	The Model is replicable if certain preconditions are met: ◢ Political support at the local level and recognition of waste management issues as a priority; ◢ Capacity building training for municipal and PUC staff by experts from the Municipality of Bajina Basta and PUC "12 Septembar", who obtained certain knowledge and skills during Project implementation; ◢ Adoption of appropriate planning documents like the set of documents for the introduction of new waste management technologies; ◢ Decision-making about the appropriate municipal waste that will define the responsibilities of all participants in the waste management scheme; ◢ Establishment of mechanisms for funding under the "polluter pays" and "extended producer responsibility" principles.

15. SERBIA- Waste Quantity and Composition Analysis in the Municipality of Svilajnac

1) Good Practice General Information

Title of the Good Practice	Waste Quantity and Composition Analysis in the Municipality of Svilajnac in the frame of the Project 'IMPACT – Municipal Waste and Wastewater Management' implemented by GIZ
Location/Geographical Coverage	Municipality of Svilajnac, Republic of Serbia 
Implementing Institution/Organization	Public Utility Company "Morava"
Contact Person	Zlatana Filipović, Water Treatment Technologist PUC Morava, 84 Svetog Save Street 35210 Svilajnac Phone: 00 381 35 322 245
Publication Date	March 2015
Author(s)	Maša Šašić, GIZ IMPACT – Municipal Waste and Wastewater Management Project Manager Miodrag Gluščević, Head of the Department for Communal Services, Urban Planning and Environment, SCTM

2) Good Practice Specific Information

Period of Implementation	March 2013 – November 2014
Introduction	The Ministry in charge of Environmental Protection engaged the Faculty of Technical Sciences, Department of Environmental Engineering and Safety and Health from Novi Sad in 2008 to realize the Project named "Determination of Waste Composition and Estimates of Waste Quantity" in order to define the Strategy on Secondary Raw Materials in the Sustainable Development of the Republic of Serbia. The aim of the Project was to define the Methodology for determining the amounts and composition of municipal waste. Based on the measurements from 10 representative municipalities in 4 different seasons, as well as the extrapolation of the results to the entire country, the first real indication of the quantity and composition of waste generated in Serbia was obtained. The Methodology for assessment of amounts generated and determination of morphological composition of municipal waste in Serbia was developed in cooperation between the Faculty of Technical Sciences from Novi Sad and the German Organization for International Cooperation-GIZ through analyses of methodologies and experiences from other countries, which were then made applicable to Serbian conditions. Based on the Methodology and the Law on Waste Management of the Republic of Serbia ("Official Gazette of RS", No. 36/09, 88/10) the Government adopted The Rulebook on the Methodology for Collection of Data on Composition and Quantities of Municipal Waste at the Territory of Local Self-Government Units ("Official Gazette of RS", No. 61/10). The specific case of Good Practice has emerged as part of the IMPACT Project which has been implemented in Serbia since 2012. IMPACT Project is encouraging the use of resources from waste and wastewater in selected pilot municipalities and is supporting local authorities in Serbia by introducing circular economy principles. The aim is to demonstrate that an adapted environmental policy can become a valuable economic factor. The Project supports partnerships between local authorities through regional solutions. It also helps local authorities to develop investment projects that are ready for bank financing or are designed to attract private investment. It encourages the development of circular economy strategies in combination with municipal environmental communication and public participation activities. Engaging the public in all steps of planning aims to make people more interested in environmental protection at the local level. The Project also tends to send a strong message to other municipalities in Serbia through activities in the pilot areas. In five pilot municipalities, the Project strengthened the management skills of local authorities and public utilities, enabling them to measure quantities and morphology of waste, plan, implement and introduce new waste systems. The Project was the first in Serbia to systematically support the use of material flow analysis (MFA) at the local authority level in order to develop adapted scenarios for new waste management systems.
Statistical Information	◢ Area of the Municipality involved in SW data collection—326 km2 ◢ Number of inhabitants – 23,551 ◢ Number of households – 8,321 ◢ Percentage of coverage with services related to solid waste management – 100% ◢ Number of vehicles (trucks, tractors etc.) – 6 trucks, 3 tractors ◢ Collection system employed: Pick up system. ◢ Number of metal/plastic containers (capacity in liters/m3)—1,215 metal containers of 1.1 m3 and 50 mash containers for PET of 1.1 m3 ◢ Number of household plastic bins (capacity in liters/m3) 450 120l bins and 100 140l bins ◢ Type of collection—door-to-door and common street containers ◢ Frequency of collection – 2-3 times a week, depending on the area ◢ Number of recycling bins – 50; Green Islands – no. ◢ Use of collection bags: No bags are used for waste collection.

Stakeholders and Partners	Who are the beneficiaries of the good practice? Municipality of Svilajnac, public administration, citizens Who are the users of the Good Practice? PUC Morava Who are the institutions, partners, implementing agencies, and donors involved in the Good Practice, and what is the nature of their involvement? GIZ – financier
Methodology	**The Rulebook on the Methodology for Collection of Data on Composition and Quantities of Municipal Waste at the Territory of Local Self-Government Units** ("Official Gazette of RS", No. 61/10). The Methodology itself comprises two segments: The first segment is to perform measurements of quantities of waste generated in selected municipalities of Serbia. In agreement with the utility company from the Municipality, weighing will be performed by firstly weighing the tare weight of all waste trucks used for waste collection, i.e. before sending them out to collect waste. This will be followed by weighing the same trucks while covering their regular routes of waste collection, and when their capacity is full (gross weight). All weighing is to be done using a weighbridge. It is important to mention that weighing is done in the period covering waste collection for each household in the municipality (mostly one week). The obtained net weight of waste collected is important for further analysis. The collected waste is then transported to the official disposal site, and the procedure is repeated until every waste truck has finished collection, weighing, and disposal envisaged for the day according to the regular collection schedule within utility services in the given Municipality. Thus, the key items for the process of determining the quantity of municipal waste generated can be expressed by the following theses: 1. Utility companies should provide all necessary conditions for weighing of generated waste (provide a weighbridge, monitoring of measurement, recording of results); 2. Measurement of truckloads for waste transportation is carried out on a weighbridge; 3. If the PUC does not possess a weighbridge, it needs to provide conditions for measurement of trucks on a weighbridge at other economic entities within the Municipality; 4. First, the weight of empty trucks (tare weight) is determined. Measurement of empty trucks is done only once, weight of empty trucks can also possible be done after discharge; 5. Then, the trucks collect waste in accordance with their regular routes in their established programs; 6. When a truck for waste collection is filled to its full capacity, it goes to the location where there is a weighbridge; 7. Conducting the measurement of its gross weight and recording the data on a special form; 8. The form includes the date of truck measurement, truck's tare weight and gross weight obtained by measurement of the given trucks that day; 9. After the measurements and data recording have been carryied out, the truck is driven to the landfill, where it empties its contents; 10. The truck then continues its waste collection as scheduled, and the measuring cycle is repeated through the previous steps until the truck completes its waste collection from all locations planned by its daily schedule; 11. The same procedure is performed in the same way, measuring the mass of all trucks collecting waste that day; 12. Weight measuring of municipal waste is carried out for a period of 7 days. The second segment represents the sampling and analysis of waste morphological composition for the given municipality. For this purpose, it is necessary to bring waste samples of approximately 300-500 kg in weight to the site for analysis (preferably covered). Samples shall be taken from two types of urban zones (individual and collective housing), as well as rural parts of the Municipality. 4) Urban zone – individual houses (settlements with houses that own a yard/garden, situated in the urban zone) 5) Urban zone – collective housing and commercial areas (settlements with blocks of residential buildings); 6) Rural zones within the Municipality (settlements with houses that own a yard/garden, situated in a rural zone of the Municipality)

Ideally, analyses should be performed on a weekday on which the trucks are weighed and the total amount of generated waste is determined, to make the timelines similar and data comparable. The samples from each sector are to be taken randomly, by choosing different streets from different sectors, and then by randomly choosing the bins/containers to be analyzed which will be representative of the sector selected. The desired volume of 500 kg is reached by collecting waste from about 50 bins of 80l, 35 bins of 120l, or 6-8 containers of 1.1 m^3. Having collected the samples from bins and containers, the waste truck takes them to the site determined for sorting and analysis. It should be mentioned that each sample is analyzed individually, depending on the sector observed. Operations of sorting and analysis of morphological composition of waste would take no more than 3-5 workers, a technician, and an engineer in charge of supervision of the process. Waste is separated manually in 15 different fractions, i.e. each fraction is weighed separately, according to the proposed waste catalogue.

As a result of the analysis, we get the amount of waste categories listed in kg, and the total quantity of the sample, then the sample volume in m^3 or in l, and also for the purpose of clarity and ease of access to the data obtained, usually the share of each type of waste is given in percentages, which is usually graphically displayed. It should be noted that each sample is analyzed separately in relation to the zone observed. In this way, the process of determining the quantity and morphological composition of waste per municipality in the preferred zone is completed. Obtained data are analyzed and their evaluation is performed, thus helping local authorities to carry out effective treatment and management of such waste.

Please provide samples of the forms used in the process and photos.

Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS

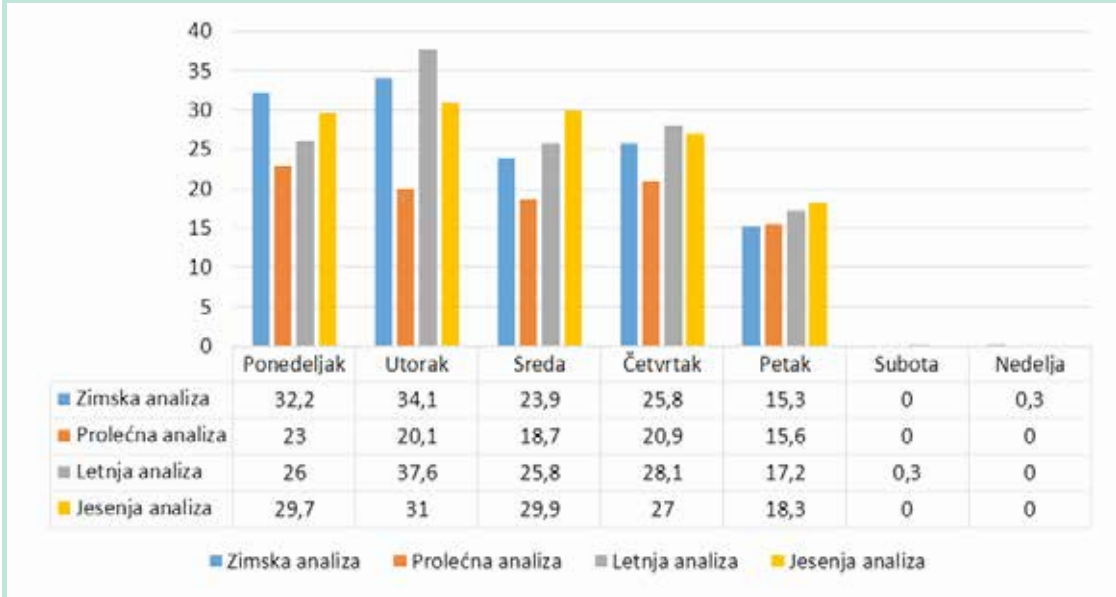
Based on our assessment and detailed analysis of the SWIS Model, it can be concluded that there is a need to upgrade it, as it is not in line with the current practice and legal framework in Serbia. The tool was developed in 2007 and the Law on Waste Management and accompanying regulations were adopted in 2009 and 2010. In order to establish a local information system which is compatible with the national one, which is the responsibility of SEPA, it is necessary to harmonize the existing model. It will contribute to the improvement of reporting on waste from the local to the national level. Moreover, several technical errors were detected. However, by manual entering the changes in the system, certain limitations could be overcome, but not completely. It is necessary to harmonize the system by developers regarding the above recommendations. Besides, it is advisable to improve and upgrade the tool by additional waste management indicators (waste moisture, calorific value, biogas potential, etc.) calculated on the basis of literature data. This kind of information system will support decision makers to find the most sustainable solution for a waste management system at the local level.

Waste Analysis

Please provide the final results on quantity and morphology of the waste of the last measurement over the year (from all measurement seasons) related to the waste categories in kg and % shares.

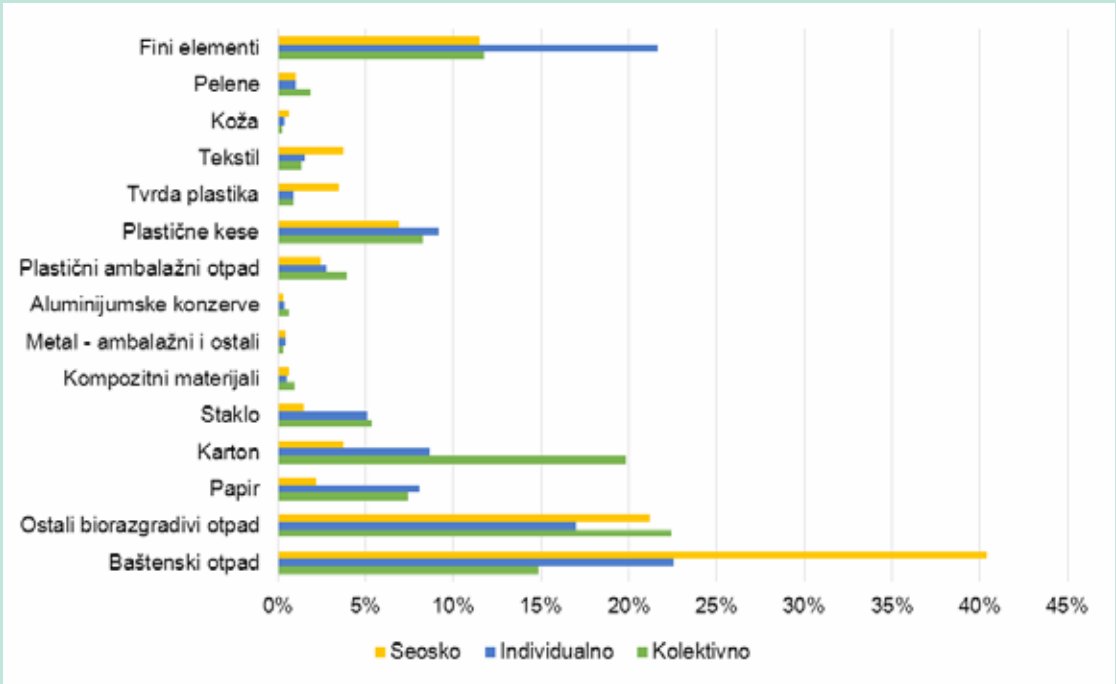
The results of waste weighing using the truck scales in the Municipality of Svilajnac within all four cycles of analyses indicate that the amounts collected on a weekly basis amount to somewhat more than 125 tons of waste.

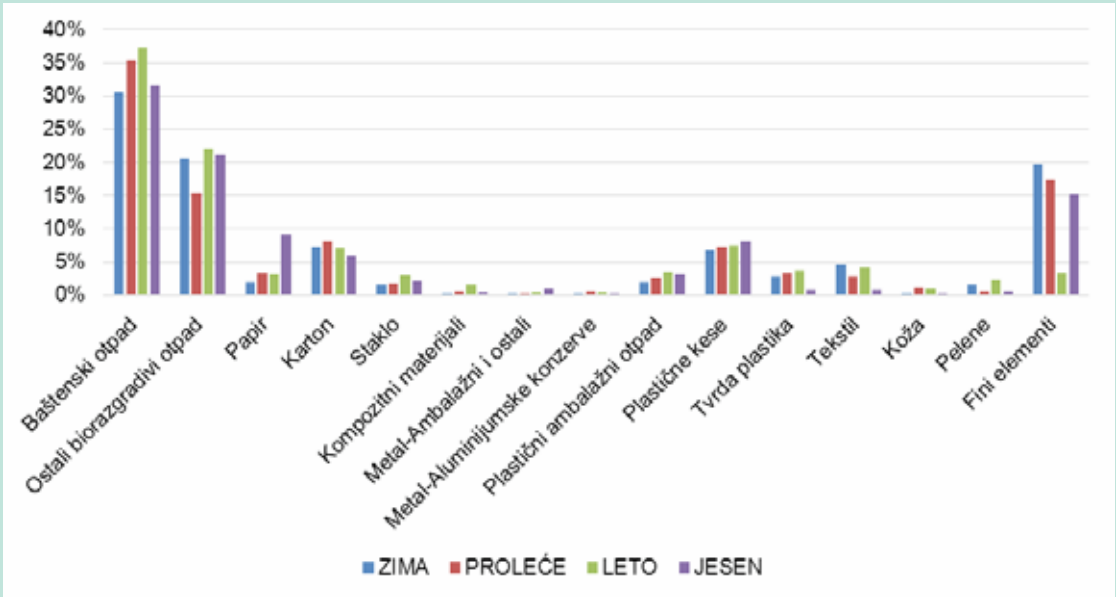
Weekday	Number of measurements				Quantity weighed (t)			
	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn
Monday	6	6	7	5	32.2	23.0	26.0	29.7
Tuesday	5	5	8	4	34.1	20.1	37.6	31.0
Wednesday	5	4	7	6	23.9	18.7	25.8	29.9
Thursday	5	5	5	5	25.8	20.9	28.1	27.0
Friday	6	4	4	4	15.3	15.6	17.2	18.3
Saturday	/	/	1	/	0	0	0.3	0
Sunday	1	/	/	/	0.3	0	0	0
TOTAL:	28	24	32	24	131.5	98.4	134.9	135.8



Projection of the results obtained in all four cycles of truck weighing using the truck scale helps conclude that the amount of waste collected by PUC Aleksandrovac on an annual basis amounts to about 6,680 tons. Having in mind that the rate of coverage of the population by the service in this Municipality amounts to 100%, it can be concluded that at the level of the entire Municipality, the generated amount of waste is the same – 6,680 t/y. Regarding the results obtained in relative values, i.e. per inhabitant per year, i.e. per day, it can be concluded that an average inhabitant of the Municipality of Aleksandrovac generates some 284 kg of waste a year, or 0.78 a day, which is somewhat less than the average national figure obtained after the recent research.

The Municipality of Svilajnac	Winter analysis	Spring analysis	Summer analysis	Autumn analysis	AVERAGE
Amount of waste collected by the PUC (t/p.a.)	7,008	5,283	7,182	7,233	6,677
Total number of population in the municipality	23,551				
Number of population covered by collection services	23,551				
Percentage of coverage by organized collection	100%				
Generated amount (kg/per capita/year)	298	224	305	307	284
Generated amount (kg/per capita/day)	0.82	0.61	0.84	0.84	0.78
Total for the entire municipality (t/y)	7,008	5,283	7,182	7,233	6,677


Fini elementi
Pelene
Koža
Tekstil
Tvrda plastika
Plastične kese
Plastični ambalažni otpad
Aluminijumske konzerve
Metal - ambalažni i ostali
Kompozitni materijali
Staklo
Karton
Papir
Ostali biorazgradivi otpad
Baštenski otpad
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
Seosko
Individualno
Kolektivno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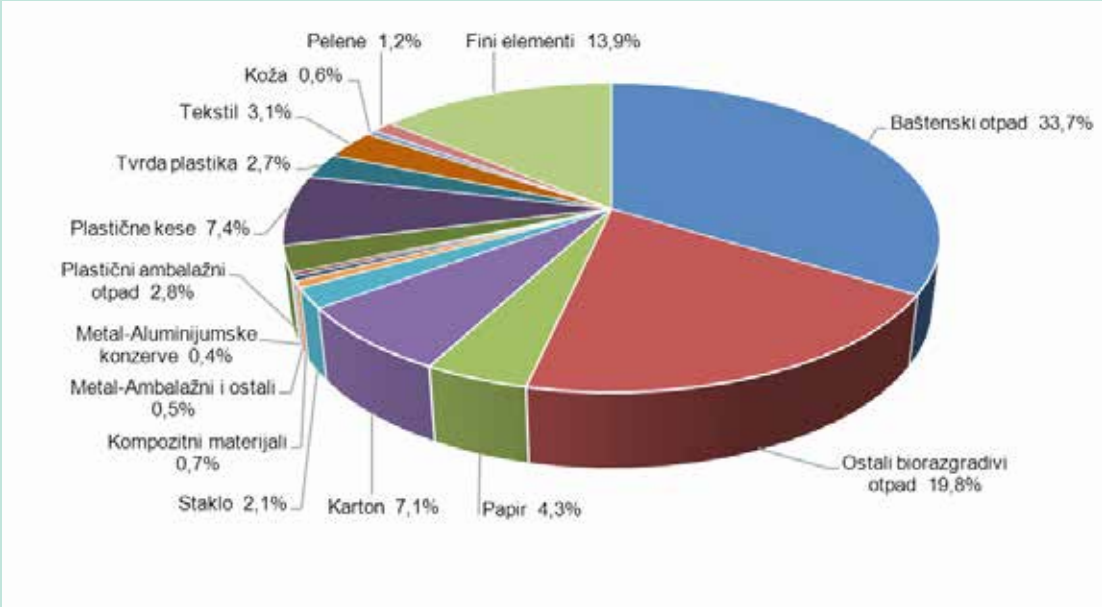
Baštenski otpad
Ostali biorazgradivi otpad
Papir
Karton
Staklo
Kompozitni materijali
Metal-Ambalažni i ostali
Metal-Aluminijumske konzerve
Plastični ambalažni otpad
Plastične kese
Tvrda plastika
Tekstil
Koža
Pelene
Fini elementi
ZIMA
PROLEĆE
LETO
JESEN

Taking into consideration the results of all analyses conducted and having observed all average values, it may be observed that the organic fraction, comprising garden and other biodegradable waste, has the largest share, with the total mass share of 53.5%. Fine elements also have a significant share in the composition of waste, with almost 14%, which is an unfavorable result having in mind the fact that this component of waste is not suitable for any kind of treatment. When it comes to recyclable fractions, the ones with the largest shares were plastic bags with 7.4%, cardboard with 7.1%, paper (4.3%), plastic packaging waste (2.8%), high density plastic with 2.7% and glass (2.1%), as well as leather which, with its 1.3% share surpasses the regular values. The remaining components of waste do not have significant values and range within the expected.



Innovation and Success Factors

In 2006, the Municipality of Svilajnac started its cooperation with GTZ and that was when the first analysis of waste composition took place. In order to get more representative results, 100% of municipal area had to be covered with a waste collection system. Since 2008, the Local Government in cooperation with PUC started negotiations with local communities in the villages of the Municipality of Svilajnac about establishing a waste management system that would benefit each and every citizen. In every village, there was a meeting organized by the local community with Local Government Authorities. After a series of meetings, citizens agreed that in order to save the environment and keep it clean, they need to cooperate with PUC and dispose waste properly. Local Government provided metal containers of 1.1 m^3 and by 2011 every village was covered. Local Government also took an extra effort to clean most of the dumpsites and re-cultivate these areas.

In 2012, the Municipality of Svilajnac started its cooperation with GIZ IMPACT as one of the first municipalities that have 100% of its area covered by waste collection. This provided better quality of life to all our citizens and also we have more representative results of waste composition analysis.

Constraints	One of the biggest challenges was the return of the dumpsites. These dumpsites are uncontrolled and we do not know the amount and composition of waste. Certain areas that were cleaned and re-cultivated transformed into dumpsites again. PUC cleaned these dumpsites with heavy machinery on a monthly basis but they always returned. Big signs that said "Forbidden to dump waste here" were put and Environmental Inspection had a task to patrol these areas and penalize every citizen that was seen dumping the waste here. This helped for all those dumpsites that were near roads but there are still dumpsites in some inaccessible areas where it is almost impossible for trucks and tractors to approach. Also, PUC provided more containers to the villages. The second challenge concerned the revenue from waste collection services. Households with low or no income at all could not afford to pay fees for waste collection. They were put in a special social program in cooperation with the Center for Social Work and Local Government. Once a year, the Center for Social Work issues a certificate for those families that are in the program, so PUC does not charge them for waste collection. PUC is reimbursed for the services by the Local Government.
Sustainability	Sustainability of the action should be ensured through a participatory process that would include all relevant stakeholders from the public, civil and commercial sector as well as consultations with citizens. Furthermore, an appropriate waste management scenario should envisage appropriate cost covering fees for waste collection. The scenarios should be covered by appropriate local decisions and documents.
Impact	The most important impact on citizens is clean and safer environment. Establishing a waste management system was an expensive task for the Local Government, but it was easily implemented thanks to the good cooperation with citizens. Most of the produced waste is controlled by PUC and put at one controlled dumpsite since the Municipality of Svilajnac does not have a sanitary landfill. 2% of the waste is recycled and we hope to increase this number in the next few years. One dumpsite was re-cultivated and turned into a playground. The area that has once been dirty and unsafe is now a place where children play. It showed to the local community that it is never too late to change bad old habits and make room for improvement.
Gender Aspect	Gender aspects were not covered specifically but rather indirectly through workshops and consultations with various citizen groups like children and retired people.
Lessons Learned	The most important message is to establish good communication with citizens. Local Government needs to hear all the problems regarding the wellbeing of citizens and they can solve them together. Also, it is important to explain well to the citizens how this change would affect them, how they would benefit and what would happen if nothing changes at all. Citizens have to learn first what a waste management system is, why it is important and what they could do to improve it. This could be done through meetings in local communities, but also in written forms like fliers or through TV and radio shows. Local Government needs to cooperate not only with local communities, but also with all other institutions like schools, health centers, libraries, cultural centers, NGOs and the media, so they could all participate in making decisions on a municipal level.
Replicability	Replicability is possible, especially in municipalities of similar size but also with some modifications in others, as well. Certain preconditions need to be met like strong and constant political support imbedded in local decisions and documents, broad public participation, cost covering principles applied.

16. TURKEY- Integrated Solid Waste Management, the City of Kocaeli

1) Good Practice General Information

Title of the Good Practice	Integrated Solid Waste Management
Location/Geographical Coverage	The City of Kocaeli/Turkey
Implementing Institution/Organization	Kocaeli Metropolitan Municipality (member of MMU)
Contact Person	Mr. Huseyin KILIC Manager of Waste Management Department, Kocaeli Metropolitan Municipality +90 262 331 83 91
Publication Date	
Author(s)	

2) Good Practice Specific Information

Period of Implementation	
Introduction	Prior to the Metropolitan Municipal Law No.5216 enacted in 2004, activities such as separate collection at source, training & awareness raising, etc. that should be carried out by district and town municipalities within the scope of the Environment Law No. 2872, could not be realized at the desired level due to the lack of technical personnel and insufficient financial sources. In addition, solid waste collected by district and town municipalities was disposed without any record-keeping in remote storage areas within municipal boundaries. Because of this reason, databases could not be established on either recyclable waste or other solid waste. As of 2004, when the Metropolitan Municipal Law No.5216 came into force, proper disposal of municipal solid waste by authorities has been ensured. Thus, activities for separate collection of waste at source (recoverable type packaging waste, used frying oils, waste batteries, electrical and electronic waste, etc.) have been carried out by district municipalities, companies/facilities licensed by the Ministry of Environment and Urbanization and authorized organizations under the coordination of Kocaeli Metropolitan Municipality. By means of this legislative regulation, the dumpsites within the borders of the city have been closed and all wastes generated within the borders of the city have been disposed in sanitary landfills. As a result of the activities conducted, a regular registration system and data flow has been enabled and data on waste quantity and morphology have started to be recorded. Having a database on waste quantity and morphology is of paramount importance to plan the facilities, manpower and equipment (storage container, indoor waste box, etc.) needed for establishing a solid waste management system and determining the waste quantity and morphology.
Statistical Information	◢ Area of the Municipality involved in SW data collection in km2 : 3,505km2 ◢ Number of inhabitants: 1,722,795 ◢ Number of households: 598,731 ◢ Percentage of coverage with services related to solid waste management: %100 ◢ Number of vehicles (trucks, tractors etc.): Activities for collection and transportation of municipal solid waste are conducted by district municipalities through 164 hydraulic compression garbage trucks. Throughout the city, waste management service is provided with 15 street sweeping vehicles and 32 packaging waste collection vehicles. Furthermore, during the tourism season, 2 coast cleaning vehicles are used. ◢ Collection system employed: The rate of using containers for collection of solid waste, throughout the whole city, except Golcuk Municipality, ranges between 70% and 100%. The rate of collection by bag reaches up to 50% only in Golcuk Municipality. ◢ Number of metal/plastic containers (capacity in liters/m3): 62,030 solid waste containers. ◢ Number of household plastic bins (capacity in liters/m3): ◢ Type of collection (door-to-door; curb collection; common street containers…): Common street containers. The rate of using containers for collection of solid waste, throughout the whole city, except Golcuk Municipality, ranges between 70% and 100%. The rate of collection by bag reaches up to 50% only in Golcuk Municipality. ◢ Frequency of collection: The frequency of collection in urban centers is daily. Outside the city center it is 1-2 times a week. ◢ 6,520 packaging waste storage containers. Throughout the city, 4 "Waste Bringing Centers" are already established and operational. ◢ Usage rate of bags is 50% for the collection of household waste within the borders of Golcuk District.
Stakeholders and Partners	The beneficiaries of the Good Practice are households and industrial facilities (waste producers). The users of the Good Practice are District Municipalities, Collection, Separation, Recovery, Recycling Facilities licensed by the Ministry of Environment and Urbanization, Authorized Organizations by the Ministry of Environment and Urbanization, Waste Disposal Facilities, Universities

Methodology

The Methodology[1] for determining the quantity and morphology of solid waste is legally prescribed. "Solid Waste Characterization Circular" under No. 2007/10 prepared by the Ministry of Environment and Urbanization was released within the scope of municipal waste composition.

In the context of Circular No. 2077/10 about "Solid Waste Characterization and Solid Waste Disposal Facilities Information Update" prepared by the Ministry of Environment and Urbanization, municipal solid waste characterization analysis has been done twice a year, in the summer and winter seasons, since 2008, in order to represent the region and season by metropolitan municipality. The results of the studies are submitted to the Ministry of Environment and Urbanization until the end of February each year under the coordination of Provincial Directorates of Environment and Urbanization.

Under the Circular No. 2077/10, four groups of household wastes from low-income, middle-income and high-income areas, as well as from markets are separately collected (Monday and Tuesday) by district municipalities within the city. Collected wastes are separately dumped at the area where the characterization will be done. Then, under the supervision of the technical staff of Metropolitan Municipality, approximately 1 ton of waste is taken from each group into the volume container of 0.5 m^3 and then again separated into categories specified in the relevant circular. Wastes divided into categories are weighed on scales and results are recorded.

Sample of the form used in the process.

Name of Municipality/Union		City		Population Served		Waste Quantity (tons/year)		Person Who Filled in the Form		Phone	
KOCAELİ METROPOLITAN MUNICIPALITY											
ANNEX–3. Waste Weighing Form (Average-2014)											
COMPOSITION OF SOLID WASTE	Income Level											
	Low			Middle			High			Market		
Kitchen waste	Gross	Tare	Net	Gross	Tare	Net	Gross	Tare	Net	Gross	Tare	Net
Paper												
Carton												
Bulky carton												
Plastic												
Glass												
Metal												
Bulky metal												
Waste slectric and electronic equipment												
Hazardous waste												
Garden waste												
Other non-combustibles												
Other combustibles												
Other combustible bulky waste												
Other non-combustible bulky waste												
Other												
Ash (including dust, sand and stone)												

[1] For example: SWA Tool—European standard for the characterization of municipal solid waste—the European Commission, ASTM standard for determining the composition of unprocessed municipal solid waste—U.S. standard etc.

Using IT Systems for Data Collection and Sorting with Particular Attention to SWIS

SWIS was not used at all.

Waste Analysis

The final results on quantity and morphology of the waste of the last measurement over the year (from all measurement seasons) related to the waste categories in kg and % shares.

2014- THE CITY OF KOCAELİ GENERAL WASTE CATEGORISATON (%)					
Waste Composition	DÜŞÜK	ORTA	YÜKSEK	ÇARŞI	ORT.
Kitchen waste	57.75	57.76	55.16	54.26	56,44
Paper	5.03	4.01	7.72	7.96	6,11
Carton	2.51	2.60	2.03	2.32	2,25
Bulky carton	0.00	0.00	0.12	0.00	0,03
Plastic	9.45	10.65	10.37	11.34	10,23
Glass	3.56	4.13	3.97	4.92	4,06
Metal	0.73	1.36	0.97	1.00	1,02
Bulky metal	0.00	0.00	0.00	0.00	0,00
Electric and electronic equipment waste	0.09	0.67	0.49	0.30	0,39
Hazardous waste	0.89	0.92	1.12	1.25	1,03
Garden waste	1.09	2.95	0.87	0.61	1,34
Other non-combustibles	0.00	0.00	0.05	0.00	0,01
Other combustibles	15.60	12.81	15.50	16.05	15,17
Other combustible bulky waste	0.00	0.00	0.00	0.00	0,00
Other non-combustible bulky waste	0.00	0.00	0.00	0.00	0,00
Others	0.00	0.00	0.00	0.00	0,00
Ash (including dust, sand and stone)	3.31	2.14	1.63	0.00	1,91
TOTAL	100.00	100.00	100.00	100.00	100,00

Innovation and Success Factors	
Constraints	Solid waste management is a high-cost activity. However, according to "Full Cost Basis", the necessary financing by solid waste producers for fulfillment of these services is not possible within the current legal regulations. The "Regulation on Procedures and Principles in Determining Tariffs for Wastewater Infrastructure and Municipal Solid Waste Disposal Facilities" was prepared by the Ministry of Environment and Urbanization in 2010; however, major problems have been experienced so far in the implementation of this regulation.
Sustainability	For the sustainability of activities carried out within the scope of waste management and in order to attract attention to this issue, to raise and spread environmental awareness, training and awareness-raising activities have been carried out in households using the door-to-door method, in primary schools and civil society organizations. In addition, these activities are supported by public spots. An Opinion was delivered to the Ministry of Environment and Urbanization to put training and awareness-raising activities into the national education curricula.
Impact	Complaints related to the environment decreased in the years following the fulfillment of these services, and positive feedback has been received for the fact that recoverable wastes have been added to the economy.
Gender Aspect	
Lessons Learned	A good database should be established including the number of waste producers, types and amount of waste they generate, as well as waste morphology for the planning of sustainable waste management and its implementation.
Replicability	◢ To share knowledge and experience with other Local Governments, ◢ To establish related departments and employ qualified technical staff, ◢ Senior managers of Local Governments to have interest in these issues, ◢ To produce new projects in cooperation with higher education institutions