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IMPACT OF EUROPEAN WASTE MANAGEMENT TARGETS ON DEVELOPMENT OF WASTE MANAGEMENT SYSTEM - CASE OF SERBIA

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ABSTRACT: Fulfilling the waste management targets set-up in the Directives, will be challenging task for Serbia. This paper identified the drivers which will support the development of waste management system which is in accordance with the Directives goals. Foremost priority in development of waste management system will be environmental protection and building the waste management infrastructure. Strengthen the law enforcement, capacity building, increase the efficiency of current waste management system will important task in the support the development of waste management system. Financial sustainability of the system will be the most challenging task, from building the infrastructure to establishing the well-functioning system adjusted to local conditions.
Keywords: environmental protection, developing countries, Waste Management Directives

1. INTRODUCTION

In developing and "emerging" countries, like a Serbia, main driver for waste management development is transposition the European Union (EU) Directives (Wilson, 2013).
Set of EU Waste Directives and their goals, the Waste Framework Directive, the Landfill Directive and the Packaging and Packaging Waste Directives, will have a great impact on the future waste management system development in Serbia, (EC, 2008; EC, 1999; EC, 1994)
Experiences from EU countries in reaching the goals of EU Directives are different. In countries where the disposal of waste remained cheap after the Directives implementation, and there were no fees and charges established for waste disposal, the implementation of directives and waste treatment technologies has been more slowly. In countries where fees for waste disposal and taxes were introduced before the Directives implementation they gradually started to build the necessary infrastructure for waste management and successfully fulfill the goals (Lasaridi, 2009). In addition, some member states e.g. Poland, Bulgaria, Romania, Croatia still depend on landfilling and treatment options are rarely in place and therefore still a large amount of biodegradable waste is disposed of in landfills (BiPRO, 2012). Also, five development factors are identified that influence the development of waste management system, beside Directives targets (Guerro et al., 2012):

- public health and environmental protection,
- resource value of waste,
- closing the loop,
- institutional and responsibility issues and
- public awareness.

Similar to countries in south-eastern Europe (Stanic-Maruna and Fellner, 2012), waste management in Serbia suffered from long historical negligence of solid waste issues and it's focused on fulfillment minimum regarding public health.

Solid waste management system in Serbia is rudimental, include only collection, transport and direct disposal at landfill, without any pretreatment. In spite of several legal acts, which transpose the obligations from the Directives, waste management system in Serbia pose risk for health and environment (Republic of Serbia, 2010). Waste management is mainly in charge of public utility companies, which are not managed in good manner, and inefficient. Waste is disposed and non-sanitary landfills, and non-compliant landfills (dumpsites) (Stanisavljavic et al., 2012).

Weak and inefficient law enforcement mechanism, fragmented inefficient organizational structures, lack or weak capacity or motivation of staff, lack of finances for investments are few of issues responsible for undeveloped waste management system in Serbia.

From experiences of member states, Serbia will have difficulties in practical implementation and enforcement of EU waste legislation at national level, and development of waste management system, as now waste management relies on landfilling.

Main focus of this paper is to analyze the identify drivers for the development of sustainable waste management system in Serbia on example of Novi Sad waste management region (NSWMR). Also, future actions will be defined in order to support the development of waste management system.

2. METHODOLOGY

Novi Sad is the second largest city in Serbia, with approximately 350.000 inhabitants and surface area of 701,7 km^2. Novi Sad is one of the 26 regional waste management centers (Republic of Serbia, 2009), and accordingly to the Law on Waste Management, all the waste from the defined region is supposed to be treated in Novi Sad. Morphological composition of municipal solid waste in Novi Sad is in Table 1, (Vujic et al., 2010). Dominant fraction is biodegradable waste, garden waste and other biodegradable waste.

Table 1: Morphological composition of municipal waste in Novi Sad and waste quantities in 2035

MSW morphological composition	2008 (ton/ year)	2035 (ton/ year)
Garden waste	26,472	45,188
Biodegradable waste	62,399	106,514
Paper	13,236	22,594
Glass	11,345	19,366
Cardboard	13,236	22,594
Waxed cardboard	1,324	2,259
Al.-coated cardboard	1,702	2,905
Metal pack. and other	1,891	3,228
Metal – Al cans	473	807
Plastic pack. waste	7,564	12,911
Plastic bags	11,345	19,366
Hard plastic	7,564	12,911
Textiles	7,564	12,911
Leather	945	1,614
Nappies	6,807	11,620
Fine waste particles	15,127	25,822
Plastic bags	11,345	19,366
Total	189,089	322,769

Methodology applied in this article is based on requirements of EU Directives regulating solid waste management, particularly goals for reduction for biodegradable municipal waste, goals for recycling packaging waste and goals for recycling and reuse of household waste, Table 2.

Based on Directives targets we have estimated municipal solid waste quantities which need to be treated and managed properly in order to fulfill the EU waste goals. Analysis was done for the year 2035. Waste increase rate used for this analysis is 2%, based on estimation for the Novi Sad waste management region.

Table 2: EU waste targets

	Targets		
Landfill Directive	Reduction of BMW going to landfill by 25% of 1995 baseline levels by 2010	Reduction of BMW going to landfill by 50% of 1995 baseline levels by 2013	Reduction of BMW going to landfill by 65% of 1995 baseline levels by 2020
Packaging and Packaging waste Directive	By 2011 recycling of 55–80% of packaging waste		
Waste Framework Directive	Reuse and/or recycling of minimum 50% waste by weight from households		

Total generated waste in the region was grouped as follows:

» packaging waste for recycling (Re),
» biodegradable waste diverted from landfill (B).
» rest waste (Rw)

Packaging waste include: plastic (plastic packaging, plastic bags, and hard plastic), paper (cardboard, al-coated cardboard, waxed cardboard, paper), glass, metal and other (textile, nappies, leather). Biodegradable waste for recycling is generated as garden waste and other biodegradable waste, and can be treated in composting plant or anaerobic digestion plant, since both plants are proven for treatment of biodegradable waste (IPPC, 2006). Rest waste is remaining waste after packaging waste and biodegradable waste is separated and it could be landfilled or treated in incinerator.

3. RESULTS AND DISCUSSION

In 2035 total amount of municipal waste in NSWMR, with 2% growth rate, will be approximately 322.000 tons. In Table 3, are given estimated quantities which needed to be managed in order to comply with Directives.

Table 3: Estimated waste quantities base on EU targets

	Estimated waste quantities (t/year)
65% of BMW for treatment	113,776
Packaging waste streams for recycling	46,773
Rest waste	162,266
Total	322,815

In spite of "legal "progress in waste management, system is still undeveloped and at the development level where the public health is a main driver, with the focus on collection. Regarding the management of the waste, reduction of landfilling the biodegradable waste will be very hard, since all waste is landfilled. Identified waste quantities identified above will need further treatment, mainly biodegradable waste through composting or anaerobic digestion and packaging waste. Also, close of non-compliant landfills and non-sanitary landfill to comply with Landfill Directive. Based on identified drivers for development of waste management in developing countries, in NSWMR following drivers will have main impact on design of waste management system:

1. Environmental protection and public health
2. Capacity building, institutional and responsibility issues
3. Public awareness and public participation
4. Financial sustainability

In order to fulfil the foremost priority in waste management, health, and environmental protection, it would be necessary to close non-compliant landfills close current non-sanitary landfill, and build up a new sanitary landfill which is in accordance with EU landfill requirements.

Development of waste management infrastructure is necessary. As mentioned above, composting or anaerobic digestion are proven technologies for biological treatment. Composting is less demanding technically process comparing to anaerobic digestion and have lower cost. Delays in planning treatment facilities will exceed the landfill capacity, coupled with waste increase, and as a result, we will still have landfilling as only available treatment method which is least desirable from the aspect of the environment and public health (Lasaridi, 2009). Only by reallocating the landfill sites and not implementing concrete protection measures e.g. landfill taxes it will be difficult to achieve the proposed targets and protect the environment and public health.

All stakeholders must be included in future development of waste management system. Stakeholders include e.g. users and potential users, who are the waste generators as well as the 'clients' g providers, including the local municipal department or enterprise, and both the formal and informal private sectors, who actually offer the service g external agents in the enabling environment, including national government, neighboring municipalities, producer responsibility organizations and external support agencies.

Since, the public utility company (PUC) in charge of waste management and its performances and efficiency are not considered at all, it is necessary to gradually introduce and use the instruments normally deployed in the private sector to improve performances and increase efficiency as well to organize waste management system to be transparent, accountable, and their services competitive on the market.

Important aspect of successful waste management is participation of citizens. The need to improve public awareness of, and community participation in, waste management and its development has been widely recognized (Wilson, 2011). This is not financially demanding task for the local authorities, but demanding in changing the people's perception of waste and waste management. It is necessary to educate people and have promoting campaigns before introduction of e.g. separate collection of glass or paper or building new treatment facility etc. In some cases, due to emergency situations and lack of public acceptance, suboptimal solutions for waste treatment have been adopted (Lasaridi, 2009). Therefore, local government and other stakeholder need to organize promoting campaigns about waste and waste management, its importance for the society and environment.

Lack of finances is common problem for developing countries. Financial sustainability is a one of the most influencing driver in the design of the future waste management system. We can say that financial sustainability is "pushing" driver for all above discussed drivers. Cost of waste infrastructure development is important for development of the future waste management strategy. As mentioned earlier, sanitary landfill and composting are priority in order to protect the environment and health. Estimation cost are based on available data on literature. Cost of sanitary landfill and biological treatment we have based on data for Romania and Bulgaria from literature (Hogg, 2009). Capital and operational cost for sanitary landfill are 118 € and 5 € per ton of landfilled waste, respectively. Therefore, cost for sanitary landfill is 123 € per ton, Table 4. For landfill capacity of 162,266 ton, total cost is 19,958,718 €.

Cost for in-vessel composting plant are 157 € capital cost per ton and 11 € operational cost per ton, Table 4. Total cost for composting plant with 113,776 ton capacity is 19,114,368 €.

Table 4: Estimated cost for composting and sanitary landfill

	In-vessel composting	Sanitary landfill
Capital cost (€)	17,862,832	19,147,388
Operational cost (€)	1,251,536	811,330
Total (€)	19,114,368	19,958,718

Establishing the financially sustainable waste management system is challenging task, not only for Serbia. There have been numerous examples where 'proven' technologies have failed in developing countries because sufficient attention was not given to deliver a well-functioning system (Wilson et al., 2013). Important task regarding in establishing financially sustainable system is introduction of landfill taxes which is task for the local institutions which will support the development of infrastructure for waste management. Serbia as an EU candidate country, can utilize EU funds, for development of waste management infrastructure. Building new sanitary landfill and composting plant is financially demanding task, as well as closing dumpsites, and utilizing EU funds may minimize the cost.

Based on above discussion, identified drivers and tasks for the development of the waste management system in Novi Sad waste management region is given in Table 5.

Table 5: Identified drivers for waste management system development and corresponding task

Environmental protection and public health	Introduction of landfill tax to divert waste from landfill Close non-compliant landfills Building the infrastructure
Capacity building, institutional and responsibility issues	Intensive inspection and enforcement activities in order to ensure compliance with legal provisions for municipal waste management Strategy for development of waste management system
Public awareness and public participation	Local and national institution must initiate awareness raising campaigns All stakeholders must participate and have proactive participation in campaigns
Financial sustainability	Utilize available EU funding to support development of waste management infrastructure Improve performances and increase efficiency of PUC

4. CONCLUSION

The shift from current waste management practice will be difficult, but inevitable. Design of the waste management system in Novi Sad, as well in Serbia, will face the increase of municipal waste quantities, and the need to manage it properly, in order to protect the health and environment.

The establishment of an efficient and cost effective waste management system, compliant with EU Waste Management Directives, and corresponding targets, will be an onerous task, as well as large infrastructure investments in treatment technologies. Solutions need to be developed and tailored specifically to local needs and conditions.

Giving the high political priority to environmental protection, increase the national investment in this sector, will be one step forward to the development of sustainable waste management. Without creating environment and conditions which will support the development of the well-functioning waste system, implementation of waste treatments is hardly feasible, and cannot sustain in long term, as well as the whole waste management system itself. This not one-time action, but long-term commitment of the all stakeholders and responsibility of local and national institutions, and the whole society as well.

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