

Solution Methods for Irrational Waste Landfilling in Terms of Environmental Protection

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Abstract. Appropriate waste management is one of central pillars for sustainable development. Thus, it is important to understand that even waste disposal in a landfill that corresponds to all the European Union regulations could result in a threat to environmental protection. This can happen within irrational waste disposal, when valuable materials are not being extracted and the landfill lifespan is decreased. This paper is devoted to the analysis of the problem, if Latvian waste management system is rational and what actions can be undertaken in order to make it more efficient.

Keywords: environmental protection, municipal solid waste, sanitary landfills, waste management regions.

I. INTRODUCTION

The environmental policy of the European Commission intends to set standards for the handling, transport, treatment and disposal of waste in order to reduce the negative effects to human health and to the environment [1].

The main aims of waste management are: (1) to protect human beings and the environment; and (2) to conserve resources. Under the principles of sustainability, these goals, which are applied worldwide, should be achieved in a way that does not impair the wellbeing of current as well as future generations [2; 14; 15].

Latvia has already experienced a major shift in the period from 1995 to 2011, when the entire waste management infrastructure was revised and with the aid of European Union ISPA (until 2004) and Cohesion Fund totally new infrastructure was constructed. [3].

Schneider and Bogdan note, that efficient waste management is one of preconditions for sustainable development of any country. In spite of increasing share of waste that is separately collected for the purpose of recycling and recovery, the quantity of waste that finishes at the landfills is growing each year [4].

As stated in Agenda 21, environmentally sound waste management must go beyond the mere safe disposal or recovery of wastes that are generated and seek to address the root cause of the problem by attempting to change unsustainable patterns of production and consumption.

When analyzing Latvia – the disposed waste amount has experienced a decrease from 2008, which is mostly explained by three reasons: a) objective and precise waste control was introduced (waste weighting at the entrance to the landfills), b) Global economic downturn and c) high migration rates of Latvian citizens [3; 5].

Nevertheless, table 1 provides a comparison of waste generation and treatment options in the field of in waste management in the leading European countries and in the

Baltic states. From this table it can be seen, that the Baltic countries, which joined the European Union in 2004 still have very poor waste treatment, with over 75% of collected waste, going directly to landfills.

This leads to a conclusion, that the problem of rational waste treatment has not been solved yet. The figures in the paper will show, that in 2010 the rate of sorted waste in Latvia was only about 8-10%, which is very low and is directly influenced by the external circumstances, which will also be covered in the paper.

This study is meant to demonstrate the existing level of irrational waste landfilling in Latvia and emphasize the possible unreceived profit to the industry.

TABLE I
WASTE TREATMENT IN EUROPEAN COUNTRIES

2010	Household waste, kg/capita	Waste treatment, %			
		Landfilling	Incineration	Recycling	Composting
Lithuania	360	95	-	4	1
Latvia	333	92	0	8	0
Estonia	346	75	0	14	11
EU 27	513	38	20	24	18
Belgium	491	5	35	36	24
Denmark	833	4	48	34	14
Netherlands	616	1	39	32	28
Sweeden	485	1	49	36	14
Austria	591	1	29	30	40
Germany	587	0	34	48	18
Switzerland	706	-	49	34	17

II. OBJECTIVES

General aim of this paper is to provide an insight into current Latvian Waste Management System, to explain existing waste treatment option structure (with the help of household and GDP expenditure on waste treatment ratios) and to show what benefits the industry might get not only in

terms of fulfillment of European targets, but also in more tangible, monetary terms.

III. METHODS

Within this study the Authors have used the statistical data analysis, alongside with application and modelling of waste management system with STAN (subSTance flow ANalysis), developed by Vienna University of Technology. The main advantage of MFA system is that it must obey the law of conservation of matter and thus it forms a natural science base that can be cross-checked for consistency and probability [6].

IV. EXPENDITURES FOR ENVIRONMENTAL PROTECTION

As defined in the paper by Broniewicz (2011) environmental protection expenditure (EPE) is the amount of money spent on all purposeful activities directly aimed at the prevention, reduction and elimination of pollution or nuisances resulting from the production processes (or consumption of goods and services). Data on environmental expenditure are collected from the European countries through the Joint OECD/Eurostat Questionnaire on Environmental Protection Expenditure and Revenues (EPER) [7].

In the Table 2 the authors have summarized the % of GDP and Euro per capita for 2010 for Latvia and the leading countries in waste treatment, according to Eurostat data, which was also analyzed in previous study and is presented in Table 1[8].

From the table it can be seen, that the leading countries spend on average from 94 to 550 Euro per capita for waste treatment, whereas Latvia only dedicates 8.5 Euro per capita for this activity. This leads to a logical conclusion, that the treatment options are mostly limited to collection and disposal, which is also well illustrated in the Table 1.

Figure 1 provides a clear picture of average per capita expenditures in Latvia, from which it can be seen, that 0.65% of expenditures are devoted to household waste management. This fact and the data from the Table 1 are the best reflections and explanations of the existing waste management situation in Latvia. The expenditures on waste treatment have to be increased constantly until reaching the level, at which the inhabitants will be interested in waste sorting and waste prevention in the households and the industry will have sufficient resources to implement waste recycling and re-use.

TABLE II
EXPENDITURES ON WASTE TREATMENT

Country	% of GDP, 2010	EUR per capita, 2010
Latvia	0.08	8.49
Belgium	0.48	152.61
Denmark	0.66	283.47
Netherlands	1.58	551.57
Sweden	0.36	133.37
Austria	0.75	247.17
Germany	0.32	93.42
Switzerland	0.85	334.30

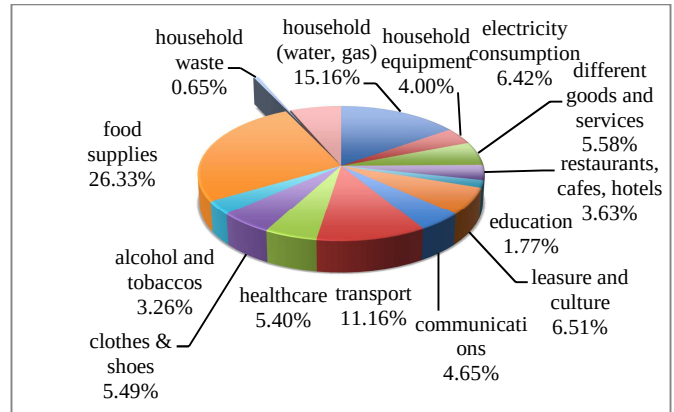


Fig.1. Structure of household expenditures per capita [14].

V. LATVIAN WASTE MANAGEMENT SYSTEM

Up to 2012 Latvia has had 11 sanitary landfills in operation. The entire constructed infrastructure was financed from ISPA and Cohesion Fund, with co-financing from 65% to 85% of the referral costs. The investments into waste management industry reached 96,661,381 Euro. Although, it is vital to mention, that the preliminary calculations were based on assumptions of constant economic development and number of inhabitants. Due to the global recession both variables, as being dependent have changed, but this did not result in the current ongoing projects in waste management field [3; 5; 9].

Table 3 provides a summary of the existing waste management infrastructure. Even within one country the regions do vary significantly, for example Austrumlatgale and Dienvidlatgale regions have only the basic infrastructure developed, comparing to a very diverse infrastructure of Piejūra region, where a project with total costs amounting to about 30 million Euro has been implemented. Main reasons for such differences lay in the fact that regions have different access to and affordability of the economic infrastructure. This also has resulted in a negative impact on current waste management system. As most of the regions took loans in order to cover the co-financing part of the projects and of course the projects were not changed during construction when the global economy experienced a downturn. Currently the landfill operators, which are the municipality-founded entities, are interested in increase of landfilled waste amount in order to keep them profitable and to be able to pay back the loans.

Overall waste amount generated in 2010 was 633 000 t. From the Figure 2 it can be seen that 50% of all collected waste is landfilled in the biggest landfill site – Getlini, in Riga region.

TABLE II
REGIONAL INFRASTRUCTURE, SOURCE [13]

	Landfill				ECO areas	Sorted waste collection areas	Waste sorting stations
	Size, ha	Cell size, ha	Cell operation time, years	Operating time, years			
Austrumlatgale	13	4,8	20	20	-	9	-
Dienvidlatgale	10,5	5,6	9-12	25	-	66	-
Maliņa	15	5,6	20	20	0	115+7 for hazardous waste	1
Ventspils	30	4,3	15	25	-	52	0
Liepāja	29,09	5,6	8,5	20	3	54	-
Rīga	87	20	15	20	-	58	1 private
Piejūra	15	5,5	10	25	-	366	4
Zemgale „Grantiņi”	3	1	6-7	6	2	313	1
Zemgale „Brakški”	5	2,5	6-7	12			
Ziemeļvidzeme	12	3,16	7	28	11	34	1

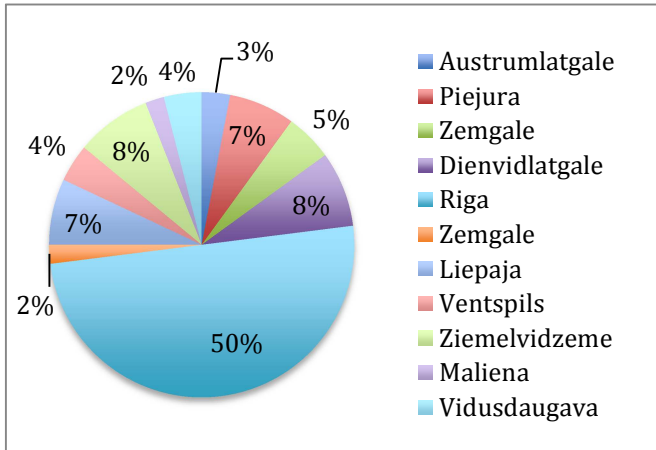


Fig. 2 Distribution of disposed waste in Latvian regional landfills in 2010 [14].

In the previous studies the authors have evaluated the existing waste management system from the economic perspective, performing ex-post feasibility analysis. This analysis has revealed, that four regions: Māliena, Piejūra, Zemgale and Vidusdaugava have negative NPV, IRR and C/B ratios [5; 9]. This is mainly explained by the fact that the regions resulted to be too small and during the recession, number of inhabitants decreased significantly, raising the investments per capita. From the perspective of economic efficiency, the above-mentioned regions have to be united

with the neighbor regions and transformed into technological parks. This assumption is also supported by the data in Figure 2, from which it is clearly seen, that five landfills receive less than 5% of total landfilled waste amount in Latvia.

VI. RESULTS OF STAN ANALYSIS

Figure 3, which has been developed with the help of STAN software, presents the general picture of Latvian waste management system, without Regional division. It is clearly seen, that mayor part – roughly 92% of total household waste collected is directed to the landfill without any pre-treatment. This leads to a conclusion, that the landfills are not rationally used and their lifespan will be much shorter, then planned.

When analyzing waste composition, over 40% of waste is organic and according to European requirements, the biodegradable fraction disposed in the landfills has to decrease by 35% from the 1995 volume in 2010, by 50% in 2015 and by 75% in 2020 [10; 14]. In order to reach such high ratios significant measures have to be taken.

A waste composition analysis has been undertaken in 4 sanitary landfills, which are already in operation since 2004-2005. These regions - Ziemeļvidzeme, Rīga, Ventspils and Liepāja already have some sorted waste collection implemented. Still the analysis has revealed, that the disposed waste contains 6% of paper, 7% of plastics, 21% of glass and 3% of metal [11].

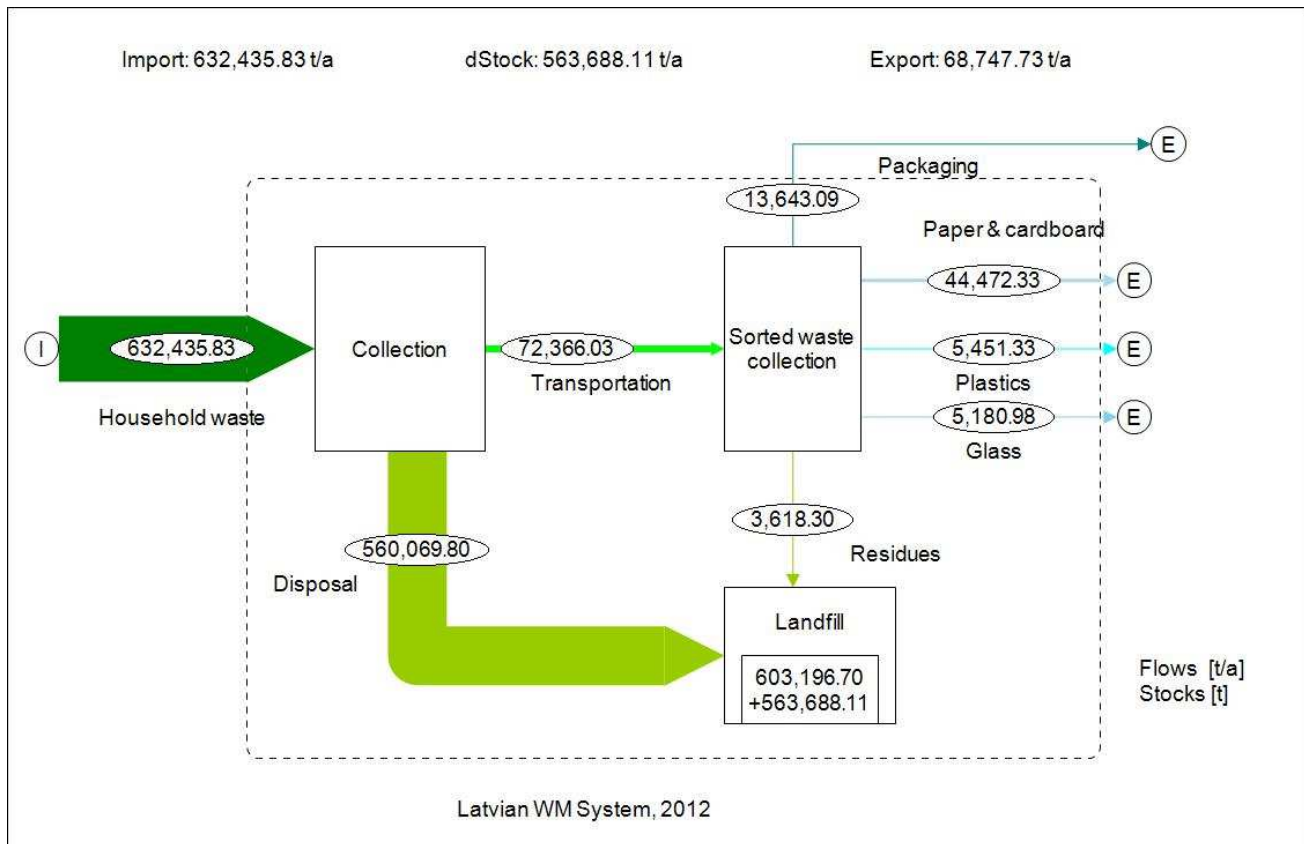


Fig. 3 STAN analysis of Latvian waste management system

The analysis has shown that the potential of separate waste collection even in the regions, where it is already quite developed is quite high. This means that in the regions with less developed infrastructure or the ones, which have been constructed later, the potential amount of waste that can be sorted out of the total volume is much higher.

Currently the issues regarding bio wastes also arise as they have to be diverted from landfilling, but no precise treatment options have been determined and currently the compost standard issue is under discussion.

VII. CONCLUSIONS

This paper was aimed at the analysis and understanding of the waste management processes currently occurring in Latvia. One of the main explanations of slow development of sorted waste collection and waste treatment limitation to landfilling is explained by low % of GDP, being devoted to the waste management sector and also by low % of inhabitant expenditures on waste treatment. Until significant sums are not going to be introduced, it will be considerably complicated to involve the inhabitants in waste sorting and prevention.

Although rational waste treatment and environmental protection are highly prioritized topics, sometimes local actions and interests indirectly impact them. For example – currently the sanitary landfills are not interested in increase of sorted waste collection as the income from sorted waste sales is received by waste operators and not landfills.

Still, the issue of sorted waste collection as well as diversion of biodegradable waste from disposal are national priorities, which, if not fulfilled will lead to significant fines from the European Union.

Another important issue is that construction of new landfills will not receive any co-financing from European financial instruments and this action results are also very complicated due to such social factors like NIMBY (Not In My Back Yard), NIMO (Not In My Office time) and BANANA (Building Absolutely Nothing Anywhere Near Any- body) [8; 12]. As every construction of similar facilities is not likely supported by the inhabitants.

The analysis of disposed waste composition can be considered as one of the best representations of irrational waste landfilling and drawback of environmental protection. Change of gravity center from landfilling to sorted waste collection will prolong landfill exploitation.

When transferred into monetary terms, it will be very clearly seen that there is a significant volume of unreceived profit to the industry due to weak sorted waste collection.

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