WASTE MANAGEMENT IN BROD-POSAVINA COUNTY

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Abstract

Waste management is a major challenge for all countries of modern society, mostly because of a sudden increase of waste quantity, local budget constraints due to the high costs of waste management and lack of understanding of many factors that affect waste management. Increasing population and population density, rapid economic development, rapid urbanization and increasing social standards significantly increase the production of waste in households. Local government units have to, in accordance with the existing legal norms and accepted guidelines, provide an environmental friendly and energy-efficient waste management system. Due to a lack of organizational and financial resources, the complexity and interdisciplinarity of problems and lack of awareness of population about the need to solve this problem, it is not easy to conduct this task.

After analyzing the available literature from period of 2005-2012 on waste management projects in developing and developed countries, we conducted a research in 28 rural and urban local government units in Brod- Posavina County and analyzed factors that affect the waste management system. Organizational strengths and weaknesses are determined by SWOT analysis of the waste management system in Brod- Posavina County. Threats and opportunities for effective waste management are identified by analyzing the existing resources and opportunities.

This article proofs that an effective waste management system is not based solely on technological solutions, but also on environmental, socio-cultural, legal, institutional and economic factors that allow the establishment of an efficient system. Trained staff, adequate infrastructure, the interest of local officials for the problems of waste management and effective financial support of the central government is the necessity of establishing a sustainable modern system.

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1 Introduction

Waste is a problem of modern civilization, and certainly the most visible environmental issue. This problem is present not only in cities and municipalities of the Republic of Croatia, but also in the whole world. Steady increase in volume of generated waste is recorded, due to economic growth and rising consumer spending. The effect of waste can cause emissions to water, air and soil, which can affect human health and the environment. What will the impact be, depends on the quantity and characteristics of waste and the manner in which it is managed. Therefore, it is necessary to monitor the waste streams in order to have an impact on them.

National Waste Management Strategy (Official Gazette 130/05) defines the term waste management as a set of activities, decisions and measures aimed at:

- avoiding and reducing of waste generation,
- encouraging recycling and separate collection of waste
- providing treatment and disposal of residual waste (that cannot be recycled), in accordance with the principles of sustainable development, in an environment friendly manner
- care for landfills that have been closed

Waste is any substance that has properties that cause its owner wants or has to get rid of. Waste emerges as a result of various human activities in households, different economic sectors, especially in industry. Waste is distinguished according to characteristics and place of origin. Every usable item (food, clothing, furniture, equipment, car ...) once we discard and transform into a waste. Waste is not a bunch of useless garbage, and therefore it must be approached as a (still unrecognized) source of raw materials and energy. In case that, in accordance with previous practice, the waste is not separated at the place of origin, its further use becomes much more expensive (the cost of separation, degradation of raw materials), and is often greatly reduced, even impossible.

2 Waste management

Awareness of the necessity for sustainable development and environmental protection initiated significant trends worldwide. Problems with waste are similar in most countries, but the degree of effective care depends largely on the economic power of a country and the socio-economic level of social development.

Systematic and integrated waste management is very complex matter. As a starting point of waste management (collection, sorting, recycling, treatment, disposal of only used and inert waste) around the world, "4R" principle is accepted. The name comes from the four English words: *reduce, reuse, recycle, recover.*

2.1 World and European experiences in waste management

The EU has a very important role in creating a global environmental policy. Some EU members are very active in implementing environmental policies, and the enlargement process involved also the candidate countries. It is essential that this process comes to life successfully and very soon. That way a uniform environmental standard will prevail in Europe. There is some skepticism in EU countries that the admission of new members will result in a reduction of environmental standards in favor of economic development. According to waste management hierarchy it is obvious that focus is on the separate collection of waste.

Availability of landfill for certain types of waste directly affects the amount of their separate disposal. According to data on municipal waste collection published by Minghua et al.¹, it is evident that smaller distance between "green islands" and individual households directly leads to increased share of separately sorted out and collected fractions. A sufficient number of easily accessible separate tanks and their timely discharge, according to Pokherei and Virakaghavan, reduce the problem of arising of illegal landfills. Roughly, it is calculated that "green islands" should be set within a radius of 2-4 km, which means that about 5000-50000 inhabitants gravitate to them. Such determination of number of "islands" is very doubtful, especially in rural areas. It is proven experientially that separate waste

¹ Z. Minghua, et al. (2009) Municipal solid waste management in Pudong New Area, China, Journal of Waste Management 29 , 1227–1233

collection "door to door" reaches up to 85% of total waste quantity (of total waste quantity that can be recycled), "green islands" ensure separation of about 25% of the waste. In cases when "green islands" are not existing, about 95% of municipal and non-hazardous waste ends up in landfills!

When separated waste collection is considered, it is important to examine fractions that can be recycled, and from that aspect to highlight the role of national governments in recycling process, because this activity is directly dependent on the recycled materials market and increasing professionalism of the companies involved in recycling. Waste collection is usually associated with low social status², which leads to lack of interest of employees and poor personnel structure. Utility companies, however, often lack of managerial and professional knowledge, as a consequence they do not have enough information and resources for a successful and independent problem solving. According to data from the literature³, quality change in this segment can occur only with greater involvement of public and private sectors in waste disposal problems. It is necessary to raise awareness of greater part of the population on the necessity of systematic waste disposal. This necessarily implies the inclusion of many people in work of environmental non-government organizations, what would help implement active policy and move towards the sustainable management of waste disposal in total population.

2.2 Waste management in Republic of Croatia

Waste Management Strategy of RH from year 2005 and Waste Management Plan are the most important documents for waste management in Croatia. Directive on Waste in European Union (2008/98/EC) is, in the process of adjustment to the acquis communautaire, transferred in our legislation by Waste Law. These documents are congruous when it comes to responsibility for waste management and waste management hierarchy.

Local and regional government units are responsible for waste management. Regional and local plans are, basically, the preparatory phase for quality waste management system at the national level. National framework provides not only the legal framework and institutional guidelines for waste disposal, but it also directs

² C.K. Vidanaarachchi et al.(2006) Municipal solid waste management in the Southern Province of Sri Lanka: problems, issues and challenges, Journal of Waste Management 26, 920–930

³ Ekere et al.(2009) Factors influencing waste separation and utilization among households in the Lake Victoria crescent, Uganda, Journal of Waste Management 29, 3047–3051

all processes from local and regional levels into a generally accepted national waste management system in a sustainable manner. In case of Croatia, although Waste Management Strategy has been around since year 2005, most of the goals have not been achieved yet. According to the obligations under the pre-accession agreements, by the end of this year, Republic of Croatia has to reduce biodegradable component in landfills at the level of 75% of the reference 1997. According to data from the Environmental Protection Agency, the primary waste sorting is hardly implemented. With the exception of special categories of waste, such as packaging and some types of hazardous waste (only about 14% of total waste), most of the waste from industrial and municipal waste continues to be disposed of without any treatment. As Republic of Croatia is on the threshold of joining the EU this year, Directive 1999/31/EC on waste disposal is extremely important for our waste management. With that Directive European Union has further tightened conditions, prohibiting dumping of any waste to landfills after 2018. In other words, by that time we should have a system that will be able to recycle everything that can be recycled; the rest should be energy recovered or, if it so chooses Member State (example Denmark) – it is possible to regenerate energy from most of waste.

2.2.1. Local and regional level waste management in Republic of Croatia

Unsolved problems of waste management are often put in the forefront during the election campaign for local leaders. However, it is wrong to consider waste disposal as a sole responsibility of local and regional authorities, without any personal responsibility of the individual - as it is in our present position. Operationally, effective system is based on both instances, so both have to participate in decisions concerning the waste disposal.

The local level is oriented to waste collection (operational issues of separate collection, frequency of collecting certain factions, fees, location or "green islands", concessions, etc.). Regional level tasks are utilization of wastes as raw materialsrecovery, recycling, mechanical and biological processing, utilization of waste as an energy source and the final disposal of the rest.

When organizing a system of waste collection and processing on local and regional basis it is important to take into account the fact that this process must be based on the principle of cost recovery. However, the burden of investments are extremely high, with low availability of funds in local, regional and national budgets, so it is necessary to raise assets from international funds. It is considered that the fees for certain basic services, such as waste management or water management, cannot be more than 1% of household income.⁴

3 Waste management in Brod-Posavina County

The issue of waste collecting and disposing in the County is very large. Based on analysis and causes of actual state of waste management, the Waste management Plan of Brod-Posavina County for period 2008 to 2015has been adopted. A sustainable integrated waste management system, organized in accordance to the applicable statutory requirements and European standards will be implemented. Waste Law stipulates local governments the obligation of drafting and adopting waste management plans for cities / municipalities, which must be coordinated with regional and national plans. Of the 28 local authorities in the area of Brod-Posavina County, 22 of them adopted waste management plans, two did not, and for 4 of the data are not available.

There are a large number of illegal landfills that do not meet even the basic requirements for such facilities. High cost of remediation of the existing illegal landfills and the lack of financial resources in the budgets are the main reasons for the inability of systematic financing of waste management activities. However, since 2005., with co-financing from the Environmental Protection and Energy Efficiency Fund, the existing landfills has been taken to remedy. Landfill "Baćanska" (Municipality of Davor) is the only one fully rehabilitated so far. In County area, in the surroundings of Nova Gradiska Oriovac, Slavonski Brod and Velika Kopanica the macrolocations for waste collection have been established, while each local government will have to provide a location for the recycling yard and "green the local and the state legislature with the accepted guidelines of the European Union, which in practice results in insufficient and uncoordinated activities in the problems of municipal and other waste disposal and management.

According to data from the Environmental Protection Agency, Croatia produces more than 1.6 million t of non-hazardous municipal waste annually, or about 367 kg / capita, while in the EU the average is about 502 kg / capita. In Brod-Posavina

⁴ Gospodarenje otpadom na lokalnoj razini, Regionalni centar zaštite okoliša za Srednju i Istočnu Europu, Znanje 2009.,39

County, according to available data, this amount is about 310 kg / capita per year⁵. For comparison, according to the same source, the amount of municipal waste per capita, in average, in Croatia equals 327 kg / capita per year, and is in the range of 206 to 467 kg / capita per year. The waste quantity varies greatly depending on socio-cultural, economic and other indicators, but is also depends on the development of environmental awareness of the population.

Determining of the amount of municipal waste in Brod-Posavina County, that is collected and disposed to the landfills, was carried out based on the data supplied by the utility companies. There are no records on disposed waste quantity kept on the landfills. Available data on waste quantity are estimated based on number of waste vehicles and their volume- according to data provided by utility companies. Data obtained in this way vary from year to year and show excessive deviation, so such data cannot be used with confidence to determine the actual waste quantity. It is necessary to conduct at least one measuring cycle of waste structure and quantity during winter and summer periods, due to possible fluctuations in quantity and structure of waste.



Organized waste collection covers all of the inhabitants (100% of population) in the County.

Figure1: Quantity of waste collected in Brod- Posavina County

Source: individual work of authors

A downward trend in waste quantity in 2011 is noticeable, but also an upward quantity of separately collected fractions of municipal waste. At this time, the separate collection of waste is conducted in the cities, and the situation in the munici-

⁵ Plan gospodarenja otpadom RH (NN85/07)

palities vary a lot - from a complete lack of separate collection to the establishment of "green islands" and recycling yards.

From a total number of 26 municipalities, separate collection (partly) is implemented only in 5 of them (19,23%).

47301t of municipal waste is collected in 2011, that equals 268kg/capita per year, and that is a big step forward compared to the past years.

Separate collection of glass, plastics, paper and municipal waste from households is carried out in Slavonski Brod, by sorting fractions of waste in plastic bags or containers in residential areas and the business entities, as well as through "green islands". Furthermore, additional containers for paper are placed in 25 economic and other subjects that are major producers of this type of waste.

year	waste quantity by type in tons			
	paper	plastics	glass	
2007	181	27	18	
2008	317	33	46	
2009	327	51	31	
2010	328	42	29	
2011	336,85	54,96	29,69	

Table 1. Quantities of separately collected waste in the town of Slavonski Brod

Source: Report on the implementation of the Waste Management Plan of Brod-Posavina County for 2009-2011

Measures required by project documentation are implemented during waste disposal at landfill of town of Nova Gradiska. Concluding with the year 2011, total waste quantity of approximately 134.600 m³ (87.526 t) is deposited on the landfill.

Based on the available data, the specific quantity of waste is 0.61 kg / capita / day and it is expected that specific waste quantity increases. The amount of industrial waste disposed in 2011 equals 1604t, and approximated quantity of disposed construction waste is around 1490t. Separate waste collection system in the city is organized through the recycling yard. There are 21 "green islands" in the city area, that consists of containers for separate collection of paper, glass and plastic.

Noar	waste quantity by type in tons		
year	paper	plastics	glass
2010.	41,84	4,86	19,28
2011.	44	5,35	19,28

Table 2. Quantities of separately collected waste in the town of Nova Gradiska

Source: Report on the implementation of the Waste Management Plan of Brod-Posavina County for 2009-2011

"Sorting" of waste, determining its composition, analysis of waste composition, as well as seasonal analysis are not conducted in the area of Brod- Posavina County. There are no data on the composition of municipal waste in Brod- Posavina County. There is no data obtained by direct analysis of the composition of the morphological, structural and other physical and chemical characteristics of municipal solid waste. It is necessary to determine the quantity and composition of waste generated, sources of generation and predictive picture for the next period in order to achieve preconditions for solving waste management problem on local and regional level. Analysis of the existing scheme of waste collection and landfill sites will allow improvement of the system of separate waste collection, disposal of existing landfills and preventing "illegal" sites.

Analysis of the current situation and conditions in waste management in Brod-Posavina County is presented by SWOT analysis, a fundamental tool in making the strategy and planning of individual projects in waste management of Brod-Posavina County. Table3: SWOT analysis on waste management status in Brod- Posavina County

STRENGTS	WEAKNESSES
plans for waste management in most of local	unreliable data on the quantity and
government units are made	composition of waste
collection of municipal waste in all local	lack of environmental awareness
government units is organized	law regulations
location for Waste Management Centre is	a small number of green islands and
determined	recycling yards in municipalities
recovery of illegal landfills started	small share of separately collected waste
human resources(educated management)	the existence of illegal landfills
the existence of positive motivation	insufficiently entrepreneurial climate
experience in attracting funds from IPA	high degree of social and labor exclusion
high unemployment	
low income population structure	
OPPORTUNITIES	THRETS
applying for EU funds	the lack of a common strategy at the local
energy production from renewable sources	level
opening of new jobs	the possibility of environmental
implementation of new technologies	contamination
human resources(educated management)	an unfavorable business environment
successful development agencies and consultants	poor organization
with experience in attracting available funds	

Source: individual work of authors

Strategy governs waste management for different types of waste from its generation to final disposal, with the primary objective of achieving and maintaining an integrated waste management structured in accordance to modern European standards and requirements. Purpose of the integrated waste management system is to maximally avoid or reduce waste generation, minimize adverse influences of waste on human health, the environment and climate, and to achieve that integrated waste management system works in line with the principles of sustainable development.

In order that in Croatia, and therefore in all counties, cities and municipalities already accepted "4R" waste management strategy could be implemented, it is nec-

essary to carry out communication "3E" program, where 3E stands for Educate, Economize, Enforce.

Educate – to educate on responsible waste management, increase understanding of the importance and possibilities of proper waste management,

Economize – to reduce the costs of waste management, use waste as a raw material

Enforce – to apply the concepts of effective management in law and in practice and to include all interested parties in the planning, decision making and managing.

Waste Law represents a good starting point on taking over the European standards of waste management, but is unworkable in terms of the set target for the introduction of an integrated waste management system until 2018.

Concerning the given objectives of separation of valuable components of municipal waste and timelines for implementation of integrated waste management system, those objectives cannot be realized especially when it comes to biodegradable waste. By the end of 2013, biodegradable waste in landfills should be reduced by 25%, compared to the reference year 1997.

Existing Law highly enables irrational waste management, because it is unclear in defining the role of import / export of waste, the role of local administration and governments, does not implement necessary education for population for the fulfillment of the goals set. It is also unclear in defining criteria for making so called waste management maps, environmental fees are not précised, etc. The law must initiate the economically sustainable waste management systems, because even though (according to valid regulations of EU) waste incineration is allowed, and it is necessary for at least a part of it, waste recycling and reuse can get much better value through a useful raw material and can employ a lot more people in that industry.

From the above, one can see the obvious disparity in waste management in Croatia, but that does not relieve Brod- Posavina County of the responsibility of establishing a sustainable system in their region.

Conclusion

- Brod- Posavina County should actively use the European funds (available funds) to speed up the rehabilitation of existing illegal uncontrolled landfills, and also construction of waste management center.
- The project of separate waste collection must be approached systematically in order to reduce the loss of useful components of waste as a valuable resource. Common approach is essential and therefore it is necessary to involve all participants in the process concessionaries, utility companies, waste collectors, local governments and development agencies, as well as total population, NGOs and others.
- Organize the separation of biowaste from households.
- Educate people about composting at home (we are mostly rural county), set up at least one composting.
- In terms of rehabilitation of existing landfills it is necessary to determine the possible need and ways of rehabilitation of groundwater beneath the landfill, which gravitate toward existing and planned water well sites, in order to preserve the quality of the drinking water wells.
- We also believe that, with the help of the central government, it is very important to consider the transition from county to regional concept of the waste management centers, because it is a positive step towards a better and more rational management of all waste management procedures.
- Local government units do not have sufficient technical and managerial skills and human resources, so it is necessary at the county level to organize systematic training and professional teams that would be made available to local governments.



Figure 2: The concept of operating the waste management project in Brod- Posavina County

Source:Individual work or authors based on Waste Management Strategy of Republic of Croatia

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