

SELECTIVE COLLECTION – AN ESSENTIAL COMPONENT OF INTEGRATED WASTE MANAGEMENT

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Abstract: This paper proposes a selective collection scheme for household waste management in the city of Cluj-Napoca. The scheme is designed to serve the city of Cluj-Napoca, with a stable population of 410,923 inhabitants. *The proposed scheme is based on the finding that currently, in the investigated area, the household waste management is partially organized. Often, the selective collection points are located at quite distant places, over 1000 m, which creates the discomfort of moving for many citizens. In addition, the waste components that were selected at collection points (paper/cardboard, plastic, metal, glass) are collected together, being mixed in the same transportation car, so citizens that were otherwise responsible from the environmental protection point of view will be discouraged to continue the selective collection of waste.*

This scheme is based on principle of population access to sanitation services, under which public authorities are responsible for organizing public services of the community so that all members have equal access to these services. *In order to implement an appropriately waste collection system, the participation of citizens is necessary. By applying the proposed scheme, we aim to achieve the following goals: empowering people in terms of practical activities for selective waste collection, sanitation services at affordable prices, the reduction of generated waste and the recovery of useful materials contained in waste (paper/cardboard, glass, plastics and metal), purposeful actions that lead to a clean and healthy environment.*

In calculations across this paper, the habitation density was considered different from one neighborhood to another. This means that the city has neighborhoods in which blocks of flats prevail. In this case, the habitation density is high. But some neighborhoods (districts) are less crowded, where houses are predominant. In this case, the habitation density is lower.

The citizens of Cluj-Napoca must understand their role in the waste management system and co-operate with the local authorities for the system to work. Implementing this collection system should ensure the optimum number of collection points so that the population responds positively to all the actions of the local authorities in order to increase the amount of waste that will be recycled.

Keywords: household waste, selective collection, collection point, environmental protection

JEL classification: Q53

1. Introduction

Nowadays selective waste collection plays more and more important role in the life of companies and private persons, as well. If the waste arising at businesses and households is selected, namely separated by materials, the selected waste is recyclable. After adequate treatment the waste is reusable as secondary raw material. In this case waste is not garbage but value.

We believe that not us, but generally people do not have the required education to treat waste problem as something serious that can influence decisively our future existence. Any system that is seen to be dirty or polluting is likely to result in reduced acceptability of the whole waste management system. Clean and well-managed systems are more likely to be accepted by the public. Good public support is as essential to a waste management system as good management.

For the generated waste, it is essential to start the selective collection of the packaging waste among the population, which must be informed, and having its awareness raised through environmental education. Selective waste collection benefits include the selection of recyclable fractions (paper/cardboard packaging, glass packaging, plastic packaging, metals packaging, textile packaging), avoid storing easily biodegradable waste in landfills, and increasing calorific value of waste remains.

Collected metals are separated by type (aluminum, steel and so on), melted and transformed into new objects. Collected paper is pressed and transported to paper mills where it is used as a raw material to produce new paper. Many newspapers, magazines and boxes we use every day are made with recycled paper. Collected glass is melted and transformed into new objects or containers. This way, it can be recycled countless times. It is mandatory to dispose of waste without any food and chemical residues.

Household waste can include household chemicals and other substances for which the owner no longer has a use, such as consumer products sold for home care, personal care, automotive care, pest control and other purposes. These products exhibit many of the same dangerous characteristics as fully regulated hazardous waste due to their potential for reactivity, ignitability, toxicity, or persistence. Examples include drain cleaners, oil paint, motor oil, antifreeze, fuel, poisons, pesticides, herbicides and rodenticides, fluorescent lamps, medical waste and so on. Inappropriately managed waste can attract rodents and insects, which can harbour gastrointestinal parasites and exposure to hazardous wastes, particularly when they are burned, can cause various other diseases including cancers. The toxic waste materials can contaminate surface water, groundwater, soil, and air which causes more problems for humans, other species, and ecosystems.

2. Literature Review

In their research, Sasikumar and Krishna (2009), considered that the sustainable waste management requires continuous efforts of the waste producers of the city, irrespective of the waste quantities they generate. Therefore, waste management should not only be the responsibility of the local self-government, but also households, communities, private enterprises and NGOs. Each of them has a specific responsibility to introduce an element of sustainability into the way finance and other resources are to be used, the consumption pattern they adopt, and choices of the waste management.

Reddy (2011) considered that the sector of the waste management can contribute to greenhouse gas reduction in ways that are economically viable and meet many social priorities. Waste management is a low-cost option to reduce emissions and promote sustainable development. A safe and sustainable environment is an absolute necessity for a healthy life.

The waste collection is the contact point between the waste generators and the waste management system, and this relationship needs to be carefully managed to ensure an efficient system. The householder needs to have his/her waste collected with a minimum of inconvenience, whilst the collector needs to receive the waste in a form compatible with planned treatment methods.

From the householder's viewpoint, collection of all solid waste together probably represents the most convenient method, in terms of both time and space requirements.

Most treatment methods will require some form of separation of the waste into different fractions at source, i.e. at home, prior to collection.

Selective collection of recyclable waste can only positively contribute to a healthy environment, that further influences the health status of the population. An improved health status of individuals would only bring socio-economical benefits along, according to Vaidean (2015).

A large numbers of Post-consumer PET products especially bottles and containers do not create a direct hazard to the environment, but are a problem due to their substantial volume fraction in the solid waste streams, their high resistance to the atmosphere, their poor biodegradability and photo degradability. PET is used in the preparation of a variety of products differing widely in their physical characteristics and hence, their end uses. The varieties of prominence are fibres and filaments, sheets and disposable soft-drink containers, soda drinks containers, juice containers, mineral water containers, soy sauce bottles, photographic films, etc. (Sadeghi and Sayaf, 2003)

The collection method influences the quality of recovered materials or the energy that can be produced for the market. The importance of market for the recovered materials cannot be over-emphasized: in the absence of suitable markets, the useful products cannot be produced. Therefore, either the collection method defines the subsequent treatment options, or taking the reverse case, the existing or potential markets will define how materials should be collected or sorted if they are to be recovered. In any case, there must be a match between market need and the materials collected and sorted. (McDougall et al., 2003)

The waste collection is the first subsystem of the technical system of solid waste management which is part of the municipalities 'services. Some households can afford a waste bin made of concrete, plastic or steel built in front of their houses. Other simply store their waste in plastic bags or in used cartons or boxes in front of their houses. These wastes are then picked up by a community collector cart, a small truck, etc. depending on the arrangement in the neighborhood community. Some large and medium-sized cities have been contracting out part of the collection and transportation to private firms. (Damanhuri and Padmi, 2012)

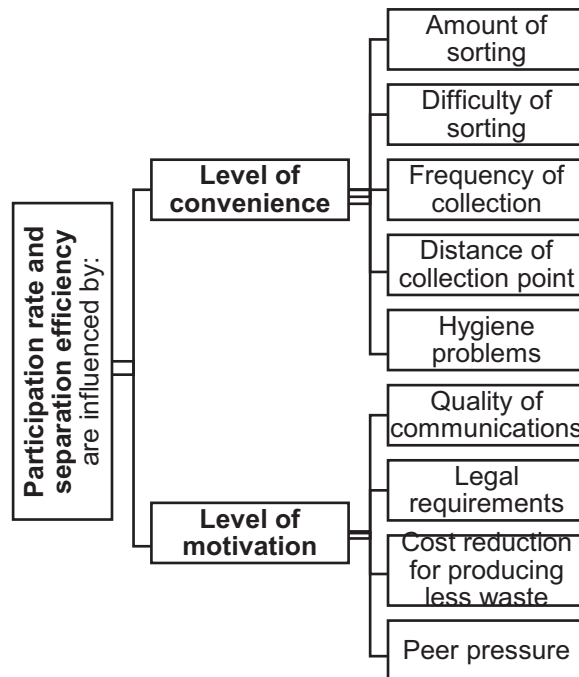


Figure 1: Influences on material recovery

Source: McDougall, White, Franke, Hindle, *Integrated solid waste management: a Life Cycle Inventory*, 2003:195

According to S. Matsumoto (2012), in a group collection program, local residents form a recycling group and agree a contract with a waste management company. Residents separate recyclables at home and take them to the collection site on a designed day. The contracted company then collects and transports these recyclables to the centralized recycling station. It is expected that recyclables are collected more efficiently in group collection programs and thereby the overall cost of recycling is reduced. Because of these reasons, many municipalities encourage group collection programs and subsidize recycling groups.

3. Methodology and Results

The proposed scheme is designed to serve the city of Cluj-Napoca, with a stable population of 410,923 inhabitants. In calculations across this paper, the habitation density was considered different from one neighborhood to another. This means that the city has neighborhoods in which blocks of flats prevail. In this case, the habitation density is high. But some neighborhoods (districts) are less crowded, where houses are predominant. In this case, the habitation density is lower. Based on input data obtained from the local authorities, we performed a calculation of the waste containers number and selective collection points in Cluj-Napoca.

MĂNĂȘTUR: having a population of 115,727 inhabitants, out of which:

885 persons live in *HOUSES*

250 households have their own waste bins

the number of houses: 250

Density habitation in the houses is equal to 2.76 people.

Number of inhabitants that have their own waste bin and live in houses is calculated as follows: $250 \times 2.76 = 690$ inhabitants

The number of inhabitants to acquire bins is determined as follows:

$885 - 690 = 195$ inhabitants

Based on these results, the number of necessary waste bins can be determined as follows:

$195 : 2.76 = 70$ households = 70 bins (240L)

Further, we can determine the number of collection points required for people living at houses. To do this, at each 100 houses a collection point for waste can be built. Considering that the total number of houses in Mănăştur is 250, for the selective collection to function properly, a number of 3 collection points should be constructed. They will be equipped with suitable waste containers as follows:

9 containers of 0.6 m^3 (3 containers of 0.6 m^3 / collection point)

3 two-compartment container (1 two-compartment container/collection point)

The number of persons living in *BLOCKS OF FLATS* is calculated as the difference between the total number of inhabitants living in the Mănăştur neighborhood and those living in houses:

$115.727 - 885 = 114,842$ inhabitants

The habitation density in blocks of flats is 2.84 persons. Considering these values, the number of the apartments is calculated as the following:

$114.842 : 2.84 = 40.437$ apartments

In the calculations, we will consider a number of 400 apartments grouped to one collection point. Therefore, the total number of collection points for the blocks of flats areas is calculated as follows:

$40.437 : 400 \approx 101$ collection points

Assuming that the access to some of these collection points could be more difficult, we considered a total of 105 collection points for the 40.437 apartments, divided as follows:

50 points endowed with non-selective collection waste bins: 5 / collection point;

55 points collection, having:

3 containers of 0.6 m^3 / collection point

1 two-compartment container / collection point

The total number of recipients that should be purchased in Mănăştur is apparent from these results:

70 waste bins (240 L) at houses

$9 + 165$ containers of 0.6 m^3 ($3 + 55$ collection points $\times$ 3 containers/point)

$9 + 55$ two-compartment containers ($3 + 55$ collection points $\times$ 1 container/point)

250 waste bins for the nonselective collection (i.e., 50 collection points $\times$ 5 bins/collection point = 250 waste bins)

558 recipients

The same calculation algorithm was applied in the other districts of Cluj-Napoca and the results are summarized in Table 2. In the proposed scheme, it was taken into account that a part of the population living in private houses have their own collection containers.

Table 2: Calculations on the number of recipients and the selective collection points in Cluj-Napoca

Districts	Population	Collection points number	Recipients number for collection		Total recipients
			selective	Non-selective	
Mănăştur	115,727	105	238	320	558
Mărăşti	88,023	70	210	140	350
A.Mureşanu	5,475	10	30	20	50
Centru	21,950	24	72	48	120
Gruia	12,456	14	42	28	70
Grigorescu	33,145	30	90	60	150
Zorilor	47,124	36	108	72	180
Intre Lacuri	17,640	19	57	38	95
Gheorgheni	23,048	20	60	40	100
Becaş	6,442	12	36	24	60
Borhanci	7,000	12	36	24	60
Someşeni	13,595	14	42	28	70
Bună Ziua	14,087	15	45	30	75
Sopor	910	1	3	2	5
D. Rotund	1780	4	12	8	20
Iris	2,521	5	15	10	25
TOTAL	410,923	378	1134	756	1890

Source: own data processing

According to the data obtained through calculations, it can be concluded that a total of 378 household waste collection points are required in the city of Cluj-Napoca. Equipping them with collection containers (containers in total of 1890 pcs) would improve the current collection system. Any improvement to this component can significantly reduce the total cost of the waste management.

Implementing this collection system should ensure the optimum number of collection points so that the population responds positively to all the actions of the local authorities in order to increase the amount of waste that will be recycled.

After collecting the selected waste it is reused as raw material. Through recycling we can protect the natural resources and our environment. Without selected collection of waste there is not recycling. Recycling makes a circulation similar to the circulation in the nature and a responsible, environmentally friendly life possible.

Participation rates in selective collection schemes will depend on the economics. If householders have to pay for an additional recyclables container participation rates will be lower. Participation rates will be higher if households are offered a cost reduction for having less non-recoverable material in their waste bin. In some schemes, separation of the recoverable fractions at source is required by law.

4. Conclusions

In conclusion, the waste is an inevitable product of the society. Waste generation is a particularly important issue because, on the one hand, it affects the environment and the human health and on the other hand, it is a reflection of the inefficient use of natural resources by the society.

It is my conviction that, in addition to the responsibilities of public authorities on implementing the waste collection system, the population is responsible for the success or

failure of such a project. Encouraging collaboration and increasing communication between citizens and public authorities is an important part of an effective sustainable waste collection program. In this context, public authorities are responsible for organizing the collection, transport and waste disposal, they are obliged to take measures such as:

- Waste collection points with a sufficient number of containers for selective collection;
- Selective collection and timely transportation of all produced waste in localities;
- Development of guidelines for businesses, institutions and individuals on how to organize waste management;
- Organization of actions on environmental restoration.

We believe that this modern system of sustainable waste management proposed for the investigated area will help reduce the amount of waste disposed in this area, being an adequate system which also treats the main fraction of household waste to protect the environment.

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