

Indicators of Solid Waste Management in the City of Valladolid, Yucatán

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Abstract: Management and source reduction generation USW is a strategy that precedes the integrated waste management as it affects the generated volume and nature of waste, thus having proper management of USW is contributing to the prevention of the increasing contamination of soil and water bodies, as well as the proliferation of vermin and disease transmission. In the city of Valladolid society plays a key role in waste management, since from its responsibility as a generator can minimize generation, which is why in this study internal indicators of management of USW were estimated at the source and external indicators by the municipal quality services related to managing USW by applying to socioeconomic survey to 287 households. The results are obtained from the study population, the middle stratum is more aware of their responsibilities as a waste generator, but it is the least minimization actions performed, on external indicators are deficient services provided (28.68%), this affects dejectedly on generators responsible for managing and minimizing waste are made.

Key words: waste, management, consumer habits indicators

1. Introduction

In México, in the General Law of Ecological Balance and Protection of the Environment [LGEEPA]^[4], defines waste as: “Any material used in processes of extraction, benefit, transformation, production, consumption, use, control or treatment, whose quality does not allow to use it again in the process that generated it”. In this way, the waste can be in the three fundamental physical states of matter: solids, liquids or gases. The General Law for the Protection and Integral Management of Waste [LGPGIR] [1] classifies solid waste (SW) into three types depending on its generation characteristics and health and environmental conditions in hazardous waste, special handling and urban solid waste (USW).

The definition of Urban Solid Waste (USW), taken from article 5, fraction XXXIII, of the LGPGIR [1] is: “Those generated in the houses, resulting from the disposal of materials used in their domestic activities, of the products that they consume and of their containers, packaging or packaging; the waste that comes from any other activity inside establishments or in the public road that generates waste with domiciliary characteristics, and the resulting ones of the cleaning of the routes and public places, whenever they are not considered by this law as waste of another nature”. Therefore, solid waste includes all solid or semi-solid material that the person who generates it (generator) no longer considers it of sufficient value to continue its possession. The management of this residual material is a fundamental concern of all local, regional, state and federal planning activities. For this reason, it is important to know as much as possible about indicators that lead to inadequate generation by the generator, which in turn can have an impact on the success of the

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application of solid waste management plans in the municipalities, with the purpose of identifying types and quantities of waste solids, proportions in which these solid waste will arrive, types and quantities of material that has been selected and withdrawn for reuse and recycling, properties of solid waste of economic value and generated volumes. The management and reduction in the generation source of USW is a strategy that precedes the integral management of waste, since it will affect the volume generated and, up to a certain point, the nature of the waste, but even so there will be waste that will be generated and will require integral management systems. Therefore, in addition to the minimization or reduction at the source, an effective system is needed to manage these [2]. In the Report on the environmental situation of the environment in Mexico ^[8], notes that there are deep relationships between the indiscriminate generation and mismanagement of the USW and climate change, the thinning of the ozone layer, the increasing contamination of soil and bodies of water, as well as the proliferation of harmful fauna and the transmission of diseases. The objective of this study was to estimate the internal and external indicators for the management of waste in the city of Valladolid, to generate recommendations that allow for an integrated management of waste by municipal authorities under the following hypothesis “The generation of waste in the city of Valladolid is closely related to the consumption habits and the level s economic leisure of families”.

2. Materials and Methods

The study was conducted in the city of Valladolid, Yucatan Mexico from October to December 2015, the total population of the municipality [3] is 74,217 people. The selection of the population was made based on the simple random sampling model, choosing 20 colonies of a total of 40 registered in the municipal cadastre office of the city, for which the stratum was identified by superimposing the maps socioeconomic

situation in which the colonies were to the classification of National Institute of Statistic and Geography [INEGI] [4] and locating the properties according to the database of the Portable Water Services of the Municipality of Valladolid (SAPAMV), being a total of 2724 properties in the study area. For the estimation of the population pre-sample, one apple per colony was selected by means of the table of random numbers as indicated by the NMX-AA-061-1985 [5], and 15 houses were selected per block taking as reference the apple side that is to the south with respect to the orientation of the compass rose, selecting the first 15 houses from left to right, in case of having some trade it is discarded and it is passed to select the next one to house-room in subsequent order In this way, a population sample of 287 houses was obtained, distributed in 20 blocks. The study was carried out in October and November 2015 with the help of 12 volunteers, first the properties to be sampled were identified through the visit physical and in a second visit a survey was applied to obtain important information on consumption habits, social and economic aspects of families, indicators of the waste collection service, efficiency in the collection of waste and quality indicators in municipal services coverage [6]; citizens were also explained and sensitized about their participation in the project.

3. Results and Discussion

3.1 Results of the Survey

Most of the properties have 4 inhabitants which coincides with the average of 4.2 for Valladolid that reports the INEGI [3]. It was estimated that the scope of people during this stage of the research was 1206 people in the 287 houses surveyed. Among the results of the socioeconomic study it was found that most of the people surveyed have education at the high school level, they live in their own house that counts With at least one bathroom and ceramic floor, the most used services are electric power and cable, and the appliances most in demand are fans, televisions and

stoves (in order of popularity). On consumption practices, the high and medium strata, they come more frequently to make their grocery purchases to the super market, and the low stratum to the small grocery stores. During lunch 85.17% of the people surveyed cook and eat in their homes, so you should expect less disposable waste and more organic waste. The type of food most consumed at lunchtime is meat, fruit or vegetables for the high and medium strata, unlike in the low stratum only 10.52% eat meat and 47.37% its food base are grains such as corn and beans, bottled soft drinks are consumed by 65% of the population (expecting to have a considerable percentage of plastics), being the low stratum with 72.41% the most bottled soft drink consumed.

3.2 Qualitative Indicators

It was determined that the middle stratum was the one with the most knowledge in the identification of waste types and they practiced to a greater extent the separation of waste at the source with 54.22% and 31.84% respectively (Table 1), the high stratum gives

its recyclable waste to people who go to the door of their homes in a 46.34% and the low stratum in 37.93% sells recyclable materials generated to the collection centers u obtained. The medium stratum is the one that has a greater proportion of a temporary site under better conditions (located in a covered place and away from the sun's rays), which would prevent the acceleration of the decomposition of organic waste, and the high and medium stratum with 88.62% and 72.65% have the municipal services of waste collection, in the low stratum only 17.24% have these services, being evident that this is a factor associated with purchasing power, since for low-income families it is difficult to allocate money to something they do not consider a priority when it is more important to eat or have a roof to sleep on. In general, the degree of fulfillment of the responsibilities as USW generators by socioeconomic stratum was measured, obtaining the following indices on average 46.46% in the high stratum, 48.09% for the medium and 31.02% in the low stratum. In general, an indicator of 41.86% was obtained.

Table 1 Qualitative Indicators of solid waste management in the city of Valladolid.

Indicator	Stratum				Average indicator
	High	Medium	Low	Average	
* Knowledge of the subject (USW).	26%	54.22%	45.98%	42.06%	Internal 41.86 %
** Separation of waste at the source.	27.43%	31.84%	19.51%	26.26%	
* Promotes the sale or reuse of waste.	46.34%	34.39%	37.93%	39.55%	
* Site of temporary disposition of USW in houses in good conditions.	43.90%	47.37%	34.48%	41.91%	
* Users that have the service of collection of Waste.	88.62%	72.65%	17.24%	59.50%	
** Street sweeping coverage	46.34%	47.85%	24.14%	39.44%	External 28.68 %
** Proportion of paved streets in adequate conditions.	78.2%	17.42%	30%	41.87%	
** Collector truck in good condition.	14.16%	0%	0%	4.72%	
Total qualitative indicators	46.37%	38.22%	26.16%	36.91%	35.27 %

* Internal indicator e ** External indicator. Source: Own.

The external indicators measure subjectively the responsibility of the municipal authority with respect to its obligations according to the LGPGIR in the integral management of the USW. Regarding street sweeping coverage, the average stratum said to have service at 47.85% and the high stratum at 46.34%; in the city, only streets and main avenues are usually swept in the

morning; in the case of the low stratum that is represented by colonies of low economic income and far from the conurban zone, it is only carried out in 24.14%. The proportion of paved streets in good condition (without potholes and cracks) was estimated since it represents an indicator to know if the collection vehicles go to look for the SW to those areas, or in

doing so, they can shorten the useful life of the collector trucks. In this indicator it was more than evident that the colonies that represent the high stratum had a better percentage of investment in street paving with a total of 78.2% and the low stratum in 30% because they are areas of recent colonization and priority in their Attention, on the other hand, the middle stratum is the one with fewer streets in good condition, expressing that only 17.42% of its roads are in adequate conditions. The percentage of properties by socioeconomic stratum was measured in it, they go to look for their waste in a collection truck suitable for the service either compacted or of separating boxes, this service having only the high stratum in 14.16%, the types of trucks that used to provide the service are usually vans redilas types and tippers. The average external indicator was 16.34% being a very low percentage with respect to the responsibilities that the municipality should have in the handling of solid waste. In this study was also determined the scope indicators of waste collection services was 74%, with 26% of people living within the city of Valladolid still not having the waste collection service, mainly in the neighborhoods of the socioeconomic strata low and medium. The indicator of quality of the public services of collection of USW that the City Council provides was 26.1%, this shows the areas of opportunity that the City Council has on the improvement of public services. It is recommended to have better efficiency in the times of attention to complaints, to do it in writing and to be friendly with the users of the municipal services, it is important to mention that the service in which more complaints have been made is in the collection of waste, They had two houses that claimed to have been insulted and assaulted by garbage collection workers, and it is very common for people who provide this service to ask for extra money to carry more than two bags per house.

4. Conclusions

In response to the hypothesis of this project it can be

concluded that this study is of great importance and contains relevant information on the generation of waste in the city of Valladolid. On the generation of solid waste, it can be said that the city of Valladolid despite having 74217 hab. And to have the category of city, consumption habits are very different from those of metropolitan cities such as Mexico City or the city of Merida. The hypothesis is accepted, since consumption habits do not they are still unconscionable like those of the big metropolis, they still make purchases in a conscientious way taking care of money and cooking at home, however the situation was presented of which the middle stratum is the largest generator of SR despite being the most consenting Its internal indicators, however, are the least minimizing actions performed in comparison with the high and low strata, possibly due to the work situation of the heads of family in which both parents must work and do not leave time to carry out activities that promote reduction of SW. Regarding external indicators, it is clear that there is a need for greater options and applications of public policies that regularize the actions of the inadequate disposal of solid waste and in turn implement the best environmental awareness techniques in the area and that provide quality services so that citizens feel committed to their responsibilities as generators of solid waste, which will bring good to the environmental environment of the municipality of Valladolid.

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