Solid Waste Management as an instrument of sustainability in protestant denominations

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Abstract

Nowadays, there is a worldwide concern about issues related to the environment and one of the biggest environmental problems caused are generated by inadequate solid waste management and the lack of society's involvement. The present work deals with the management in Protestant Christian religious institutions, which are also producers of solid waste and, therefore, deserve to be studied scientifically, in order to answer the following guiding question: Solid waste management in Protestant Christian institutions in the city of Manaus asserts itself as an effective instrument for the concept of sustainability? The main purpose objective of this work is to evaluate how Protestant Christian religious institutions act in the management of solid waste, identifying if such these institutions do any kind of management of this generated waste, in order to monitor how it is done using quality management tools, methodology and analysis of the results achieved. The applied methodology will be descriptive, through observation, registration, analysis and correlation of the object or facts under study, however, without manipulating them. With the information collected from selected churches in all areas of the city, in equal quantity and, through a practical formulary and checklist based on Brazil's the National Policy on Solid Waste (PNRS), it will be possible to build a DMAIC framework and sequentially apply the GUT tool, to notes on of the most urgent problems. The results of these notes will be put into the PDCA cycle for improvement planning and, finally, the 5W2H will be used to propose improvements, which will facilitate observation, data collection and analysis of the information obtained. The survey results showed a great possibility of these Christian communities to serve as environmental schools, and that if it would be carried out, could bring a real mass awareness of society, thanks to its enormous scope.

Keywords: Solid Waste, Environmental Education, Sustainability.

Introduction

The management of solid waste, as well as its correct disposal, is already taking place in several segments of industry and commerce in Brazil, whose "proper destination in landfills received 59.5% of urban solid waste collected" (VIANA, 2020). The positive impact generated through the proper management of solid waste was proven in thousands of studies that attest the resulting benefits for

companies that employ such form of management. However, one cannot say that this model is necessarily present in any other loci except the industry.

The amount of solid waste collected (an important indicator that integrates works with such waste) in the city of Manaus, during the period from 2013 to 2019, indicates an average collection of almost 890 tons of waste per year (Table 1). Such information is fundamental for planning development activities and monitoring, for example, the variations in consumption in Amazonas. According to the most recent data on solid waste production, within the scope of Manaus "from January to December 2019, the Manaus landfill received 954,090 tons of solid waste, of which 98.01% is municipal solid waste (MSW) and 1.99% is third party waste. The average is of 2,395.40 tons of waste disposed per day in the landfill". (SEMULSP, 2020).

The most part of the daily tons of waste in Manaus is generated by its population. Thus, in order to raise awareness so that this picture changes and becomes truly sustainable, it is required a place capable of encompassing a good amount of people and make them aware, through the Protestant churches installed in the municipality, since most of the population is found in this niche.

The increase in the production of municipal solid waste is evident and investments to supply sustainable needs would take time due to lack of environmental education and allocation of resources. The DMAIC methodology (Definition, Measurement, Analysis, Improvement Implementation and Control) was applied to investigate the municipal solid waste that represents 98.6% of all tons of waste disposed per day in the only landfill (municipal landfill) in Manaus.

Manaus has about 1,620,554 declared Christians, either Catholic or Protestant, corresponding to 89.93% of the total population, according to data from the last census, that is, almost 90% of the population is concentrated in a niche: Christian churches (IBGE, 2020). Given such information, it is clear that the awareness of this segment of society can cause a direct impact on almost all the waste produced in the city (considering that the majority of the waste produced in Manaus is characterized as municipal solid waste). Furthermore, the production of solid waste in such institutions is still not sufficiently known; equally unknown is the way in which management of such waste occurs.

In this sense, the aim of this study was to evaluate the management of solid waste in Protestant Christian institutions, seeking to identify the level of knowledge they have about the proper administration of such, as well as what plans they have on disposal and whether they raise awareness of their membership through their ecclesiastical administration.

Method

Sample

Data collection had, as parameters, the National Policy on Solid Waste - PNRS (Law No. 13,405, August 2, 2010) and other also relevant instruments, seeking to identify the strengths and weaknesses, besides being observed, with emphasis on sustainability, how waste is managed in the institutions under study. The data was observed in the form of a comparative table, between the chosen institutions. Since this is an exploratory research, there are few studies about it, so the main data collection instruments used were bibliographic research in books about the theme and direct observation by the researcher.

Instrument

In direct observation, it is possible to visualize the structure of the organization, highlighting where they need more attention, in order to obtain a position focused on a certain fact. Therefore, in the Protestant institutions, direct observation was carried out in a very broad way, through technical visits in which a checklist was used for notes and records. Through this verification, it was possible to observe, in a general way, the points that need most attention.

The analysis of the problem identified corresponds to the analytical evaluation of the data collected as described in the previous paragraph. After data collection, performed through bibliographic research and direct observation, a tool called SWOT analysis was applied, widely used by private institutions to identify the strengths and weaknesses of an organization (Bastos, 2020). SWOT is the acronym for the words strengths, weaknesses, opportunities, and threats.

Once the problem was identified, a tool called GUT analysis was applied.

GUT is the acronym that summarizes the words Gravity, Urgency and Tendency, whose matrix is used for problem solving, strategies, project development and decision making. The main advantage of this tool is the possibility to quantitatively evaluate the problems of organizations, making it possible to prioritize corrective and preventive actions (PERIARD, 2011).

For improvement planning, the tool called PDCA (Plan, Do, Check, Act) was used, which is a quality tool used in process control for problem solving, allowing the standardization of quality control information, with less probability of errors in the analysis by making the information more understandable.

To develop a proposal for improvements, the tool called 5W2H was used (Who? What? When? Where? Why? How? How Much?), used mainly in mapping and standardizing of processes, developing action plans and establishing procedures associated with indicators (PERIARD, 2011).

For the development of the diagnosis, it was necessary to investigate the forms of waste management in prominent Protestant Christian institutions. Information about the solid waste generated in these institutions was verified, as well as their collection points, packaging, storage, transportation, and treatment.

The diagnosis was based on technical visits, photographic reports, use of a form, checklist, and others. With the information collected it was possible to create a DMAIC (define, measure, analyze, improve, and control) framework and a flowchart of the process. DMAIC refers to a data-driven improvement cycle used to improve, optimize, and stabilize processes.

The flowchart shows how the entire cycle of waste collection, conditioning, storage, transport, and treatment was mapped in the diagnostic.

This mapping is important to identify where the flaws are in the process and the possibility of improvements.

From the DMAIC framework, a GUT (Urgency, Severity and Trend) matrix was created to establish an action plan according to the priorities of each activity. This action plan aims to consider solutions for all the problem situations found in the diagnosis, designating those responsible for each function to be performed.

Eighteen churches were visited, three institutions in each area of the city of Manaus, in order to cover the entire municipality, as shown in Figure 1.

Results

The city of Manaus is located in the state of Amazonas, and borders the municipalities of Presidente Figueiredo, Careiro, and Iranduba. Its area extension is 11,401,092 km², and its estimated population in 2020 was 2,219,580 inhabitants, resulting in a population density of 158.06 hab./km². (IBGE,2020).

Manaus is divided into six urban areas which are: Central-West Zone, Central-South Zone, West Zone, East Zone, South Zone, and North Zone. The research was carried out by three institutions from each region of the city, totaling 18 institutions surveyed.

The diagnosis was made by filling out a formulary and direct observation in field research, with the purpose of identifying the religious institutions that perform the correct segregation and disposal of waste generated, providing information about how these institutions manage their sustainability indicators.

During the visits to religious institutions, from April 15 to May 9, 2021, it was possible to identify how the institutions manage waste. It was observed that the institutions separate the waste generated through cans, pack the waste in plastic bags, send the waste for collection and, then, the municipal public cleaning service makes the transportation and disposal of waste.

Considering this analysis, it was found that this is not the appropriate methodology for the process, because it does not have a broader focus capable of covering the social, environmental, and economic dimensions. In this sense, it was proposed the readjustment of the method used by the institutions for waste management. (TOCHETTO,2005).

For the adequacy of waste management in religious institutions, a new waste management process was proposed in which new management steps were implemented. In this new process, religious institutions will be responsible for the process of transporting and recycling the waste generated, no longer depending on the municipal public cleaning service and beginning to establish contact with groups and institutions that perform the work of recycling the waste generated. The churches involved will contribute to the economy of the place where they are located, in addition to contributing to the environment. This is the new process exposed by the author when he comments on the reduction of the causes of variability. (SILVA, 2020)

Discussion

However, it is verified that such activities still do not solve the problem of including the 3Rs in the proposed process, since so far only one would be used, namely recycling. (ANDRADE, 2012)

A research formulary was applied to investigate the researched institutions, verifying if the organization practices management over the generated waste.

Through the analysis of these formularies, it was found that, of the 18 researched institutions, 47% of them generate from 2kg to 3kg of waste daily, and that 29% of the institutions generate from 5kg to 10kg of waste.

Similar research, also carried out in religious institutions, showed similar indexes in the south of the country, where the garbage in greater quantity was organic, which makes an estimate of 740.22 kg per year, approximately.

It was also observed that, during separation, some recyclable waste was deposited next to organic waste and, also, that the average amount of waste generated in the institution studied was 1.89 kg (PENNA, 2021). It was also found that the largest quantities of waste generated in the institutions are paper and plastic, which represent 88% of the total waste generated.

Still, in relation to the diagnosis performed, another point that draws attention is: of the 18 institutions, 10 do not know the final destination of the waste generated, and the lack of awareness can cause problems of segregation and packaging, generating failures even in the final disposal of waste.

The discarded waste was analyzed and it was identified that 83% of the institutions reported that the collection is done daily, which is not a positive point, because if the institutions segregated and packaged the waste correctly, they could sell in large quantities and generate a financial and sustainable return (NOLASCO, 2020).

According to social class, in only two institutions it was observed that the non-generation, reduction, reuse, recycling, and treatment of solid waste are visible goals in such places. This relationship between social class and the opportunity to dispose the garbage in a correct manner was observed throughout the research. In general, the churches that were located in more noble areas of the city, besides having better disposal for their waste, their members also had this awareness, unlike what could be observed in churches located in more distant neighborhoods of the city.

It was observed that eleven institutions generate solid waste class II A and seven do not. This waste is popularly known as organic waste and it is important to highlight it for its ability to transform and use nutrients, and it can be disposed of in sanitary and recycled landfills. Recent research has shown that in some supermarkets this waste, previously simply discarded, began to be used in reverse logistics, adding up to R$ 4,000.00 (or $744,55) per month in the purchase of feed (NOLASCO, 2020).

Regarding the segregation of waste, it was found that only four institutions have a selective collection system identified through collectors by color and properly separated. On the other hand, fourteen do not do any kind of separation. And, still on the segregation issue, only two churches perform solid waste recycling or treatment.

Only four institutions promote environmental awareness, through educational and informative signs about the waste generated. It was identified that ten institutions pack the garbage in plastic bags and store it in baskets, and eight do not. The packaging is made in plastic bags and placed in baskets.

Regarding transportation, it was found that in nine institutions the solid waste is safely and correctly sent to the packaging plant, and the other nine do not perform this process safely. In seven institutions, the access to the packaging is easy; in eleven it is not. Regarding the correct waste management, it can be said that none of the visited institutions, even those with large (and beautiful) structures, follow the proper protocol, because this management should be done by people with personal protection equipment (PPE), such as: gloves, boots, apron, mask and even uniform (CONCEIÇÃO, 2020).

The majority of the institutions do not have extramural shelters for waste storage until its collection by the municipal urban cleaning service and, of the institutions that do have them, only three meet the technical construction criteria.

Conclusion

Through this research it was found that churches are not only great centers of concentration of people with the same affinity, but also great generators of solid urban waste.

Taking into account that sustainability is a concept that involves all large religious centers, they can serve as indicators of sustainability in a solid waste management model.

The survey showed that 80% do not adequately separate their waste and do not correctly identify their waste. Only 60% do the correct packaging of their waste and 90% do not even have a shelter for temporary storage of waste. And only one has some kind of project to collect solid waste as an income generator.

In all the places visited, there was a 100% receptivity to the theme, with understanding of its importance and awareness about the possibility of such places also serving as means of teaching on the subject.

The research typology applied in this work results in a model where churches can serve as educational support to the members of their congregation, which in itself has a high power to transform the mentality about the whole population, since 90% of the city is in this niche.

It was concluded that the proposed solid waste management model is affirmed as a concept of sustainability in Manaus, through an interdisciplinary approach between institutions through education.

References

Andrade, J. B. L. Sustainability Indicators Applicable to Management and policies for Industrial Solid Waste: a contribution focused on the Industrial Pole of Manaus (2012). 1° ed. – Manaus: 2014.

Bastos, M. SWOT Analysis (Matrix): concept and application. Available on: <https://www.portal-administracao.com/2014/01/analise-swot-conceito-e-aplicacao.html>. Access on 07 of march of 2021.

Conceição, M. M.; JÚNIOR, A. P. Solid waste management plan at a higher education institution. Braz. J. of Develop., Curitiba. Vol. 6. pp. 45643-45675. Jul. 2020.

IBGE. Brazilian Institute of Geography and Statistics. Available on: <https://cidades.ibge.gov.br/brasil/am/manaus/pesquisa/23/22107>. Access on 27 of May of 2020.

Nolasco, E.; Nascimento, T. L; Faria, B. S.; Abreu, L. M. Analysis of solid waste management generated in supermarkets in Planaltina/DF, Brazil. Brazil. J. Anim. Environ. Res., Curitiba. Vol. 3, pp. 4228-4240, Dez 2020.

Penna, L. F.; Cardoso, J. B; Franklin, A. H.; Costa, G. S.; Santos, W. B. Characterization of Solid Waste in a Religious Institution in the municipality of Governador Valadares – Minas Gerais. IBEAS – Brazilian Institute of Environmental Studies. GRAMADO: RS, 2021.

Periard, G. GUT Matrix – Complete Guide. Avialable on: http://www.sobreadministracao.com/matrizgut-guia-completo/. Access on 25 of september of 20215.

SEMULSP 2021. Management Report 2013 to 2020. Available on: <https://semulsp.manaus.am.gov.br/wp-content/uploads/2020/12/Relatorio-Semulsp-2013-a-2020-parcial.pdf>. Access on 05 of July of 2021.

Silva F. Environmental education in a Higher Education Institution in Alagoas: Reduction and Recycling of Solid Waste., Maceió – AL, 2020.

Tochetto, M. Management of industrial solid waste. Universidade Federal de Santa Maria. Santa Maria, 2005.

Viana, F. L. (2021). Circular economy and solid waste management – perspective for Brazil northeast. *Econ. NE. Vol.* 52, 9-25.

Table 1

Amount of Solid Waste collected in Manaus (2013 to 2020)

Year	Quantity
2013	904.426
2014	995.837
2015	1.013.873
2016	852.973
2017	870.778
2018	920.411
2019	954.090
Jan to Oct 2020	731.070
Total	**7.243.278**

Figure 1

Distribution of the churches visited in Manaus-Am.