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FUTURE STUDIES RESEARCH JOURNAL:
TRENDS AND STRATEGIES

PROFUTURO: FUTURE STUDIES PROGRAM
Scientific Editor: James Terence Coulter Wright
Evaluation: Double Blind Review, from SEER/OJS
Review: Grammatical, Normative and Layout
Received in: 11/12/2015 Approved in: 12/18/2015
Category: Techinical Report

System Integrated Management of Municipal Solid Waste in Cidade Ocidental (GO)

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ABSTRACT

This technical report aims to present the construction of a Waste Management System Municipal Solid, held in the city of Cidade Ocidental in Goiás with emphasis on the implementation of a cooperative of waste pickers. To that end, we conducted a literature review containing the context of urban solid waste to Brazil level, the management of municipal solid waste and the guideline for the preparation of a management plan and solid waste management. In primary and secondary sources, diagnostic information was collected performed at the beginning of project implementation, containing municipal information and main points of improvement. It also registered the strategic information for the project implementation, such as management plan for solid waste and actions of the project for implementation of the selective collection system including the incorporation of social technologies and environmental education as a form of awareness to county residents. It was concluded that this report presents a practical way of implementing a management system, enabling alternatives aiming at the implementation of an integrated management system of municipal solid waste that is economical, effective and has social inclusion as premise, especially of people living garbage as an income source. From the selective collection program could be greater integration of collectors in this system, ensuring better working conditions and income.

KEY-WORDS: Solid waste management. Solid waste. Social technologies and social inclusion management.

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Sistema de Gestão Integrada de Resíduos Sólidos Urbanos na Cidade Ocidental (GO)

RESUMO

Neste relato técnico o objetivo é apresentar a construção de um Sistema de Gestão de Resíduos Sólidos Urbanos, realizado no município de Cidade Ocidental (GO), com ênfase na implantação de uma cooperativa de catadores de materiais recicláveis. Para tanto, foi realizada uma revisão bibliográfica contendo a contextualização dos resíduos sólidos urbanos no Brasil, a gestão dos resíduos sólidos urbanos e a diretriz para a elaboração de um plano de gestão e gerenciamento de resíduos sólidos. Como fontes primárias e secundárias, foram coletadas informações do diagnóstico realizado no início da implantação do projeto, contendo os dados do município e os principais pontos de aprimoramento. Também foram registradas as informações estratégicas para implantação do projeto, como o plano de gestão dos resíduos sólidos e as ações realizadas no projeto para implantação do sistema de coleta seletiva que inclui a incorporação de tecnologias sociais e de educação ambiental, como forma de conscientização dos moradores do município. Concluiu-se que o presente relato técnico apresenta, de forma prática, o processo de implantação de um sistema de gestão integrada de resíduos sólidos urbanos, que seja econômico, eficaz e que tenha a inclusão social como premissa, especialmente das pessoas que vivem do lixo como fonte de renda. A partir do programa de coleta seletiva, foi possível maior inserção dos catadores nesse sistema, garantindo-lhes melhores condições de trabalho e renda.

PALAVRAS-CHAVE: Gestão de resíduos sólidos. Gerenciamento de resíduos sólidos. Tecnologias sociais e inclusão social.

1 INTRODUCTION

In the world, the production of solid waste has been increasing at a considerable scale, generating public health problems and polluting the environment. In Brazil, the management and the solid wastes handling are defined in National Solid Waste Policy (PNRS), Law No. 12,305, 2010, regulated by means of Decree No 7,404, 2010, that after twenty years of course at the National Congress established a new regulatory framework for the country (Jacobi & Besen, 2011).

According to the research Ciclosoft developed by Business Commitment for Recycling (Cempre), the majority of the initiatives and actions of collection is informal, with only 14% of the 5,561 municipalities operating programs of selective collection. Out of this total, 86% are in regions South and Southeast (Cempre, 2013).

Currently, the majority of urban centers have problems to dispose the garbage on the ground. The strategy of minimizing waste has focused on avoiding at the most the waste provisions in the soil arising from the principles of reduce, reuse and recycling. With the PNRS, the cities are seeking practical solutions to the implantation of systems of selective collection using environmental education as a way to guide the population (Bringhenti, 2004).

The managers of the municipality of Cidade Ocidental (GO), after the closing of the dump in the year 2008, needing to adapt to the law, faced the challenge of searching for solutions to implement a selective collection program which incorporates the collectors who got by of the waste discharged at the dump. They tried, then, to solve this problem by means of consultations and studies that would enable the implantation of a selective collection system integrated that offered training to collectors and environmental education to the population.

In this sense, in this technical report the technical objective is to propose, based on literature review and professional experience of the authors, the deployment of a system of integrated management of solid urban waste, with the incorporation of social technologies, management of recycled material and environmental education, as a way of raising

awareness of the inhabitants of the municipality of Cidade Ocidental. The aim was to propose alternatives to implement a system that is cost effective, efficient and that has social inclusion as a premise, especially for people who live or have the garbage as a source of income.

As specific objectives of the project are:

- Reactivate the recyclable materials sorting center;
- Establish a system of selective collection of low operating cost;
- Incorporate informal collectors of the municipality to the official system of selective collection;
- Enable 20 people for the formation of a cooperative;
- Promote the participation of a community in the management of the system of selective collection, through environmental education.

2 THEORETICAL REFERENCE

The theoretical reference includes the following basic component: The contextualization of solid wastes, the management of urban solid wastes (USW), as well as the guidelines for the elaboration of a plan of management of solid wastes.

In the contextualization of the solid wastes, it is presented information regarding the environmental legislation in force and the initiatives of selective collection in Brazil. In SMW management, it is featured the concept of integrated management of solid wastes (GIRS) and, finally, the guidelines for the elaboration of a management of solid wastes.

2.1 CONTEXTUALIZING THE MUNICIPAL SOLID WASTE

According to Brazilian standard NBR 10004 of 1987 (ABNT, 1987), the solid wastes are classified as those wastes in solid and semi-solid states that result from the community activities from industrial, domestic, hospital, commercial, agricultural, services and sweeping. In this way, we seek to prioritize the reduction, reuse, treatment and final disposal (Zanta & Ferreira, 2003).

As the years go by, this type of solid waste collection has evolved in the country. Currently, 59.8% of the 5,565 Brazilian municipalities have initiatives for selective waste collection. This survey, done for the five regions of the country, is presented in Figure 1. Despite of the numbers are significant, it is worth pointing out that many of these cities have only voluntary delivery places (PEVs) or simple formalization of partnerships with co-operatives of collectors who are running the service, without a transport vehicle (Abrelpe, 2012).

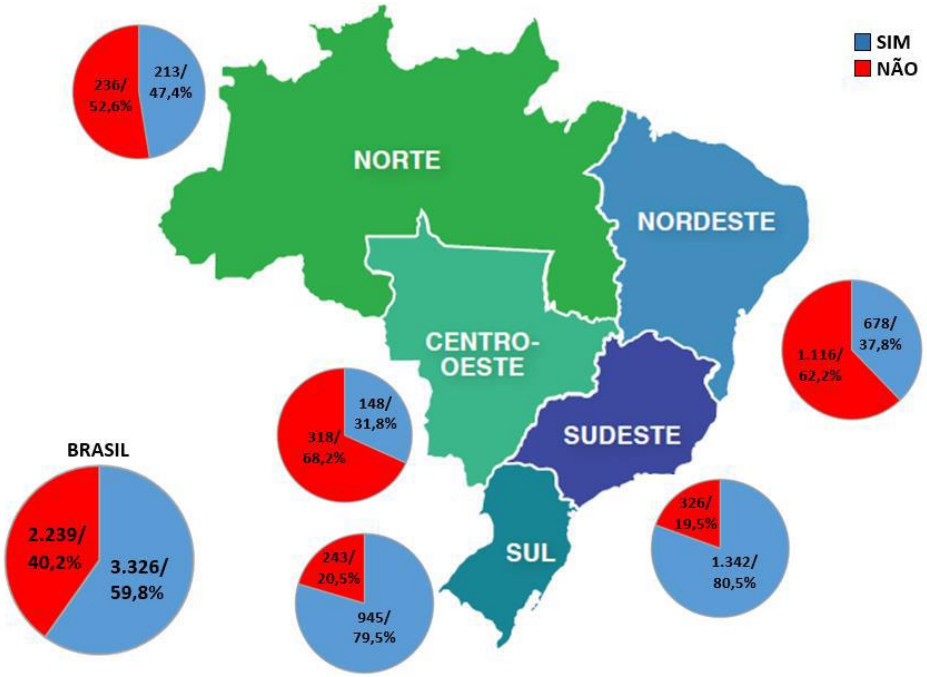


Figure 1: Municipalities with initiatives of selective collection - per regions of Brazil and total

Source: Abrelpe (2012)

2.2 MANAGEMENT OF MUNICIPAL SOLID WASTE (MSW)

According to Lopes (2003), it is understood as management of urban solid wastes (USW) all rules and laws related to them. Now the concept of management of integrated solid wastes (GIRS) covers all transactions involving the wastes, such as collecting, treating, final disposal, among others. Among the activities executed for the management, the first step is the realization of a social environmental diagnosis considering initial survey of the main potentials of the municipality. After the diagnosis it is performed

the participative plan of management of the SMW pointing out alternatives for their management and, finally, the search for social technologies for social inclusion of different knowledge within the community, as the description of the pillars for the GRS in Figure 2.

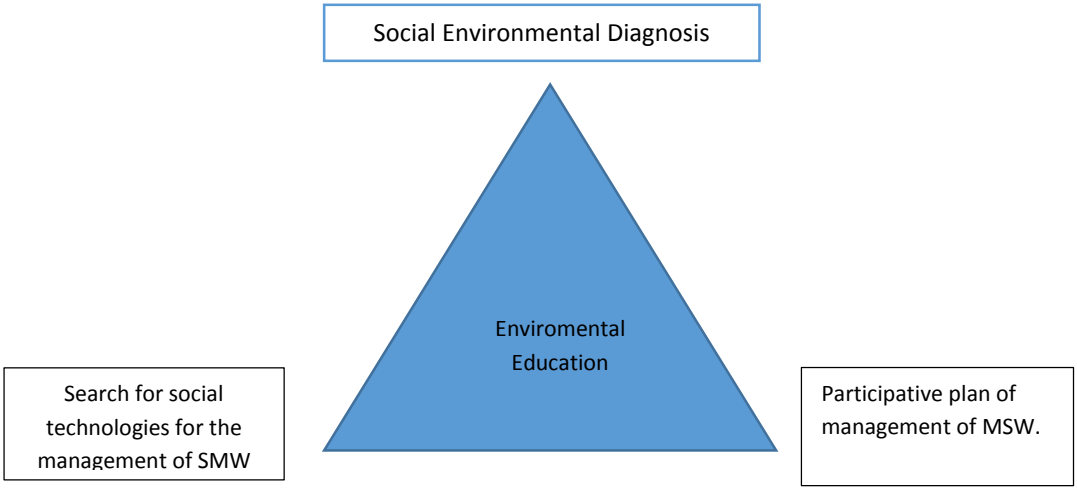


Figure 2: Pillars for GRS
Source: Lopes (2006)

To Andrade (1997) and Lopes (2003), the concept of managing arose in the administration area, associated to the notions of planning and control. This concept of managing was tied to measures of environmental preservation, natural economical resources, inputs, and the minimization of environmental pollution.

2.3 GUIDELINES FOR PREPARATION OF A MANAGEMENT PLAN AND SOLID WASTE MANAGEMENT

For the preparation of a plan of management of solid wastes, it is necessary to start through the participation of a larger number of interested parties, such as community representatives, local government, the basins committee and intermunicipal consortium and civil organized society, formed by a group composed in the form of network or forum for discussion. To Lopes (2003), it should be a priority of the research to obtain technical subsidies and to the formation of intermunicipal consortia. According to this author, you also need to encourage municipalities to get

data from the region on the generation of solid waste, qualify the professionals in the city involved and qualify the society through programs of environmental education.

3 CONTEXTUALIZATION OF THE PROJECT

3.1 CHARACTERIZATION OF THE PROJECT/PROBLEM EXAMINED

The project was developed in the Cidade Ocidental, State of Goias (Figure 3), municipality that composes the Regional Development of the Federal District (RIDE) and has about 61,000 inhabitants and 10,300 households (IBGE, 2008).

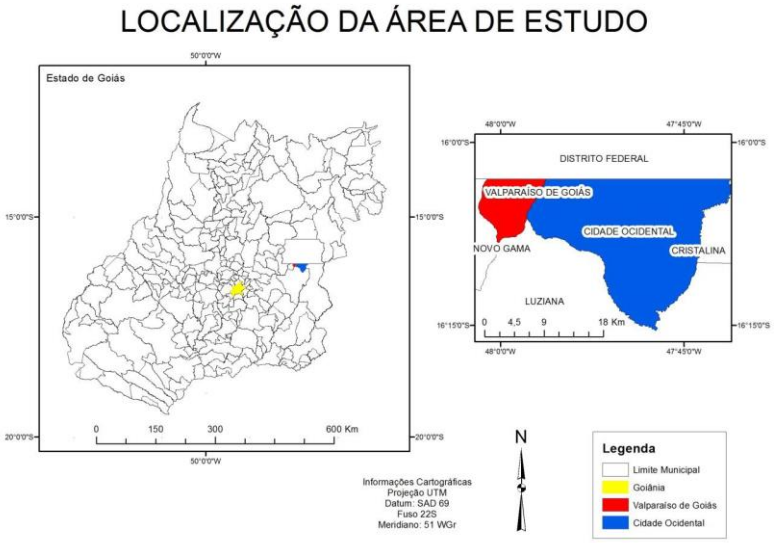


Figure 3: Location of the municipalities of Cidade Ocidental and Valparaíso de Goiás (GO)

Source: Adapted from the Secretary of Trade and Industry (SIC, 2009)

According to a survey conducted by the municipality and compared with the information from Abrelpe (2012), in the year of 2008, in Cidade Oriental, were generated on average 800 tons/month of wastes, approximately 27 tons per day. These wastes were sent to landfill sites, which, although it had all the environmental technology necessary for its operation, had a limited life. Many of the materials deposited in the landfill were not eligible for recycling and could have been forwarded to another

destination more noble with the deployment of a system of selective collection in the city.

The selective collection is the separation of the materials of organic origin of packaging made of plastic, paper, glass or metal, present in the garbage. To collect the waste separately, it is creation of the possibility of reusing of materials present there and of the packagings, which may return to the industry as raw material for new products, generating employment and income for people getting by the activity of recycling, as well as generating savings from natural resources by reducing the consumption of virgin raw material

In the city studied, the city hall wanted to deploy a central recycling for sorting, storage and sale of recyclable materials, in addition to an adequate logistics of collection and awareness of the population for the separation of waste in the residences. The estimate was to recycle 240 tons/month of packaging for the landfill that could be processed at the sorting center.

The project also foresaw the support for the organization of a cooperative of people who did not find work opportunities in the formal market and that already had contact with the recycling, enhancing the work of the collectors in order to reduce the rates of social vulnerability in the municipality.

4 PROJECT ACTIONS FOR IMPLANTATION OF THE SYSTEM OF SELECTIVE COLLECTION

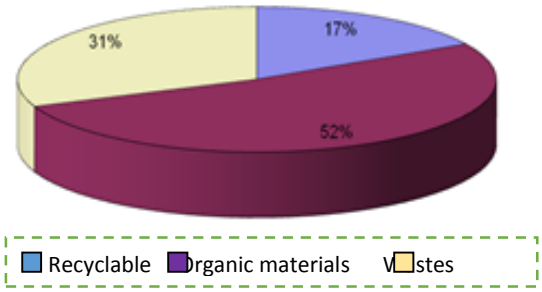
To fulfill the objectives, some steps have been taken. Initially the elaboration of diagnosis, the planning of selective collection program with guidelines for the reactivation of the sorting center and training of collectors of recycling materials for the formation of a cooperative and, finally, the environmental community education to promote community participation in the process of managing of the system.

4.1 SOCIAL ENVIRONMENTAL DIAGNOSIS

The first step for the implementation of the project was the establishment of a social environmental diagnosis, which, according to Almeida (2005), contributed to the decision-making of public managers of municipalities in order to identify problems for implementation of a development on sustainable basis, that is economically viable, socially equitable and environmentally friendly. The diagnosis of the municipality took place in the beginning of the project, in 2011, according to the following data.

The state of Goiás has 246 municipalities, which produced at that time 643 tons of household solid waste per day (IBGE/PNSB, 2008), Cidade Ocidental produced 26.6 tons/day of such waste, i.e., 4.3% of the total generated in the state.

According to the survey of gravimetric wastes of the city, held in May 2011, 17% of these residues are composed of plastics, paper, glass and metals that can be recycled as shown in Graph 1.



Graph 1: The gravimetric survey of waste from Cidade Ocidental

Source: IBGE/ PNSB (2008)

4.2 PLANNING OF SELECTIVE COLLECTION PROGRAM

The initiative to organize a system of selective collection in the municipality came from the city hall, which requested support from a specialist consultancy services for its implementation. Since the closing of the old dump in the year 2008, the municipality was seeking ways to organize the collectors who worked on site and who were without their

livelihood after the closing down. After the diagnosis and the lifting of demands, it was necessary to perform planning, defining the next steps to be taken, considering the following topics:

a) Organization of a team of selective collection, formed by technicians from the city hall and bound to the mayor's office;

b) Division of activities on three working fronts: The reactivation of the sorting center (and formation of cooperative with the collectors), defining the logistics of collection and environmental education;

c) Construction of a project for fundraising and budget, as well as seeking funding partners;

d) Revision of the legal framework of the activity, with the approval of the municipal law of selective collection and covenants required.

4.3 TRAINING FOR THE FORMATION OF THE COOPERATIVE

The work schedule predicted, after the beginning of the construction of the sorting center, the registration of people who have in the waste of the city their main source of income. These collectors attended meetings of clarification of the project, the possibilities of selective collection and talked about the challenges and opportunities of work in cooperative.

The collectors who were registered in the diagnosis that were willing to participate in the future cooperative were trained to the understanding of the cooperatives work and the operating rules of the selective collection program and the cooperative, for better separation of recyclable materials in the operation of the sorting center and the importance of his work for the environment and society.

With the elaboration of the project to resource capitation, it was possible to access the Growth Acceleration Program (PAC) and build the shed for the sorting center, where the materials are separated from the collection and then sent for sale through the truck collection (Figure 5).

Figure 5: Sorting center of Cidade Oriental (GO)

(a) shed of the sorting center. February, 2012. (B) truck used at the selective collection.

Source: Photo collection from Cidade Ocidental City Hall

The operation is carried out by their own cooperative members (Figure 6), which enabled and legalized, form the cooperative *Esperança de Materiais Reciclados*, a working place that has space for separation and storage of material, kitchen, dining room, bathrooms and office.

Figure 6: Cooperative members

Source: Photo collection from Cidade Ocidental City Hall

The collectors, in addition to agents of collection, have played a crucial role in raising the awareness of the citizens, both in the implementation of the collection and maintenance of the program, emphasizing the importance of understanding and responsibility in the whole process.

From the urban layout and mapping the rural areas of Cidade Ocidental, it has been designed a roadmap for the collection of recyclable

materials, divided by sectors. In each sector, the selective collection was performed in three ways: Through truck-cage, voluntary surrender places(PEVs) or by collecting with appropriate carts, as represented in Figure 7.

Figure 7: Organization of the roadmaps of selective collection

Source: Photo collection from Cidade Ocidental City Hall

4.4 COMMUNITY ENVIRONMENTAL EDUCATION

For Arruda, Barbosa, Souza, Rigo & dal Piva (2014), environmental education seeks to form educated citizens in relation to the environment, i.e., sufficiently well informed to be able to perceive their environment and critically analyze the situations that are presented. In this sense, all local partners (schools, associations, churches, trade, local leaders and health units) were invited to participate in the commission of selective collection. In Figure 8, it is shown the training of environmental agents.

Figure 8: Training of environmental agents.

Source: Photo collection from Cidade Ocidental City Hall

In addition to the actions commanded by the cooperative of recycling and by city hall, support was given to each partner interested to develop environmental education activities. The deployment of collection and the awareness of the villagers consisted in dividing by sectors the streets and neighborhoods of the city, which ensured a detailed and progressive campaign in the municipality. The awareness activities included presentations, lectures, ludic workshops and a chain of clarification door-to-door.

It was also made communication campaign, with banners, posters, brochures, *website*, *jingle* of collection, among other materials. An important action, as shown in Figure 9, were the distributions of Raffia sack for storage of recyclable, attitude which greatly increases the adhesion of the citizens, since only the material is dumped in the truck, and the dweller can reuse the bag.

Figure 9: Distribution of returnable bags for storage of recycled material

Source: Photo collection from Cidade Ocidental City Hall

5 RESULTS OBTAINED AND ANALYSIS

All in all, the selective collection program in Cidade Ocidental was organized in three years. The goal of the first year of work, between August 2009 and August 2010, was to organize the planning of the campaign, the fundraising, the construction of the shed and the legalization of the cooperative.

With the implementation of the sorting shed, in 2011, it was possible to carry out the implementation of the selective collection program in the city. In that year, it was developed the communication materials, the

training of the partners, task forces to increase awareness and, finally, the beginning of selective collection in August 2011. In a year of project execution, it was possible to deploy the selective collection in five of the nine routes planned, attending the neighborhoods of greater urban concentration of the municipality. Among the main results, those that stood out were:

- 50% of municipalities served by the selective collection;
- 322 tons of materials sent for recycling;
- R$ 128. 882.00 of revenue generated;
- An average of 22 jobs generated;
- Income of the members next to minimum wage.

6 FINAL CONSIDERATIONS

From the initial diagnosis, we can observe great potential for the deployment of selective collection in the municipality and later the program planning. Within the planning, a crucial point for the development of the project was the formation of the technical body of the city hall and the reactivation of the sorting center, space that enabled the organization of a group of 20 collectors and implantation of a low-cost system.

Another important point was the division of the activities on three working fronts: organization of the sorting center, definition of the logistics of collection and environmental education. The training, which was also performed for the residents of the municipality, aimed to raise awareness of families to the separation of the materials to be sent to the selective collection.

With the development of the project and subsequent resources capitation, it was possible to access the Growth Acceleration Program (PAC) and build the shed of sorting. It was also possible, with the acquisition of resources, implement a system of selective collection of low operating cost.

For a system of Integrated Management of Solid Urban Waste to be effective, it is necessary that the system submits forms of implementation and that allows alternatives that aim to the social inclusion of people who have or use the trash as income source. This implantation was successful

because it was performed by means of training and inclusion of the collectors in the region and now it keeps growing thank to a process of evaluation and monitoring with system of goals to expand the collection, in order to meet the greatest number of neighborhoods until we have all the municipalities participating of the collection system.

According to Van Paden (2004), Assessment tools are needed to verify the path of development, as systems of goals and measurable performance criteria, as in case of selective collection, which can monitor performance through the system of data, that provides information on the total volume collected, sorted, sold, hours worked and the average income of the members.

REFERENCES

Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais - Abrelpe. (2012). Panorama dos resíduos sólidos no Brasil. Edição Especial de 10 anos. Recuperado em 23 de junho, 2015, de http://www.abrelpe.org.br/Panorama/panorama2012.pdf

Abrelpe. (2012). Panorama dos resíduos sólidos no Brasil. Edição Especial de 10 anos. Recuperado em 23 de junho, 2015, de http://www.abrelpe.org.br/Panorama/panorama2012.pdf

Almeida, L. D. (2005). Diagnóstico socioambiental e contribuições para o planejamento ambiental do município de Maracanaú-CE. *Caminhos de Geografia*, *11*(15), 108-125.

Andrade, J. B. L de (1997). *Análise do fluxo e das características físicas, químicas e microbiológicas dos resíduos de serviço de saúde: proposta de metodologia para gerenciamento em unidades hospitalares.* Tese de Doutorado, Escola de Engenharia de São Carlos, Universidade de São Paulo: São Carlos, SP, Brasil.

Arruda, A. M. D., Barbosa, M. D., Souza, W. R. D., Rigo, A. S. N., & Dal Piva, C. (2014). Conhecendo a realidade dos moradores do Parque do Sol para promover o desenvolvimento socioeconomico e ambiental. *Anuário da Produção de Iniciação Científica Discente*, *14*(24), 91-103.

Associação Brasileira de Normas Técnicas - ABNT. (1987). *NBR 10004: resíduos sólidos.* Rio de Janeiro: ABNT.

Bringhenti, J. R. (2004). *Coleta seletiva de resíduos sólidos urbanos: aspectos operacionais e da participação da população*. Tese de Doutorado, Faculdade de Saúde Pública da Universidade de São Paulo: SP, Brasil. CEMPRE (2013). Review 2013. *São Paulo: Cempre*. Disponível em:<http://www.cempre. org. br>. *Acesso em: Janeiro, 2016*.

IBGE, (2008). Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Amostra por Domicílio – PNAD. IBGE: Rio de Janeiro.

IBGE/PNSB, (2008). Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Amostra por Domicílio – PNAD. IBGE: Rio de Janeiro. Disponível emp://www.sidra.ibge.gov.br/bda/pesquisas/pnsb/

Demográfico, I. C. (2014). Disponível em:<http://www.ibge.gov.br/home/estatistica/populacao/censo2010/default.shtm>.

IBGE (2008). Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Amostra por Domicílio – PNAD. IBGE: Rio de Janeiro.

Jacobi, P. R., & Besen, G. R. (2011). Gestão de resíduos sólidos em São Paulo: desafios da sustentabilidade. *Estudos Avançados, 25(71), 135-158.* Recuperado em 20 de novembro, 2014, de http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-

Lopes, A. A. (2003). *Estudo da gestão e do gerenciamento integrado dos resíduos sólidos urbanos no município de São Carlos (SP).* Dissertação de Mestrado, Escola de Engenharia de São Carlos, Universidade de São Paulo: São Carlos, SP, Brasil.

Lopes, L. (2006). Gestão e gerenciamento integrados dos resíduos sólidos urbanos: alternativas para pequenos municípios. Dissertação de Mestrado, Faculdade de Filosofia, Letras e Ciências Humanas da Universidade de São Paulo: SP, Brasil.

Ministério do Meio Ambiente. (2014). *Governança ambiental, geoprocessamento.* Fonte: Ministério do Meio Ambiente: http://www.mma.gov.br/governanca-ambiental/geoprocessamento

SIEG (2009). Limites municípais da base cartográfica planialtimétrica de Goiás. SIEG-Sistema Estadual de Geoinformação - Goiás. Recuperado em 3 de junho, 2015, de http://www2.sieg.go.gov.br/pagina/ver/11587/mapas-interativos.

Van Bellen, H. M. (2004). Desenvolvimento sustentável: uma descrição das principais ferramentas de avaliação. *Ambiente & Sociedade*, *7*(1), 67-88.

Zanta, V. M., & Ferreira, C. F. A. (2003). Gerenciamento integrado de resíduos sólidos urbanos. In A. B. de Castilho Júnior (Coordenador), *Resíduos sólidos urbanos: aterro sustentável para municípios de pequeno porte*. São Carlos, SP: Rima Artes e Textos.