CLEAN DEVELOPMENT MECHANISM (CDM) PROJECTS FOR LANDFILLS IN THE CITY OF SÃO PAULO AS AN IMPROVEMENT TOOL OF URBAN SOLID WASTE MANAGEMENT

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ABSTRACT

The main goal of this article is to analyze the implementation of Clean Development Mechanism (CDM) projects for landfills as a tool to improve a city´s urban solid waste management (USWM). For that, two major landfills of the city of São Paulo are considered in the study: *Bandeirantes* and *São João*. The analysis of the issue CDM/USWM is referenced in the analytical framework of the multi-agent models, which enable the identification of the stakeholder's competences and preferences. Moreover, it makes possible to study thee interactions among them in the political, economic and social sphere. It was verified that the landfills surrounding communities need to get more information and awareness about CDM project and their benefits for the sustainable development which ought to be attended along with their implementation. The main weaknesses identified concerns the lack of communication amongst the City Hall instances involved in the USWM, and the performance of the proponents (public and private) when interacting and planning the CDM projects, which should be able to improve the USWM.

Key-Words: CDM, solid waste management, service innovation

1 INTRODUCTION

This article aims to examine how the Clean Development Mechanism (CDM) projects for landfills can generate innovative services which contribute to the improvement of cities' municipal solid waste management (USWM).

The CDM covers the development and implementation of projects which reduce or eliminate the emission of greenhouse gas (GHG) emissions in developing countries. They must be financed by developed countries in exchange for credits to be deducted from their commitments to reduce emissions, per their participation in the Kyoto Protocol.

The emission reduction per se does not mean a promotion of sustainable development, when was a recommendation in the 12th article of the Kyoto Protocol and in the III annex of the Resolution No. 1. According this Annex, the project participants should indicate how the project activities will contribute to sustainable development, as determined by some aspects of the Kyoto Protocol. From this perspective, the aggregates value of carbon credits should be increased by the promotion of social, environmental, economic, ethnic, cultural and technological sustainability, with notable contributions to building a sustainable society in all its dimensions.

This research is especially relevant due to the imperative necessity to improve basic sanitation conditions in Brazilian cities, and particularly their solid waste segment (SWS) systems in order to increase quality of life.

The physical infrastructure of the water and sewage segments is easier to maintain than those of urban sanitation and solid waste management. This is due to the fact that the latter and the full participation of the local government to ensure a permanent flow of resources for their continuous (IBGE, 2002).

In Brazil, the first CDM landfill projects began in June 2004 with the approval of the *Nova Gerar* project in the *Baixada Fluminense*, state of *Rio de Janeiro*, and of the *Veja* Project located in *Salvador*, in the state of *Bahia*. Both generate power through the use of biogas produced by the landfill (UNFCCC, 2009). Of the 405 CDM projects undertaken in various sectors in Brazil, 36 projects are landfill projects, constituting a promising opportunity to promote the social and environmental sustainability Brazil. By supporting appropriate solid waste management system cities (CIMGC, 2009). Of the 36 landfill projects, 14 are located in São Paulo (UNEP RISOE, 2009).

The *Bandeirandes* and *São João* landfill projects were selected for this study due to the similar characteristics of the projects and both are located in a city of great complexity in terms of the role of local government managers.

The multi-agent model (WINDRUM AND GARCÍA-GOÑI, 2008) will be applied to analyze the degree of interaction between the different actors in the political, economic and social sphere. It is believed that new forms of institutional arrangements, linked to the credits arising from the CDM projects on landfills, can be viewed as an opportunity to improve the sustainability of the management systems in the cities that demonstrate the feasibility of using this mechanism. This system permits researchers to obtain evidence about the opportunities for the innovation in the service performance, emphasizing the articulation of the various actors involved in the issue.

The article is structured in five sections. After the introduction, section 2 summarizes the literature review and presents the conceptual reference basis for the analysis proposed in this paper. Section 3, presents the methodology used in this analysis. The results identifying the agents involved with the *Bandeirantes* and *São João* landfills CDM projects (and how they relate), and the conclusion are presented in Sections 4 and 5, respectively.

2 BIBLIOGRAPHY REVIEW

This section is structured to introduce what is the regulatory carbon market, with guidelines established by the Kyoto Protocol, and its peculiarities in relation to sustainable development. Then, the projects established in landfills are addressed, illustrating the possible improvements in USWM through carbon project implementation and stakeholder interaction. The following topic aims to explain the services provision innovation, emphasizing the articulation of the different actors involved.

2.1 The Kyoto Protocol, the CDM and the landfills projects

The Protocol establishment occurred in March 1998, but became effective seven years later, on February 16th, 2005. With the objective of seeking sustainable development in the world, the initiatives that set up the assumptions of joint responsibility to reduce environment degradation and the likely contribution of each individual to this reduction, the Protocol sets out guidelines for measures programmed to contain the decrease in biodiversity (RIBEIRO, 2005).

In relation to the rules determined by Articles 2 and 3 of the Kyoto Protocol, developed countries listed in Annex I must meet their commitments to reduce GHG emissions, and minimize the adverse environmental, social, and economic impacts, in order to promote sustainable development. The reductions would occur by the transformation of the activities; however, due to several factors related to technology and economics (among others) the Kyoto protocol offers flexible mechanisms. Among the flexible mechanisms, there is the CDM.

Since Brazil is a signatory country and not on the Annex 1 list of the Protocol (comprised of developed countries), the procedure for CDM is the only possible alternative for marketing carbon credits under the Kyoto Protocol. The CDM covers the development and implementation of projects aimed at reducing and eliminating emissions of GHGs in developing countries, which must be financed by developed countries in exchange for credits to be compensated for their commitments to reduce emissions (CONEJERO, 2006). The emission reduction units derived from CDM are called Certified Emission Reductions (CER).

The emission reductions project activities will be eligible for the CDM since they consider certain conditions that address sustainable development objectives established by the country where the project activities are occurring (LOPES, 2002).

According to Rocha (2003), the social and environmental aspects that should be included in the CDM projects go beyond the reduction of GHG emissions and/or carbon sequestration to promote the sustainable development of the project in the host country. Also, Article 12 establishes that the participation in the CDM of a non-Annex-I occurs on a voluntary basis. According to Monzoni (2004), it is interpreted that at this moment, is transferred by the UNFCCC the responsibility for the Designated National Authorities (DNA), the decision on the analyzed project promotes or not the sustainable development. Thus, without the effective participation of the private sector, there is no guarantee that the requirements proposed by the Kyoto Protocol are exercised.

It is emphasized that the social and environmental goals are not always placed on an equal balance with economic priorities. However, following the reasoning of Rocha (2003) and also the premises of the United Nations Framework Convention on Climate Change, the CDM does not exist by itself and the project is inserted into a much larger context, so the profits generated are not fundamental to their existence. It is expected that the sustainability of the project, from the point of view of financial, social and environmental, can attract the resources needed for its operation, generating social benefits like jobs, reducing health problems and the reduction/elimination of environmental degradation.

Descriptions related to the sustainable development that the project should promote are presented in the PDD, a document containing the technical aspects of the project. The approval by the DNA occurs after the project review under the rules and regulations of the CDM Executive Board, with emphasis on the sustainability criteria of the project.

The environmental recuperation of dumps and the systematize deployment of power generation in landfills can be economically made possible by the sale of the carbon credits, arising from the carbon emissions reductions into the atmosphere (IBAM, 2007).

According to Pavan and Parente (2006), the resources resulting from the CERs sale, could be considered as an important additional source for investments in waste management. While these resources are not always directed to the secretaries of all local municipalities responsible for operating a landfill, in most cases these projects are built by private companies, the balance received by public bodies for investment in this sector, is still beneficial.

According to Martins (2008), the USWM advancement from the CERs revenues shall be pursued also through the articulation between the different actors involved with the issue of CDM on landfills. Therefore it is essential structure solid bases for the CDM being implemented as best as possible, aiming to effectively disseminate the positive impacts of the USWM.

The CDM arises, then, as a binding and facilitating instrument to property dispose of municipal solid wastes, especially for those cities with higher populations with more waste. Brazil has significant potential for generating carbon credits in landfills. This is a promising opportunity to promote the social and environmental sustainability of the municipal development in the country, by promoting a more appropriate solid waste management system.

2.2 The *Bandeirantes* and *São João* landfills CDM projects

This section aims to describe the main characteristics of the *Bandeirantes* and *São João* CDM projects, based on their PDDs.

The *Bandeirantes* landfill has an area of 140 hectares and *São João* has 84 hectares. They are the two largest landfills in the city of São Paulo and has a huge potential to generate biogas, due to the amount of waste received during the operational years. The activities of collecting gas for power generation began in December 2003 for the *Bandeirantes*, and in June 2006 for the *São João* (UNFCCC, 2005).

Until 2003, the *Bandeirantes* landfill gas was collected only through a passive system, which consists of gas venting collected and eventually burning the gas at the surface of the drains for safety and odor control On December 23rd, 2003, they began the project of collecting gas for power generation. The estimated amount of GHG reductions by the project is approximately 7,494,404 tonnes CO2e for the first crediting period (7 years). On average, the reduction in annual average tonnes of CO2 is around 1,070,629 (PDD, 2005). *Bandeirantes* has an operational life expectancy of 21 years.

In the *São João* landfill, the period between May 2007 and March 2008 generated 258 657 CER (UNEP RISOe, 2009). On average, the reduction in annual tonnes of CO2 is around 816,940 tonnes of CO2e (PDD, 2005). The *Sítio São João* Project also has an operational life expectancy of 21 years.

Participating in these projects is the Municipality of *São Paulo,* as a public entity and the Biogas Group as a private entity. São Paulo was added as a participant, since it owns 50% of the emission reductions generated by the projects (PDD, 2005).

2.3 Service Innovation

With the undeniable rise of the economic importance of these services, researchers and decision makers have been concerned with innovatin activities in this sector (HIPP & GRUPP, 2005). Examining this issue is not an easy task because the roots of this study are based on analysis of technological innovation in manufacturing activities (TETHER & TAJAR, 2008). There are discussions addressing the service sector and the capacity to generate innovations alone or if the changes processed are sub-products of the innovation processes from industry (BARRAS, 1986; DREJER, 2004).

According to THETER & METCALFE (2004), services innovation shall be understood as any change in the character of service offered, which suggests changes in the service relationship. It is essential to develop a conceptual analysis of services focusing on attracting service that is fundamentally different from goods and products. The authors explain the difference between goods and products, discussing that the service is not produced. Also, they clarify that service is a work in process and product is the result of this process.

Thus, it is possible to conclude that services are essentially processes and cannot be simply unbound from the products that proceed of this process. From this perspective, there are approaches to capture service and innovation characteristics in this sector, focusing on the innovation process itself. The innovation process can be supported by new technological developments, the combination of existing technologies, or, by using other types of knowledge acquired.

To pick up the service innovation dynamics, there is the peculiarity of knowledge and human capital, and from the perspective of services innovation, examine methods of mutual influence and interdependence of the actors involved (MILES, 1993). Innovation activities in services possess basic character dynamic, not static, from the perspective that the system evolves. (WINDRUM P. AND GARCÍA-GOÑI, 2008)

The socioeconomic dimension of the service relationship includes the factors that perform in the actors' organization in the circumstances of service, where they operate according to the logic of the action that can only be identified and interpreted, in the course of action. The product of the service is, therefore, the understanding of an agreement constructed between the actors of the service relationship.

For the design of these networks established between the actors, different multi-stakeholders methodologies are proposed, among them the multi-agent model developed by Windrum and García-Goñi (2008) adapted in this study for the segment of USW and focusing on the public services provision.

3 METHODOLOGY

As a methodology procedure is used with the analytical framework of WINDRUM and GARCÍA-GOÑI (2008) multi-agent model, applyied it to identify opportunities for innovation in the provision of services related to the USW segment, as shown in the following figure 1.

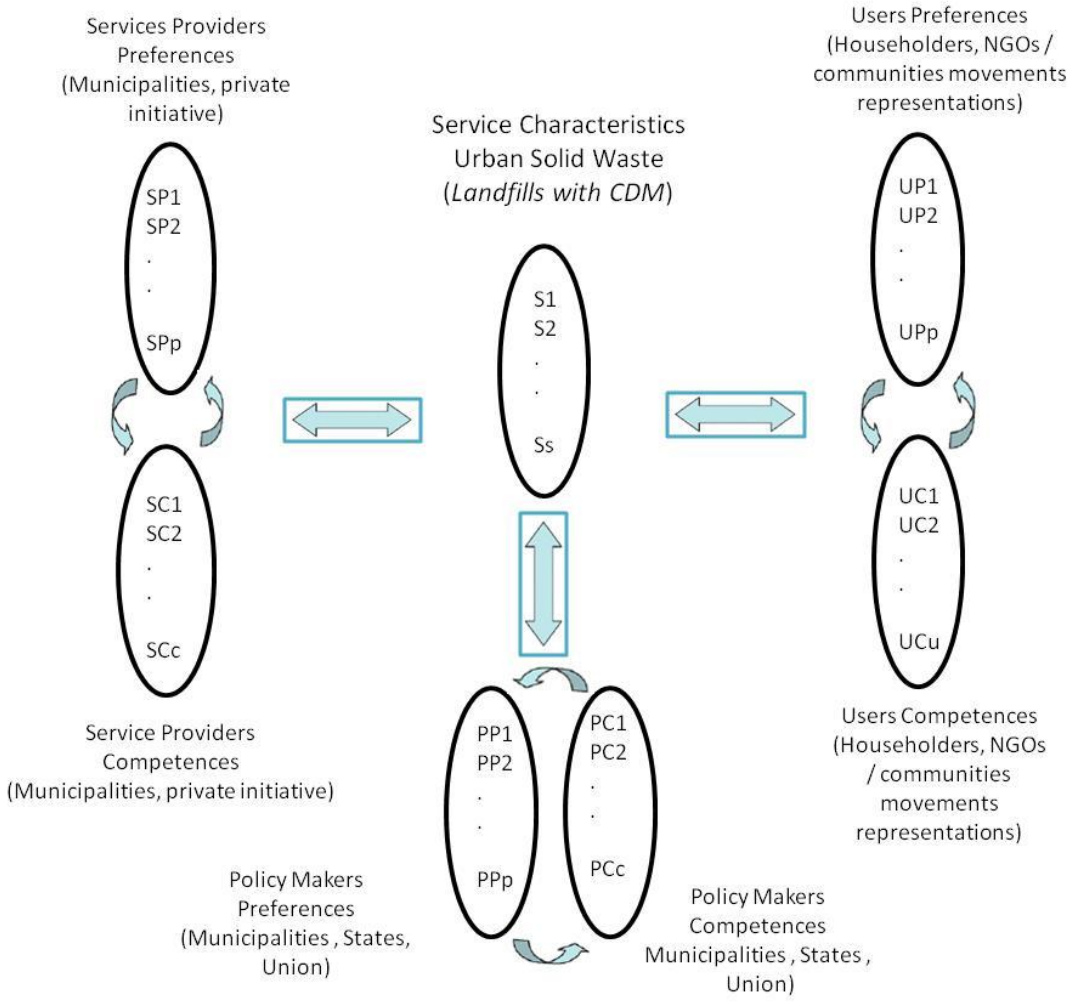

Fig. 1 Multiagents model applied to the urban solid waste segment
Source: Author's own, adapted from Windrum and García-Goni (2008)

According to Windrum and Garcia-Goni (2008), the multi-agent model must encompass political actors, service organizations and consumers/users for services innovation. This model allows including interactions between political, economic and social spheres. The innovation process in this model is directed toward the understanding of interactions between different agents. Based on the identification of preferences and competences of the stakeholders required for the service provision, we can enhance the understanding of the peculiarities of the innovation.

The breakdown by function allows the consideration of competencies and the operations that make provision of certain services (for those related to USW); thus, we can recognize the results from the actions and interests derived from the different groups covered. The multi-agent system is a facilitator for the new services development with innovative features. Therefore, in this study the model is adapted to analyze the implementation and operation process of CDM projects on landfills.

4 RESULTS

This section aims to identify the stakeholders involved in the *Bandeirantes* and *São João* landfill CDM projects, and how these actors interact, highlighting their preferences and competences.

4.1 Service Providers – Public Sector

One of the sectors of the Municipal Services Secretariat (MSS) of São Paulo is the Urban Cleaning Department (Limpurb), responsible for managing the public cleaning landfills services, among them. The USWM activities in the city of São Paulo are run by two permitted enterprises, *Ecourbis* and *Loga*. The *São João* landfill is operated by *Ecourbis,* and the *Bandeirantes* by *Loga.*

The MSS and the *Ecourbis* and *Loga* permitted enterprises are not involved in the CDM projects. The concession for the *São João* biogas capture is given by *São João Energia Ambiental S.A*. Company, and the concession for *Bandeirantes* biogas exploitation is given by the *Biogas Energia Ambiental SA*, both companies compose the *Biogas* Group. During this study it was found that there is no articulation with the Municipal Secretariat for Environment (MSE), the one in charge of signing the PDD and other related documents, and responsible for the legal aspect for the carbon credits sale in the auction. .

The MSE was established in October 2003. The MSE embraces also the Council of the Special Environment and Sustainable Development Fund - CONFEMA and the Fund for the Environment and Sustainable Development – FEMA.

The Certified Emission Reductions (carbon credits) from the *Bandeirantes* and *São João* landfills CDM projects revenues are given to FEMA. The contract signed between the municipality and the company about the gas concession stipulates the sharing of CER in the proportion of 50% for each party, but no details were disclosed to substantiate this division.

The FEMA resources are intended to financially support plans, programs and projects. That seeks the rational and sustainable use of the natural resources, control, supervision, defense and restoration of the environment, and promotion of environmental education. Regarding the *Bandeirantes* and *São João* landfills projects, the financial resources from the auction of the *Bandeirantes* landfill carbon credits are placed in projects / programs / activities, mostly related to the implementation of linear parks and plazas, and to the recovery of green areas. It was verified that there are insufficient actions that further the prospects of the USWM, which is contemplated in only one item on the implementation plan of the financial resources of the *Bandeirantes* project: Selective collection. In Table 1 is placed the budget resources movement from FEMA, is detailed.

Table 1 FEMA budget resources movement

Agency/year	Original Budget (R$)	Uptaded Budget (R$)	Pledged (R$)
FEMA/2007	32.720.500,00	32.720.500,00	271.796,36
FEMA/2008	57.366.663,00	57.366.663,00	13.821.068,36

Source: PMSP 2007; PMSP 2008

It was shown that there was a large increase in FEMA's budget due to the CER revenues. According to the data shown previously, it was found that the use of funds from the credit auction of the *Bandeirantes* and *São João*, showed a low-level of pledge value when compared to the current budget (24.21%). The implementation of projects with the FEMA funds, especially those from auctions of carbon credits, appears timidly.

The data available in the annual inspection report of the city of São Paulo, showed that the regularization of the following resolution for the financial year 2007 remains stagnant: *"Establish adequate planning for the promising use of the Certified Emission Reductions revenues"* (PMSP 2007; PMSP 2008). The annual inspection reports also indicate that the city controller for monitoring the compliance with FEMA's budget is precarious due to the different revenue sources. Therefore, it is essential that the MSE establish procedures for these difficulties to be resolved, and to practice proper dissemination of stated activities to be enjoyed by society at large.

4.2 Service Providers – Private Initiative

The *Biogás* group received in 2001 the permission to capture the gas from the *Bandeirantes* and *São João* landfills. The company repasses 50% of the CER's issued for the *São Paulo* city hall and also makes a monthly fee payment for use of the area and capture of biogas. The *Biogás Energia Ambiental S/A*, operates the gas from the *Bandeirantes* and the *São João Energia Ambiental S.A*, from the *São João* landfill.

The national and international visibilility of the *Bandeirantes* and *São João* landfills projects regards not only their GHG emissions reduction, but also the commitment of improving the monitoring of the landfills parameters.

For the local environmental sustainability, the projects provide: the biogas collection and treatment, reduction of disease-causing vectors, odor reduction by capturing the gas, monitoring the environmental quality, and reduction of other toxic gases. According to the company, they generated resources provides gains for all stakeholders: *Biogas* group, *São Paulo* City Hall, and the surrounding residents due to improved quality of life , because it reduced odors and improved the infrastructure of the landfills.

According to the *Biogas* group, being the permitted enterprise to capture the biogas, they could participate more actively in the proceedings of the landfill closure plan, which is performed by the *Ecourbis* and *Loga* companies, who have the landfills management ownership. In the *Bandeirantes* landfill, there is no relationship between *Biogas* and *Loga* for the implementation of activities at the landfill.

In the *São João* landfill, this situation is mitigated; however the relation among them could be deeper and generate greater benefits for all parties involved. The fact that there were two givens for the same area affects the relationship between these actors, and results in conflicts of interest.

There are two municipal departments involved with the USWM service provision and with the CDM projects. The SVMA, that receives the carbon revenues, and SES, which includes the *Limpurb*, a subdivision responsible for the USWM of São Paulo. These departments also do not act in an articulate manner to promote the improvement of the USWM. It was found that the companies responsible for the CDM projects have no knowledge of the landfill closure plan, which is in charge of drafting of *Ecourbis* and *Loga*. Their actively participation would be extremely important from the standpoint of the biogas generation and capture.

Regarding the interaction with the surroundings communities of the landfills, the Biogás was present in two plenary sessions held by the *Fórum de Desenvolvimento Local Perus – Anhanguera* with the purpose of providing explanations of the CDM project at the landfill.

It was evident that the sharing of 50% for *Biogas* and 50% for the São Paulo city hall, results in confusion of who will be the (major) responsible for the development of the actions described in the PDDs. There are transpositions of responsibilities and the communities do not know clearly who directly claim.

4.3 Users – Civil Society

This topic seeks to address the civil society performance focusing on the *Fórum de Desenvolvimento Local Perus – Anhanguera* and C*are Brasi*, *an* NGO, in the Bandeirantes Landfill´s case, and *"Mais Vida, Menos lixo"* movement in the case of the *São João* Landfill.

It was only after the inauguration of the *Bandeirantes* Thermoelectric Plant that the *Fórum de Desenvolvimento Local Perus – Anhanguera* began to learn that the project was occurring in its "backyard". There was not, thus, disclosure regarding the project approval and this was not discussed with the community. Therefore, it is considered that there was a deficiency in the democracy in the approval process of the *Bandeirantes* landfill CDM project (RIBEIRO, 2009).

In September 2005 the project was approved by the Interministerial Commission on Global Climate Change (ICGCC), thus confirming that the *Bandeirantes* landfill project would enable the promotion of sustainable development. In November 2006, with more information about the project, the community leaders have made a denunciation to the Federal Public Ministry (FPM) which, through a public action sent to the MPF, in September 2007, it proposes a resolution recommending that the ICGCC revise the *Bandeirantes* landfill CDM project, claiming that it is based on precarious licensing and environmental disputes are part of an investigation by the State of MP (MINISTÉRIO PÚBLICO, 1993) In a seminar held in the City Hall, in April 2007, discussions began on how the revenues from the project could be designed to support the local community.

In 2007, the city hall reported that the income from the project would be used for FEMA. In September 2007, the city hall released some actions to be carried out with the credits of the *Bandeirantes* landfill oriented to the construction and management of linear parks. The following month, the community surrounding the landfill submitted a worksheet with proposed changes in the allocation of the resources. The selective collection implementation was increased by the installation of *Ecopontos*. However, until now, the community has not received feedback from the public agency about these proposed changes.

Thus, the community believes that the gains that the CDM project can provide hardly benefit the surrounding communities as well as collectors of recyclable material and NGOs. From the viewpoint of the *Perus* community, there is no proper coordination between project proponents and the surrounding communities.

In the São João landfill´s case, the *"Mais Vida, Menos lixo"* movement, appeared from a *São Mateus* community initiative, the east of São Paulo. The movement argues that the solution to the disposal of USW in the city is not building more landfills, but in the public policy formulation, environmental education, investments in infrastructure and campaigns to promote recycling.

There is a possibility that a new landfill will be constructed on outskirts of the *São João*. The movement played by the local community seeks to discuss public policies for the domestic solid waste issue in *São Paulo* before the construction of new landfills. It is argued that it is unacceptable to install new or expand landfills before they are reviewed to ensure the favor the selective collection, recycling and environmental education for the waste reduction of households.

This local civil society movement represented the surrounding community in public hearings related to the carbon credits from the *São João* and *Bandeirantes* landfills. The movement believes that the carbon market is an inefficient mechanism, since the Kyoto Protocol is not fully played. Just what is a interest to other agents or interested parties is yet to be seen. In the view of the movement, the resources generated do not provide gains for all interested parties; they do not contemplate the landfill´s surrounding residents, recyclable material collectors: NGOs, among others. The articulation of the project leaders, in public and private spheres, occurred only in public hearings, in which the community has not been previously able to show their demands effectively or predominate the experts' technical arguments of the subject. There was resistance from the surrounding residents and collectors of recyclable materials to the implementation of the CDM projects, because they believe that this mechanism can influence the construction of landfills in the city of São Paulo, and, as demonstrated above, the community is moving to impede the project from a new landfill to be installed in the region.

It is understood that the focus on building more landfills is not the solution to the problems of the USWM, and that the resources of the project should also fund research into new ways to manage and dispose waste and also promote coming programs. Resources should also promote environmental education programs, adequate selective collection systems, and support local NGOs focused on recycling, and other environmental goals.

5. CONCLUSION

The development of partnerships is one of the guidelines that can promote the improvement of public management in the segment of USW, insofar as the municipal administration seeks to interact with the various actors of society, local government, private entities and entities representing civil society. There is clearly a need to articulate the different social actors in facing the question embraced in the management of household solid waste, promoting transparency and social control, encouraging the society to monitor the results obtained from CDM projects on landfills. Regarding to the *Bandeirantes* and *São João* landfills, there were no developments in direct improvements in the USWM of São Paulo current the resources arising from the CDM projects. Finally, it is emphasizing that the introduction of advances in the management of the household solid waste in the country is fundamentally needed to take a comprehensive view of the various factors that influence. Range this ideal scenario can be achieved by using models that consider the multiplicity agents involved in the issue, as well as their preferences and competences.

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