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SWOT analysis for the improvement of Municipal Solid Waste Management Planning

A Case Study of Iribarren Municipality, Venezuela

Maria Rosell

Supervisor

Andrius Plepys

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Published in 2011 by IIIEE, Lund University, P.O. Box 196, S-221 00 LUND, Sweden,
Tel: +46 – 46 222 02 00, Fax: +46 – 46 222 02 10, e-mail: iiiee@iiiee.lu.se.

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María Beatriz Rosell Pérez

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Abstract

This study presents the formulation of planning guidelines to apply by the responsible entity for municipal solid waste management (IMAUBAR) in Iribarren Municipality, Venezuela, with the aim of complying with the recent legislative instrument passed in December 2010, the *Law of Integrated Management of Garbage*. An overview of the Latin American Region solid waste management planning documents was carried out to determine the trends in the waste management approaches, as well as a brief examination was perfomed about the national existing conditions of SWM and its legislative framework in Venezuela. Along with this, the assessment of the current MSWMS of Iribarren Municipality, and major stakeholders involved in the system was carried out. A SWOT analysis was implemented, clustering data found in the literature review, semi-structure interviews, and site visits in order to obtain strategic actions from the overall SWOT profile. The data was grouped according to three action areas; institutional aspects, environmental aspects and socioeconomic aspects. Subsequently, the creation of ranking critera was performed to classify the outcome strategic actions in order to formulate the planning guidelines for IMAUBAR. The most relevant planning guidelines of this study lead to corrective actions to be undertaken by the IMAUBAR in regards to the enhancement of internal and external communication for increasing the level of public awareness about the new legislative instrument, and ongoing recycling projects in Iribarren Municipality. Also, the mitigation of environmental impacts, and augment of safety at the Pavia landfill is suggested, as well as inter-institutional cooperation for the solid waste characterisation. Among other planning guidelines created there is the promotion of cooperatives by IMAUBAR as an alternative form of organization is proposed between the collection companies and the existing group of people illegally working at Pavia landfill called *gancheros* for the improvement of the MSWM in Iribarren.

Keywords: Municipal Solid Waste Management, SWOT analysis, planning guidelines, Iribarren Municipality.

Executive Summary

The objective of this study is to create planning guidelines for the improvement of the municipal solid waste management system (MSWMS) in Iribarren Municipality, based on the assessment of the internal and external factors affecting the current scheme, as a starting point to develop a full strategic framework to comply with the new regulation passed in January of 2011. For the purpose of the planning guidelines formulation, a SWOT analysis was performed to cluster the information obtained in the literature review, and interviews to obtain strategic actions, data which subsequently was categorised by the application of raking criteria, based on attributes, developed by the author.

Existing situation

In developing countries, the MSWMSs have been characterised by the obsolete or unrealistic strategies to deal with residues and waste (Srivastava et al. 2005). Nevertheless, in the context of the Latin America, there have been efforts to conduct a proper management of waste, by the strategic planning that properly sets goals and targets in a time frame, such as it is shown in the summary table in section 2.1. In Venezuela, the situation is different; the predominant system of waste management is based on the conventional conception; the generation, collection and final disposition phase, under partially controlled conditions, presenting problems in the different phases of the existing scheme (Mendoza, 2009). The waste collection methods depend on the public administration of the urban sanitation service and the residues are not properly disposed and receive scarce treatment at the final disposition sites (Gomez, 2008), which in the majority of the cases are open-air dumps, and partially controlled landfills. In the national territory of Venezuela, there are just three sanitary landfills (Zamorano et al. 2009, & Guedez, 2011). Recently, a legislative instrument was passed in December of 2010, aiming to promote the integrated management of solid waste, and setting mandates to implement corrective measures in regards to the environmental and sanitary conditions at the final disposition sites.

In the context of Iribarren Municipality, the current waste management practice does not differ much from the national level scheme. The responsible para-municipal entity (IMAUBAR) coordinates the waste collection services in association with two private waste collection service companies (SATECA and Urbaser), the existing management presents financial deficits in the administrative and operational levels that lowers the quality of the collection service (Freitez & Rangel, 2008). The administration of the final disposition site (*Pavia* partially controlled landfill) is also carried out by IMAUBAR, presenting environmental and sanitary problems, along with issues related to safety, which constantly put in jeopardy private companies' employees, IMAUBAR staff, and individuals that illegally work at Pavia known as *gancheros* (Gomez, 2008). The waste selective sorting is carried out at Pavia landfill by a group of people that represent the informal sector, from deprived social conditions to subsequently sell the recyclable material to the intermediaries between the gancheros and the collection companies, this evidences the existence of an illegal market, which according to the new legislation should be eliminated.

Methods applied

For the purpose of answering the following research question*: What are the internal and external factors of the current MSWMS affecting the effectiveness of IMAUBAR and what actions should the Municipality take to comply with the new legislative framework on integrated management of residues and solid waste?;* An overview of MSWMS in the regional, and national level was performed, based on a literature review. A literature review, semi- structured interviews and site visits were completed to subsequently examine the situation at the Municipal Level. A SWOT analysis was

implemented to formulate strategic actions, following the approach of building on strengths, eradicating weaknesses, exploiting opportunities and mitigating threats (Karppi et al. 2001). The second criteria developed has the purpose of categorising the outcome strategies to formulate planning guidelines based on: the urgency for legislative compliance, taking into account the new legislative instrument Law of Integrated Management of Garbage; the level of impact of the strategy to solve the existing problems in accordance to the findings in the literature review; and finally the relevance of the problem that the strategy tackles by the viewpoints of the stakeholders representatives.

Conclusions

As a result of this study, there were twelve (12) planning strategies for IMAUBAR; these were created for the improvement of the current MSWMS in Iribarren Municipality (see section 5.4.1). The planning strategies in regards to the institutional aspects action area were five (5); aimed to address the lack of internal and external communication of the current legislation, enhance public participation in the IMAUBAR ongoing projects, and augment of institutional transparency methods to check legal compliance was also suggested. Another planning guideline was to improve the financial administration of the waste collection management by the adjustment of tariff collection fees, and also it was proposed to enhance regional cooperation among Latin America to evaluate successful examples of the integrated management planning and assess feasibility of the models in Iribarren. In the environmental aspects action area, three (3) planning guidelines were suggested; the creation of a municipal ordinance to establish sanctions for the non-compliance of the technical regulation on sanitary and environmental; to propel inter-institutional efforts among present organisations in the Municipality for the characterization of waste, as part as an initial step for waste recovery and waste utilisation in the future. The final planning guideline created in this action area was the revision of the present plan of the municipal waste transfer station in order to include an integrated MSWM approach and avoid the reproduction of similar problems at Pavia landfill.

In reference to the planning guidelines created in accordance to the socioeconomic aspects action there were four (4) suggestions; the augment of safety at Pavia landfill, and the establishment of an environmental campaigns programs by IMAUBAR to raise public awareness in the issue of selective sorting, recycling as well as aspects of the new legislation which involve the citizens. As another planning guideline, the promotion of partnerships among the collection companies and the gancheros is suggested, as well as the creation of a municipal ordinance that will follow the legislative mandate in regards to the creation of economic incentives to the general public along with incentives to the private industries to increase the participation of all sectors of society in the integrated management of municipal solid waste in Iribarren.

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1 Introduction

The first chapter is intended to introduce the reader to the background of the study. In this sense, the first section describes the current situation with regards to waste management in a global perspective and national level in Venezuela, also, it points out the problems generated by inadequate handling of waste and residues at the case study level in Iribarren Municipality justifying the importance of the study. In the subsequent sections, the objectives, methodology, scope and limitations are described to illustrate how the research was conducted.

1.1 Problem Statement

1.1.1 Solid Waste Management as a Global concern

In the search for sustainable development, it is necessary to reconsider the processes that are carried out to treat certain unwanted matter generated by anthropogenic activities (Suarez, 1989). The consumption pattern, population growth, and the urbanisation process are factors that have deeply affected the quality of the environment not just in urban zones, but as a consequence of indiscriminate resource utilisation, rural and protected areas have been profoundly disturbed as well, putting in jeopardy not just the ecology of these localities, but also the health and life quality of all their inhabitants (Freitez & Rangel 2008).

Globally, the municipal solid waste produced in diverse regions usually presents some similarities; generally, the municipal residues are composed by a percentage of organic waste, plastic, paper, glass, metal among other matter (Suarez, 1989). Nevertheless, the proportion of this classification might vary even in municipalities that belong to the same state within a country due to socioeconomic elements such as the intensity of commerce, purchasing power, population's costumes and other aspects (Freitez & Rangel 2008). Furthermore, the accumulation of municipal waste is a collective concern of state authorities and the general public, because of the large volume of waste produced by a world population which is growing as well as its consumerism standards. Additionally, the modern pattern of consumption has led to the production of new goods, with more complex physical and chemical characteristics; thus, the toxicity levels of the disposed materials are higher. In this sense, the GHG levels (Atabarut, Kocasoy & Nuhoglu 2002), the soil acidification (Zhao, Tao Wang, & Lu, 2009), soil pollution by metals, and subsequent impacts on human health are some of the environmental impacts caused by the toxicity of waste (Gomez, 2008). As Ferrer (1996) affirmed, severe ecological impacts occur not just at the final disposition sites but also in other areas where the municipal authorities cannot enforce any mechanisms of control for waste collection.

Along with the exacerbated generation of waste, there is the common limitation of developing recycling and recovery infrastructures that would grow in a parallel manner, alongside the industries responsible for waste generation, the latter always being ahead in the market, representing a challenge for the minimisation of solid waste and residues. Moreover, another concern is the lack of a holistic perspective of waste management in regards to the non-utilization of solid waste as a resource.

In this order of ideas, the usual conception of a municipal solid waste management system (MSWMS) is a cycle that begins at the stage of generation, temporal accumulation, collection, partial treatment, and its final disposition of the residues (Freitez & Rangel, 2008). In this conventional conception of MSWMS, the emphasis is put at the final disposition stage, as if the placement of the waste is the only aspect that matters in the whole system (Castillo,

2008). In some cases in developing countries, public entities head towards building new sanitary landfills, without improving the existing conditions, or properly closing down the open air dumps or landfills already malfunctioning (Castillo, 2008), this also forms part of the erroneous strategies from public institutions within less developed regions.

The common denominator in the universal MSWMSs is the combination of the mutual responsibilities of the State and the private sector that charges to the community to perform the service (Paolini, 2007). Almost globally, a commonality in MSWMSs is that the municipality is the responsible entity, nevertheless, the participation of the private sector is ampler in industrialised nations than in developing countries; in the former, private companies not just collect recyclables and solid waste, but in its operational structure they include the recovery of material and treatment of waste to decrease the negative environmental impacts in a lucrative manner.

Following this further, the development of successful MSWM strategies in industrialised nations have been marked by adoption of strategic planning, translated into the integrated management, not just regarding the operational procedures, such as how waste is transported, treated or recovered, but also by improving the institutional and administrative structure within the responsible entities (Barradas, 2009a). This implies clear legal mandates, goals, and tasks for the stakeholder in the process, to avoid the overlap of responsibilities, as well as promoting the active participation of the society's sectors. Moreover, the MSWMS in industrialised countries has taken into consideration the participation of the community in the early stages of the waste management, such as the reduction of generated residues, and waste sorting. This was accomplished by the raising awareness among the society that has transformed their conception of residues from the NIMBY syndrome to the acceptance of their co-responsibility as citizens (Suarez, 1989).

Likewise, in these regions other elements have evolved such as market forces, which shape the manner to deal with industrial and municipal solid waste, since the market plays an essential role as drivers to improve the efficiency of the system, reducing the amount of waste that ends up at the final disposition sites and minimising the environmental impacts in ecosystems (Suocheng et al. 2001). On the issue of the waste utilization as a resource, in some developed countries there is a holistic approach of integrated solid waste management (ISWM) guided by the life cycle approach to determine the waste flows, environmental performance of all processes and operations that solid residues go through (Zhao et al., 2009). An example of an innovative decision making tool based on the ISW is EASEWASTE. Amogst other measures, there is the successful adoption and implementation of state regulations; norms that dictate how and what type of material should be recovered, treated or finally disposed. This situation differs greatly in developing countries, such as Venezuela.

The MSWMS in the majority of developing countries has been characterised by the obsolete or unrealistic strategies to deal with residues and waste (Srivastava et al. 2005), even though in some nations the legislation has been adapted to permit the execution of new strategies to improve the system. Another characteristic of the chaotic situation of the MSWMSs in the developing countries is the lack of financial and human resources allocation in the municipalities that restrict operational procedures (Zotos, Karagiannidis, zampetoglou, Malamakis, Antonopoulos, Kontogianni & Tchobanoglous, 2009). Nevertheless, in the Latin American Region there have been efforts to conduct a proper management of waste, by the strategic planning and organisation from the national level that properly sets goals and targets in a time frame (Castillo, 2008). Having done this, in some countries such as Colombia,

Brazil, Ecuador, Chile, Argentina and Paraguay, the municipalities have embraced their responsibility of creating municipal plans for the integrated solid waste management, and even if the public budget assigned for the programs is not sufficient, at least the existence of municipal integrated plans for solid waste facilitates the accomplishment of the goals and objective set for the improvement of the MSWMS.

1.1.2 Current Situation at the National level

In Venezuela, the predominant system of waste management is based on the conventional conception; the generation, collection and final disposition phase, under partially controlled conditions, presenting problems in the different phases of the existing scheme (Mendoza, 2009). Firstly, the current methods of collection of waste significantly depend on the public administration of the urban waste sanitation service provided by private companies that work for the municipality which do not sort residues or recycled material; afterwards, in most of the cases, the waste is placed in non-controlled open-air dumps (Gomez, 2008). In almost all cases, separation amongst the residues is not carried out by the company staff at a transfer center but by a group of people that represent the informal sector (waste scavengers or *gancheros*), from deprived social conditions that sort recycled material at the FDS (Gomez, 2008).

In a report of the Pan American Health Organization ([PAHO] 2003), it was informed by the year 2002 that there was no department or specific institute responsible for the solid waste management at the national level, also no entity had strategically conducted the management of residues because of the absence of policies and national strategies, besides the lack of identification of stakeholders' responsibilities (PAHO, 2003). Another problem observed by the PAHO was the duplication of efforts and functions concerning waste management, also it was detected the conflicts among public entities because the attempts of the actors to gain political prominence concerning the issue of sanitation, putting aside the monitoring and control mechanisms for a correct MSWM, thus a group of pro-active strategies and sustainability in the financial sector is needed (United Nations, 2010). On the other hand, the scarce information regarding the monitoring of ongoing projects or operative improvements does not allow the strategic management of the sector of solid waste. This situation described in the PAHO report still persists at present days in Venezuela. At the moment, in the national context the MSWM does not represent an appealing investment sector for private companies, besides its meager financial support from the public institutions in comparison with the magnitude of the problem created by the erroneous MSWM (PAHO, 2003).

Some of the incorrect practices that still take place at the FDSs are: the dumping of hazardous waste such as medical, toxic, inflammable, and electronic waste without proper cell final disposition, also, uncontrolled sorting at the FDS facilities by the informal sector (Mendoza, 2009), and finally the absence of the proper application of landfill techniques at the partially controlled FDSs. These are the general characteristics that not just create environmental problems, but also affect public health, representing a challenge for the institutions and public authorities (European Commission, 2007)

Moreover, the absence of a national plan for integrated management of solid waste and residues is a problematic issue that needs to be solved in the near future, because it is part of the major impediments to create an efficient MSWMS in the country (PAHO, 2005). There are some documents that were intended to be developed by the different States MPPE authorities, but in the totality of the manuscripts there are just reference terms that lack of objectives, standards, or specific targets. It is an urgent matter to initiate the planning

process, since it is needed to correct the existing practices, as well as the effective creation of incentives to the private sector as well as the integration of the community, and all the waste generators as essential stakeholder in the change of MSWMS.

1.1.3 The case of Iribarren Municipality

In the context of the MSWM in Iribarren, the responsible entity for the coordination of waste collection service is called the Municipal Institute for Urban Sanitation of Barquisimeto (IMAUBAR). Nonetheless, this public institution does not fully comply with the legal regulations regarding MSWM; element that creates negative environmental impacts (Gomez, 2008). Furthermore, within the Iribarren territory, there are severe ecological impacts from inadequate practices implemented at the FDS, which is a responsibility of IMAUBAR. Some of the effects are the contamination of the surface water. Also, there is a problem of soil pollution by heavy metals generated by the lack of insulating liners or drainage layers (Gomez, 2008). Another environmental impact is air pollution increased by methane emissions (among other gases), that constantly represents a danger of explotion, along with the depletion of the ecosystems´ health and proliferation of human diseases are also to be taken into account since all the residues are mixed; municipal, industrial, electronic, and hazardous waste (Paolini, 2007).

Besides the incorrect final disposition of waste, it is also relevant to mention the current erroneous practice of garbage burning, which it is a common habit of people who are not provided with the urban waste sanitation service. This is also an activity that should be regulated by the local authorities such as the Ministry of Environment, but because of the deficiencies of the public urban sanitation service managed by IMAUBAR, additional pollution is caused by the generation of emissions from this incorrect practice, along with the health problems and grave negative environmental impacts in the ecosystems (Paolini, Ramos , & Zamorano 2008).

Furthermore, having a firm municipal institutional structure to deal with the solid waste management system is essential since these are the closest public entities to the citizens and the correct policies implemented affect directly the population, as well as the erroneous decisions taken at this level (Ferrer, 1996). Nevertheless, not all the Municipalities within Venezuelan States count with municipal organisations for waste management, fact that deeply influence the continuity of the current mistaken practices that have not been corrected by the environmental authorities within the different States.

The presence of IMAUBAR as the institution responsible for MSWM is significantly positive for the development of programs and strategies that will improve environmentally and economically the existing system . Nonetheless, the absence of a MSWM plan in Iribarren, as part of the problematic situation in the totality of Lara State needs to be addressed, since it is very difficult to achieve any sort of progress if there is a lack of an integrated plan of MSWM in Iribarren as well as in any other Municipality in Venezuela (Gomez, 2008).

In respect to IMAUBAR, an evident failure its institutional structure is observed, due to different factors: very few people at IMAUBAR know about the concept of integrated waste management strategies (Mendoza, 2009); they focus in solving issues regarding how and where the waste is collected and disposed, ignoring the sorting, recovery, recycling and treatment of residues. Moreover, the personnel of this entity is not familiarised with the objectives and goals of the IMAUBAR according to the laws and ordinances established by the Municipality (Mendoza, 2009). Additionally, the lack of motivation and skills among

municipality staff is another negative aspect, as well as the lack of human and economic resources and lack of the sanctions by the local state authorities.

Parting from the fact that the fundamental pillars for the correct MSWMS should be built on the following three characteristics; environmental efficiency, cost effectiveness, and social acceptance (Sanchez, Benaiges, & Vila, 2009), and taking into account the above issue described, it is vital to transform and improve the planning regarding how residues are managed at the municipal level.

1.2 Research Statement

1.2.1 Objective

The objective of this research is to create planning guidelines for the improvement of the MSWMS in Iribarren Municipality, based on the assessment of the internal and external factors affecting the system, as a starting point to develop a full strategic framework to comply with the new legislative framework.

1.2.2 Research Question

What are the internal and external factors of the current MSWMS affecting the effectiveness of IMAUBAR and what actions should the Municipality take to comply with the new legislative framework on solid residues?

Sub-questions

1. *What is the existing situation of MSWMSs in the Latin American Region, nationally and at the Municipal level, and what are the implications of the current legislative framework for SWM?*
2. *What are the strengths, weaknesses, opportunities and threats as internal and external factors of the MSWMS influencing the effectiveness of IMAUBAR?*
3. *What are the planning guidelines to consider for the improvement of the MSWMS to be implemented by IMAUBAR?*

1.3 Methodology

The phases of the study consisted in the following:

1. Assess the existing situation of MSWMS in the Latin American Region, and assess the current state of SWM at the national level.
2. Assess the current legal framework for MSWMS at the national and the Municipal levels.
3. Understand what the current state of MSWM in Iribarren is as well as how IMAUBAR organization functions and what are the stakeholders involved in the MSWMS of Iribarren.
4. Identify the strengths and weaknesses, opportunities and threats (SWOT) as internal and external factors within the MSWMS in Iribarren affecting IMAUBAR.
5. Determine SWOT strategic actions based on the comparison of SWOT elements, addressing the maximization of strengths and opportunities and minimization of weaknesses and threats.
6. Develop and apply a ranking criterion based on attributes for the categorisation of the outcome strategic actions to shape planning guidelines from the SWOT analysis of the MSWMS in Iribarren affecting IMAUBAR.

7. Suggest planning guidelines for IMAUBAR based on the results of the ranking process of the SWOT analysis outcome strategic actions.

1.3.1 Data Collection

In this exploratory study, various research methods were employed. The main source of information for this research was found in the literature review, and the data obtained from official documents collected from the visits carried out during the research to the public and private institutions. Nevertheless, the collection of primary data included semi-structured interviews, application of semi-structure questionnaires, electronic correspondence, and direct observation of the IMAUBAR and the companies' facilities. In figure 1-1 it is illustrated the order of importance and relevance of information source in accordance to the study.

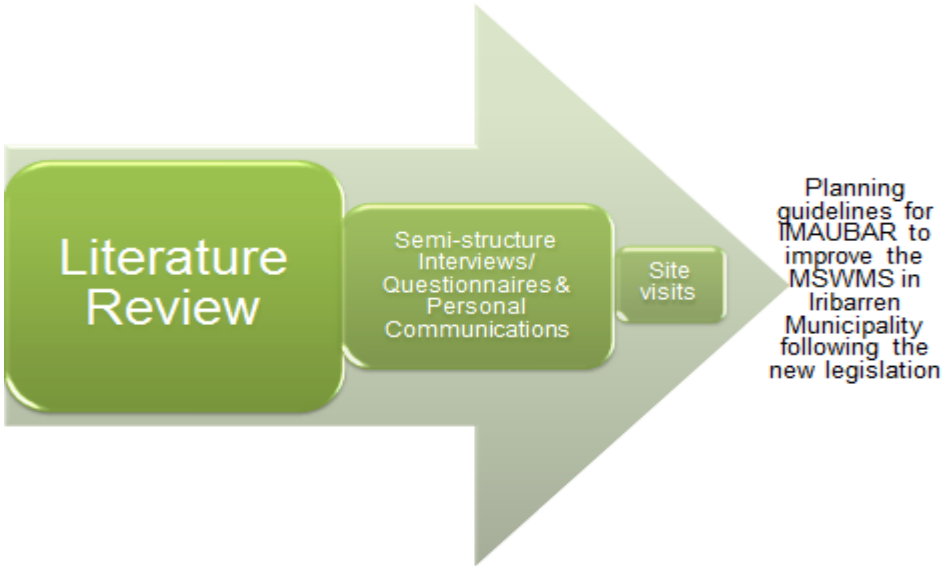

Figure 1-1 Applied methods in the study

Literature review

In the application of this method the information collected concerning MSWM was based on: a literature review of journal articles and academic publications, government documents (official and unpublished material), international organizations reports, NGOs, newspaper's articles, and on-line public material of the private collection waste companies operating in the Iribarren Municipality. Subsequently, a literature review of the legislative framework concerning waste management was carried out taking into consideration the current regulations at the national, state and municipal level, such as the Constitution of the Bolivarian Republic of Venezuela, Fundamental laws, legislative decrees, municipal ordinances, and statutes. The construction of a SWOT profile was carried out, for the subsequent formulation of strategic actions derived from the ranking process.

Semi-questionnaires to guide interviews & personal communications

The subsequent phase of this study was performed with a twofold purpose; firstly, to complement the information collected and analysed in the literature review and gather

viewpoints of the different informants, and secondly to identify the priorities in order to rank the strategic actions from the SWOT profile.

The Individuals representing different stakeholders were: academics and experts in waste management, employers and coordinators from different public and private entities from Iribarren Municipality were personally contacted, and also by electronic correspondence. Likewise, employers from the NEUSWM in the city of Caracas were interviewed, as well as experts in waste management who participated in the elaboration of the new legislative regulation (LIMG). The interviews were carried out by following a semi-structure questionnaire of open-ended questions (in Spanish) according to the area of expertise of each informant. The lists of interviewees and individuals contacted by electronic correspondence are available in the appendix II, and appendix III. The people who participated in the gathering of data were: the stakeholders previously mentioned as well as waste scavengers (*gancheros)* at Pavia landfill, individuals that work as transport staff (collectors) in the collection companies, and work directly with the *gancheros*. The majority of the data was obtained by closed-ended questions, but also open-ended questions were part of the questionnaire.

Regarding the informants that supplied information by electronic correspondence, some of them were previously contacted in person, belonging to the group of interviewees, nonetheless, they were asked for additional data regarding the organisation where they work. On the other hand, various experts of MSWM from Venezuela and other countries were contacted. These informants belong to government institutions and research institutions, and they were asked for information regarding Municipal Plans for Integrated Management of Solid Waste, and national strategies, due to the similar characteristics with the Venezuelan waste management system.

Site visits

Pavia: as a complementary method applied for the research, two site visits to the FDS in Pavia landfill were carried out. The first visit was conducted accompanied by Urbaser private company staff, to do the interviews with the current authorities and administrative staff at Pavia, as well as gathering informative documents concerning the management of Pavia. Also, at the first visit data concerning current tariffs managed at Pavia Landfill was collected, due to the absence of information at IMAUBAR facilities in the city of Barquisimeto. The second visit took place to collect photographic material of the treatment processes of waste that take place at Pavia, a brief view of the disposal terrace was done with the supervision of staff. The visits to the companies which collect municipal waste were carried out to gather data concerning their institutional structure, as well as one visit to a recycling paper company to gather photographic material of their operations. Additionally, photographic material was collected from different locations points in the city of Barquisimeto where there were installed separate collection stations by the Iribarren Municipality as part of the ongoing project "Barquisimeto recycles".

1.3.2 Analytical framework

Two different analytical techniques for qualitative research were utilised in this study. Firstly, a SWOT analysis was realised for the identification of the internal (strengths and weaknesses) and external factors (opportunities, threats) of the MSWMS in Iribarren influencing the responsible entity for MSMWS in Iribarren Municipality (IMAUBAR), clustering the information previously gathered. As an outcome of the SWOT analysis, different potential strategic actions for planning guidelines were developed; these were hierarchically categorized

according to the priorities detected from different stakeholders through the interviews and questionnaires.

1.3.2.1 SWOT analysis

SWOT is an acronym for strengths, weaknesses, opportunities and threats; it is a commonly used instrument which can be applied to an ample spectrum of research areas (Wickramasinghe et al., 2009). This tool was created in 1957 by Learnt et al. at Harvard business school and has been developed by various researchers (Chermack & Kasshanna, 2007). It has been used to determine the internal characteristics and external factors of products, industries, programs, institutions or any type of organisation, for the conduction of a situational assessment concerning a particular issue or area of interest (Srivastava et al., 2005). SWOT methodology was designed to conform the initial steps for decision making, and strategic and integrated management planning, by clustering the information gathered of an organisation in four classes (Naserbakht et al., 2008, Overseas Development Institute, n.d.) and (Seyed & Sahar, 2010).

According to Karppi, Kokkonen, Smith (2001) sthreghts are defined as "*a resource or capacity the organisation can use effectively to achieve its objectives"*, a weakness is defined as "*a limitation, fault or defect in the organisation that will keep it from achieving its objectives"* an opportunity is *"any favourable situation in the organisation's environment"* and a threat is defined as *"any unfavourable situation in the organisation's environment that is potentially damaging to its strategy"*. Karppi et al. (2001) also states the following actions to be assumed after the SWOT profile is elabourated: *"Build on strengths, eliminate weaknesses, exploit opportunities, and mitigate threaths"* (Karppi et al. 2001).

For the purpose of this research, the data gathered in regards to the current MSWMS in Iribarren was classified using three different criteria as action areas; (organizational aspects, environmental aspects, socioeconomic aspects) within each SWOT group, (strengths, weaknesses, opportunities and threaths) to create a list of determinant characteristics to define each SWOT element, which subsequently shaped the planning guidelines for IMAUBAR. The elements of the criteria were applied to create a distinction of the information gathered, as shown in figure 1-2.The criteria elements applied to how MSWMS is carried by IMAUBAR entity are the following:

- Institutional aspects (IA): this element of the criteria assembled the information about internal aspects and external factors of IMAUBAR concerning the following organisational aspects areas: including institutional capacity, financial, administrative and operational effectiveness, legislative compliance, and internal/external communications.
- Environmental aspects (EA): this component gathered information related to how the internal aspects and external factors have caused or could produce environmental impacts (positive and negative) within the urban areas of the municipality, as well as at the final disposition site (Pavia).
- Socioeconomic aspects (SEA): this section of the criteria was elaborated to accumulate information about internal characteristics (strengths and weaknesses) of the social and economic aspects related to the IMAUBAR MSWMS. Likewise, this criterion also gathers the information about the external factors (opportunities and threats) associated to the socioeconomic aspects that could influence IMAUBAR entity.

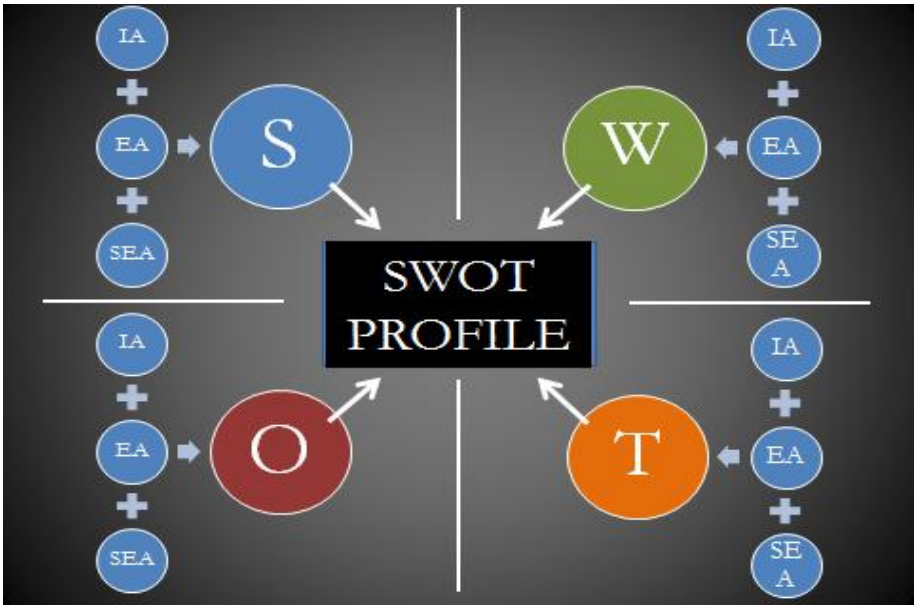

Figure 1-2 Application of the three criteria of action areas to determine SWOT profile

After the information was assigned and clustered into each of the criterion for the creation of each SWOT group, a SWOT profile was built based on internal characteristics (strengths and weaknesses) and external factors (opportunities and threats), as illustrated in table 1-1. The list of characteristics of MSWMS of Iribarren was elabourated to determine each SWOT element, the number of characteristic in each group varied depending on the SWOT element.

Table 1-1 SWOT Profile

SWOT Profile of MSWMS in Iribarren affecting IMAUBAR		
Internal characteristics	Strengths (S)	Weaknesses (W)
External Factors	Opportunities (O)	Threats (T)

Source: Modified from Nikolaou and Evangelinos (2010)

According to the research done by (Frei & Mbachu, 2010), and (Zotos et al., 2009) the successive step after obtaining the SWOT profile, should be to obtain outcome strategies resulting from the matching in pairing of internal and external elements in each SWOT element. Thus, following the concept by Karppi et al. (2001) which states "*Building on strengths, eliminating weaknesses, exploiting opportunities, and mitigating threats",* strategic actions were derived from the overall analysis of SWOT elements applying the principle of *maximasing strengths and opportunities and minimizing the weaknesses and threats.*

1.3.2.2 Determination of planning guidelines based on developed ranking strategy criteria

According to Karppi et al. (2001), the SWOT is an instrument that could be utilised for strategic regional planning, as a decision support system. In order to rank the strategic actions already formulated by the SWOT analysis to shape the planning guidelines, the identification of priorities from different stakeholders was carried out, selecting the relevant information provided by the informants in the application of the semi-structure

questionnaire in the interview process, to assess the necessities, and potential acceptance of stakeholders.

Afterwards, the strategic actions to shape planning guidelines for the MSWMS at Iribarren were classified by the following descriptive criteria: urgency of legislative compliance, severity of impacts, and relevance according to stakeholders. The ranking qualitative categorization was: high priority, medium priority, low priority (represented in the Strategy Matrix by **H, M, and L**). These time frameworks were set according to the periods established by the LIMG for corrective actions that should be executed.

Each strategy must be categorised with the same level at least twice to be classified within one of the 3 criteria to be considered as part of the final formulation of the planning guidelines (i.e. Strategy 5: high level of urgency for legislative compliance and high relevance according to stakeholders). Figure 1-3 illustrates the information sources in order to rank the strategic actions. The definition of the criteria elements consisted in the following:

- Urgency for legislative compliance: it consists on the legislative importance stipulated in the LIMG and other legal instruments that contemplate the need to correct the existing situation in a short, medium, or long time framework. Therefore, the strategies were categorised in the matrix by the time framework stipulated in the LIMG. The levels of categorisation were high, medium and low priority, and this criterion was represented in the Strategy Matrix as **Urgency.**
- Severity of impacts: it encompasses the institutional and organizational adverse aspects, environmental and socioeconomic impacts that were tackled by the strategy in a high, medium, low level. Also, the significance of the positive impact of the strategy was also categorized by high, medium and low level. Represented in the strategy Matrix as **Impact.**
- Level of relevance according to stakeholders: it is meant to categorize the strategy, in a high, medium or low level of its scope to correct, improve, or address the necessities and priority areas identified by the stakeholders. This criterion will be symbolized in the Strategy Matrix as **Relevance**

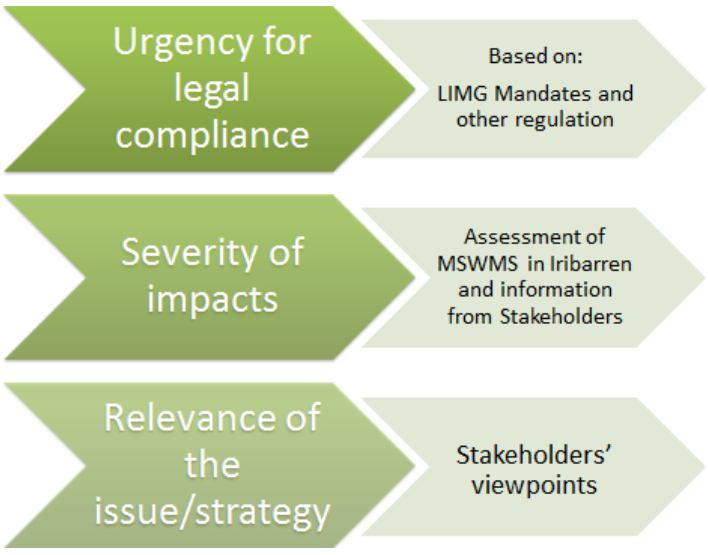

Figure 1-3 Illustration of the criteria created to rank strategic actions

Subsequently, the formulation of planning guidelines was carried out based on the results of the ranking process of strategic actions from the SWOT matrix. The planning guidelines were presented according to **high, medium and low priority**, also implementing the same classification criteria utilized to cluster the information for the creation of the SWOT profile; **organizational aspect, environmental aspects, socioeconomic aspects**.

1.4 Scope

This study aimed to provide a set of planning guidelines for MSWMS in Iribarren Municipality in accordance with the recent legislation on integrated management of residues and solid waste, giving particular emphasis to the exploration of internal (strengths and weaknesses) and external factors (opportunities and threats) influencing the responsible entity of MSWM in Iribarren; IMAUBAR, by the application of SWOT scheme and a developed ranking criterion. For this study, diverse bibliographic material was reviewed, concerning MWMSs, and SWOT analysis methodology. The aspects such as the assessment of operative plans and technical operations of IMAUBAR and other stakeholders were excluded from the research in some of the cases because of the lack of existence and in other cases because of the lack of implementation of these. Another aspect excluded is the verification of the planning guidelines by the stakeholders involved in the study; this research just focused on the ranking of strategic actions following the detected priorities from stakeholders involved in MWMS in Iribarren. The information concerning MWMSs in the Latin American Region and in the national level is provided in the document as a reference to the reader to situate and expose the commonalities of these existing systems to the reality of Iribarren, nevertheless, for the formulation of the planning guidelines, the interest was concentrated particularly in the case of IMAUBAR entity in Iribarren Municipality, due to the legal responsibility that municipalities have in the subject of management of solid residues and waste.

1.5 Limitations

As limitations of this research it is relevant to mention that the bureaucratic barriers within public institutions slowed the recompilation of information, and political differences between the municipalities' authorities and State authorities, as well as the members of institutions also may lead to contradictory information collected. The data from those sources regarding the implementation of projects, policies' efficiency and in general how the current management of waste is functioning at the Municipality was significantly variable depending of the stakeholders' perspective and job position in the public sector. Additionally, the lack of updated data and secrecy from the private companies is believed that is due to internal management problems that have recently been publically exposed in the local media. It is relevant to mention that the collection of information at these businesses was exceptionally difficult, and although the people responsible of areas related to environmental management and quality control were contacted, they refused to provide any sort of digital or physical document, instead, they agreed on being interviewed, but reserving information regarding the internal management. The employees are not allowed to share information with the general public; therefore, the primary data collected in the case of the private sector was scarce, but the rest of the data was found from public websites, presentations circulated within the companies, and previous research.

1.6 Characterisation of Studied Area

Iribarren Municipality is part of Lara State, which is located in Venezuela. The capital of both entities is Barquisimeto (FUDECO, 2004), with an estimated population for the year 2010 of 1 028 310 (PROINLARA, 2010). Its area is 2 760 km² and its estimated population for the

year 2010 is 1 073 934 inhabitants (PROINLARA, 2010), number that represent more than 57% of the population of the whole Lara State, the population density is 48.2 hab/km². Iribarren is divided in 10 districts; its economy is based on the industrial, commercial and service sector (FUDECO, 2004). Concerning environmental aspects, Iribarren Municipality counts with a significant hydrographic network, and a relevant aquifer in the valley of "Turbio" river which is part of the tropical forest "Macuto" being one of the protected areas in the municipality (CORTUBAR, 2010). The maximum altitude in Iribarren is 1800 meters above sea level (m.a.s.l.), but the majority of territory is flat, with a minimum altitude of 100 (m.a.s.l) (CORTUBAR, 2010). The type of climate existing in the locality is mainly tropical continental and seasonal, but it has been intervened thanks to the urban density, and its vegetation varies from tropical thorny- bushy vegetation, to savannah and tropical forest in the southern part of Iribarren (FUDECO, 2004).

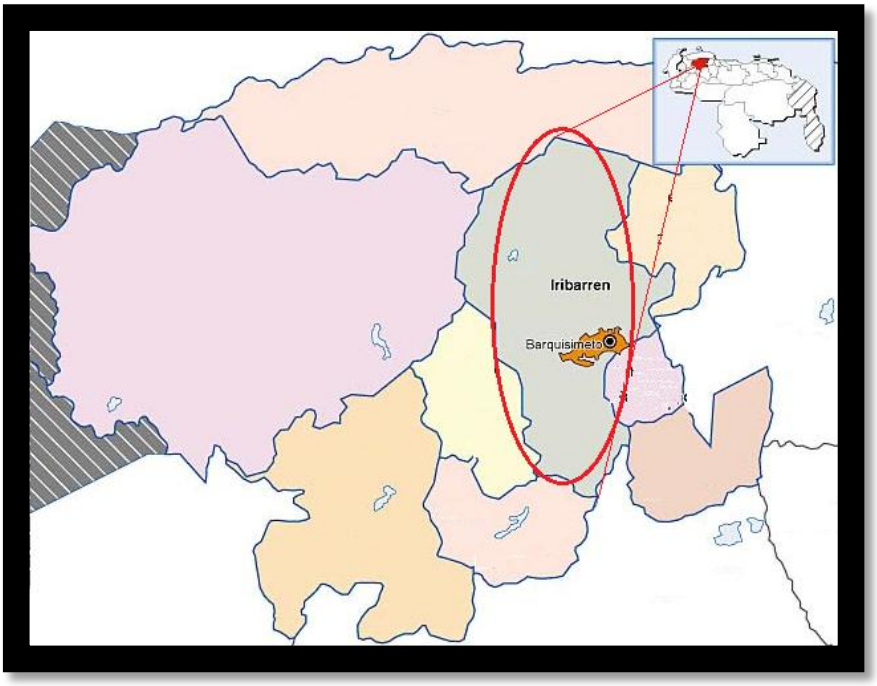

Figure 1-4 Map of Venezuela, Lara State, and Iribarren Municipality

Source: Modified from El Impulso online encyclopedia (2009)

1.7 Outline

Chapter 1: it described the importance of MSWM as a global concern. Also it exposes problematic issues in Venezuelan and in Iribarren Municipality with reference to MSWM. Likewise, it contents the methods applied to collect and analyse data, scope and limitations.

Chapter 2: this section delivered the information concerning MSWM found in the literature review and interviews conducted during the research. This section aimed to expose and assess information about the current MSWMSs in Latin American to compare the situation to the Venezuelan reality, and assess the existing situation of MSWM in Iribarren Municipality.

Chapter 3: it was elaborated to bring to light the legislative framework related to SWM at the national and municipal level. Special attention is given to the *Law for Integrated Management of Garbage* (LIMG) passed in December of 2010.

Chapter 4: it provided the characteristics and role of each stakeholder involved in the MSWMS of Iribarren Municipality, being IMAUBAR the central actor as a para-municipal responsible entity for waste management in Iribarren.

Chapter 5: in this chapter the results and analysis were shown; identified internal characteristics (strengths and weaknesses) and influencing factors (opportunities and threats) of IMAUBAR according to the SWOT methodology, forming the IMAUBAR SWOT profile. Afterwards these factors were associated to create outcome strategic actions to shape the planning guidelines. Also the SWOT strategic actions, viewpoints of the interviewees, ranking of strategic actions and the outcome planning guidelines are elabourated in this chapter.

Chapter 6: provides the reader with the conclusions and recommendations to policy makers, and furthers research.

2 Existing Municipal Waste Management Systems in the Latin American Region, at the national level

2.1 Municipal Waste Management System in the Latin American Region and successful examples of strategic planning

Within the LAR, the situation concerning MSWM significantly varies depending on the country's context, due to factors such as the institutional structure of entities responsible for MSWM, the financial resource allocation, and the public awareness concerning waste generation. The waste management has been a subject of constant debate among public institutions within the region; the majority of its member states are attempting to convert the waste management sector into a proper system following the sustainability principles given at the Rio Conference in 1992, that promote reduction, reutilization, recycle and proper treatment for the waste at the FDS in an environmentally sound manner (Barradas, 2009b).

In accordance to Barradas (2009b), the population of the LAR and the Caribbean is 480 million, and approximately 74% of the inhabitants occupy urban areas, while the rest is located in rural zones. According to the United States Aid International Development ([USAID] 2003) in the last 30 years the residential waste generation rate has increased from 0.2-0.5 kg/day to 0.5-1 kg, in the meantime that the composition of residues was almost entirely of organic and biodegradable matter, now an increasing quantity of plastic, aluminium, paper, glass and hazardous waste is generated in the LAR, and in the majority of the region, without appropriate waste management (USAID, 2003). In a report from the Pan American Health Organization (2005), it was stated that in the LAR approximately 360 000 are daily produced. The PAHO report presents different information concerning the average generation rate in the region, being 0.91 kg/day; in the poorest countries it is 0.24kg/day and in the countries with high income from the tourist sector the generation rate is 2.40 kg/day (PAHO, 2005).

In this order of ideas, the same report states that 3% of the collected material is recycled, meanwhile 200 000 families depend on the informal activity of waste sorting and collection at the FDS, representing a health risk for this social group (PAHO, 2005). The following table (2-1) shows data taken from the PAHO report (2005) and the USAID report (2003); these figures characterise the MSWMS in the LAR.

Table 2-1 General Characteristics of MSWMS in LAR

General Figures of MSWMS in the LAR	
Per capita generation rate 1970*	0.2-0.5 kg/day
Per capita generation rate (2005)**	0.9 kg/day
Population in the Region ***	480 million
Total generation rate in the region***	300 000 tons/day
Generation rate of countries depending on Tourism**	2,4 kg/day
Generation rate of poorest nations **	0,2 kg/ day
Collection rate in large cities**	81%
Collection rate in medium sized and small cities **	60%
Average of proper final disposition of MSW**	23%

Source: USAID(2003), PAHO** (2005) & Barradas*** (2009b)*

In Argentina, Brazil, Mexico and Venezuela, and 19 more countries in the LAR, the solid waste management is carried out by the municipalities (PAHO, 2005). In some cases there is a municipal autonomous entity which is reliable for tendering the contract for the private waste collection companies and companies which are liable for the treatment at the FDS (PAHO, 2005). In this sense, the Municipalities are also responsible for the design of collection routes, operation, management and financing, while the Ministry of Environment, Ministry of Health and Development are reliable for the creation of sectorial policies concerning the planning of the sanitary correction measures, supervision, monitoring, and evaluating the existing MSWMSs. On the other hand, in the Caribbean islands, there is a different predominant system, where the central government and their associated agencies carry are the MSWM, the different ministries are responsible to plan, monitor and control the waste management system, and these last mentioned entities are also responsible for tendering contracts for the private collection companies (PAHO, 2005).

In the recent years, the government authorities in the LAR have transformed the public administration of the municipal waste collection services to a more the privatised sector, since it has been realised that the public system is characterized by the following negative aspects: a permanent deficits of financial budget due to low tariffs for the collection services, high operative costs, low collection rate at the totality of the municipality area, low motivation of the personnel in public entities, lack of coordination amongst involved stakeholders due to overlap of responsibilities, and increasing dissatisfaction of the citizens concerning the collection service. For this reasons, the privatization of the waste collection services, treatment, recuperation of recycled material, and final disposition of the solid waste is either promoted as the traditional focus where the large foreign companies deal with the phases previously named, or in an alternative way of privatization. In the LAR, the most common alternatives consist in small and micro companies and cooperatives that promote the creation of jobs by utilizing intensive labor force, the use of appropriate technology to avoid high operative costs, and the integration of the community as a stakeholder by promoting sorting of residues within the residential areas.

Countries such as Colombia, Costa Rica, Peru, Brazil, Bolivia, El Salvador, have implemented micro businesses of waste collection and recuperation of recyclable material companies (PAHO, 2005). Meanwhile in some poor suburban areas, the community members voluntarily sort waste, in exchange of food or transportation tickets, such as the case in the city of Curitiba and the program called "Green exchange" (Thayane, 2007), this is an unique initiative from the local government authorities in Curitiba, that excels from the typical waste management practiced within Brazil and in the LAR.

In this order of ideas, it is relevant to highlight that in the LAR, public authorities have made efforts towards the development of the integrated plans for MSWM in the last decade. The national government has realised the importance of strategic planning for the improvement of the waste management system, in accordance to the urbanization and industrialization processes in the municipalities, as well as the recognition of the significant level of pollution that has been caused by the current inefficient MSWMSs in the urban and rural areas (Lanzano & Gaynor, 2006). The following countries count with national plans that have set specific goals and targets following the legislation: Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Mexico, Nicaragua, Peru and the State of Puerto Rico.

In order to identify the relevant strategic actions in regards to the national policies on integrated waste management adapted in the LAR countries various documents from different nations in the region were reviewed, the list of these national plans can be found in

appendix II. Table 2-2 shows a summary of the most significant characteristics of the national plans within LAR; in the second column it is pointed out the term period in which the strategies are supposed to be performed, and the third column shows the countries that share the specific strategy in the national plans. The short term, represented in the table as (S) is defined in most of the plans as 2-3 years, medium term (M) is defined as 4-10 years, and approximately 11-20 years represent the long term (L) for the plans within the LAR.

Table 2-2 Summary of Common Strategies among the National Plans for SWM within the LAR

Strategies	Term	Country
The formulation and promotion of the waste hierarchy	S-M	Argentina, Brazil , Chile, Colombia, Costa Rica, El Salvador, Mexico, Nicaragua, Peru, Puerto Rico
The establishment of an effective solid waste collection system	M	Argentina, Brazil , Chile, Colombia, Costa Rica, El Salvador, Mexico, Nicaragua Puerto Rico
Closure of the totality of open-air dumps as well as other FDSs that do not comply with the national regulations	S	Argentina, Brazil , Chile, Colombia, Costa Rica, Mexico, Nicaragua, Peru, Puerto Rico
Improvement of the environmental supervision system by training and capacity building activities for the responsible entities	S	Chile, Costa Rica, Mexico, Nicaragua
Improvement of the tendering processes' clarity in the municipalities by the implementation of a pilot project with the supersivion of national authorities	M	Chile
The promotion of Extended Producer Responsibility policy as a waste minimization strategy	M	Chile, El Salvador, Mexico
Strengthen institutional framework to enforce the execution of the national plans in a decentralised manner	M-L	Argentina, Brazil , Chile, Colombia, Costa Rica, Mexico, Nicaragua, Peru
Promotion of sustainable consumption at the household level	M-L	Brazil , Chile, El Salvador, Mexico, Peru, Puerto Rico
Promotion of selective sorting of organic matter and recyclable material from the household	S-M-L	Argentina, Brazil , Costa Rica, Mexico, Peru, Puerto Rico
Promotion of deposit-refund schemes	M	Nicaragua
Promote the use of cleaner production and appropriate technology with technical assistance from various institutions	M	Argentina, Colombia, Costa Rica, Mexico, Nicaragua, Peru
The municipalities should prompt the creation of public private partnerships to carry out the solid waste collection services	S-M	Brazil
The social reinsertion of the waste scavengers, specially the elimination of child labor of the FDSs, formalising the recycling marketing	S-M	Brazil , Costa Rica, Nicaragua
Adapt legislative instruments for the integrated MSWM	S	Argentina, Brazil , Chile, Costa Rica, Mexico, Nicaragua, Peru, Puerto Rico
Creation of a legislative instrument to address the generation of industrial waste and large portion of residues	S	Colombia, Costa Rica
Create economic incentives for the existing recycling companies and subsidies the creation of new recycling businesses	S	Brazil , Mexico, Nicaragua
Promote the Implementation of LCA, EMS, eco-labeling in the private sector to internalise environmental impacts caused by improper waste management	S-M	Argentina, Brazil , Colombia, Costa Rica, Mexico, Nicaragua
The creation of technical measures for composting the organic residues from the municipalities	S	Argentina, Costa Rica, El Salvador, Nicaragua
Design of academic curricula in primary, secondary and higher education promoting selective sorting of waste	M	Argentina, Costa Rica, Peru, Puerto Rico
Active dissemination of the national strategies throughout media, seminaries, informative workshops by the public authorities	S-M	Argentina, Brazil , Chile, Mexico Peru, Puerto Rico
Promotion of participation of all sectors of the society in capacity building activities and environmental education	S-M-L	Argentina, Brazil , Chile, Colombia, Costa Rica, El Salvador, Mexico, Nicaragua, Peru, Puerto Rico
The creation of an effective monitoring and information systems to disseminate and publish the results of strategies for SWM	L	Chile, Colombia, Mexico, Nicaragua, Peru, Puerto Rico
Elaboration of Municipal Solid Plans for the totality of the Municipality in the country	L	Chile, Colombia, Costa Rica, Mexico, Nicaragua

Prompt the Municipalities to adapt adequate tariffs of the waste collection services for better financial balance	S	Chile, Costa Rica, El Salvador, Nicaragua Puerto Rico

Source: National Plans for Solid Waste Management in different countries from LAR (appendix II)

In the rest of the countries in LAR, such as Panama, Bolivia, Honduras, Ecuador, Paraguay, Suriname, Guyana, and Venezuela the legislation on management of solid waste exists, but the absence of a national plan for solid waste management impedes the upgrading of the existing system within municipality since there are no guidelines to follow.

Furthermore, the municipal plans for MSWM in the LAR are scarce especially for the large cities with more than 500 000 inhabitants; commonly the MSWM plans for smaller cities with a population less than 300 000 are found. Nevertheless, for the purpose of this study, the MSWM plans created for the cities of Quito, Santiago de Cali, and Montevideo have been reviewed to identify the most relevant aspects of the documents and strategies within them, these plans can be found in the annex list. The cities were selected due to the similar demographic condition with Iribarren Municipality in Venezuela. In the subsequent paragraph a group of common aspects and strategies in regards to the municipal solid waste were identified from the three municipal plans:

- At the institutional level, promote technical cooperation between the public entities avoiding the duplication of efforts.
- The promotion of the waste hierarchy; reduce, reuse, recycle, recovery and disposal as the leading scheme.
- The achievement of universal collection of solid waste in the totality of the Municipality, as well as the proper management of the FDSs and closure of the existing ones that cannot be transformed following the current regulations.
- Organization of the informal sector by the relocation of the waste scavengers in recycling centers, and the promotion of cooperative associations with the private sector.
- Building transference centers to optimise transportation costs to increase the amount of recyclable material and reduce the volume of waste disposed at the FDSs.
- Creation of an information system of urban solid waste management containing an inventory of urban solid waste to gather data concerning the characteristics and potential treatment, and final disposition for the waste generated.
- The promotion of sustainable consumption, citizen integration and participation in the implementation of the municipal plans through firm environmental education campaigns as well as free access to information.
- Adoption of the auto sufficient principle, which implies building a facility network to treat and eliminate solid waste generated within the municipality's territory applying cleaner technology, and efficient energy utilization.
- Establishment of a coherent financial system in regards to the tariff scheme of the waste collection services for the residential, industrial and commercial sector, to achieve the total coverage of operative costs, promoting the differentiation according to the generation rate among the sectors.
- Compliance with the international agreements such as Kyoto Protocol, reducing the gas emission rate at the FDSs.
- Increase citizen participation and community involvement in the recuperation of recyclable material by promoting waste sorting at the household level.
- The improvement of the monitoring and evaluation and of the execution of the plans for MSWM as well as the supervision by the public environmental authorities of the FDSs.

In accordance to the preamble 32 of the EU Waste Directive 2008/98, "The waste hierarchy generally lays down a priority order of what constitutes the best overall environmental option in waste legislation and policy". In the following figure (2-1) it is shown the general structure of the waste management hierarchy followed in the different national and municipal LAR plans that were reviewed. The countries such as Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Mexico, Nicaragua, Peru, Puerto Rico, have oriented significant efforts within the planning of MSWM to meet the requirements and establish a system based in the European waste management hierarchy.

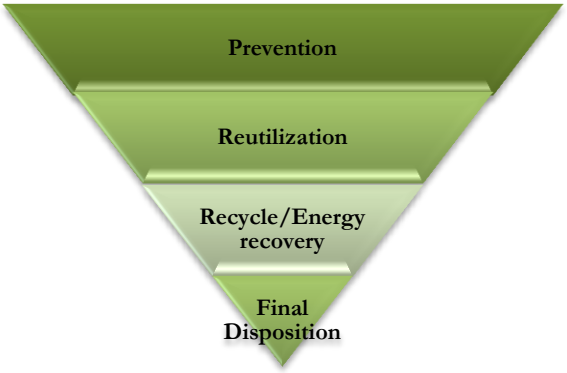

Figure 2-1 Waste Management Hierarchy applied to National and Municipal Plans in LAR

Source: National and Municipal Plan of LAR (appendix II)

As a final comment on this section, it should be highlighted the emphasis that the national and municipal plans in the LAR give to the improvement of the institutional network responsible for the solid waste management, since the duplication of efforts is still a common characteristic of the current SWMSs in the LAR, as well as voids in regards to the regulation enforcement and monitoring schemes within the MSWMSs, in particular at the FDSs, which in the majority of the nations these facilities have to be either transformed to comply with the sanitary and environmental regulations or closed because their lifespan has reached their maximum capacity. Another common issue to be addressed is the amplification of the municipal waste collection services, along with the optimization of the tariff collection in order to make the system become cost effective and less dependent on the subsidies from local government. The involvement of the private sector by the implementation of principles such as extended producer responsibility is also relevant, but the introduction of EMS, ecolabeling schemes and the implementation of LCA studies are more popular among the LAR region in order to internalise the environmental impacts.

In this order of ideas, the advances on MSWMS in the LAR could be analysed to assess the feasibility of the implementation of similar programs, as well as an opportunity for regional cooperation, technical and logistic support on planning the integrated management of MSW. The assessment of different municipal plans already implemented in the region might be a starting point, as one of the projects financed by the BID. Other type of cooperation directly connected to the operational aspects of the MSWMS, could come from the inter-municipal agencies and waste companies, since a common characteristic of the waste collection companies is their incapability to cover operational cost, thus, in the LAR there are companies that have implemented the cost-effectiveness principles within their financial administration.

In the next section, similar features between the MSWMS in the LAR and the Venezuelan system can be found. Also key common aspects among LAR systems and Iribarren

Municipality were identified and these were useful for the characterization process of the responsible entity for MSWM (IMAUBAR) in order to shape planning guidelines for Iribarren.

2.2 Waste Management System in Venezuela

Currently in Venezuela, the MSWMS is characterized by a simplified scheme of collection, transport and final disposition of waste. According to the European Commission (2007), Venezuela generates 18 000 ton of mixed solid waste per day, which is approximately 5 million tons per year. In the same report above mentioned, (EC, 2007) it is stated that the numbers of recycling centers and that in general, the collection activity has increased. Nonetheless, the national situation is very different in small cities, where there is no initiative of recycling or collection centers. Also, there are groups of people who work in the informal sector and they perform the collection and classification of a certain type of residues such as plastic and metal (Acuña & Valera, 2008). In regards to the waste collected and sorted at the FDSs by the waste scavengers, the official amount of recovered material is unknown, nevertheless, VITALIS (2011), which is a Venezuelan environmental NGO created in 2000, shares the following figures (figure 2-2) in its official webpage. This evidences the prevalence of a significantly strong market for the recyclable material as high quantities of these materials are collected, while there is a market failure for organic material, which in the case of the municipal solid waste is the predominant material generated by the households.

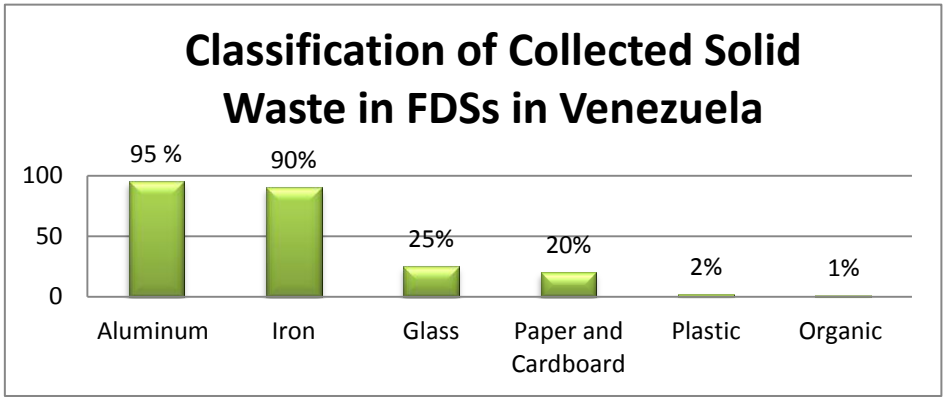

Figure 2-2Classification of the collected solid waste at the FDSs in Venezuela.

Source: VITALIS (2011)

In respect to the solid waste generation, the Inter-American Development Bank ([IDB], 2010) states that the generation rate in the national context has been doubled in the last decade, in the year 2000, the per capita generation rate was 0.4 kg/day, nowadays it is 0.87 kg/day, and the annual production is 8.9 million tons, taking into account the national population for the year 2008, that was 28 050 000 inhabitants (IDB, 2010). The Estimation of waste generation in largest Municipalities in Venezuela can be found in appendix X, which shows the generation rate of municipal waste in some of the largest municipalities in Venezuela, it is relevant information since it also indicates that Iribarren, occupies the 13th place regarding amount of residues generated per capita in the national context, but it occupies the fourth place when it comes to the total amount of residues in tons per year due to its population.

In relation to the urban waste sanitation service, it is established in the CBRV that the management of the service is an exclusive responsibility of the Municipal power, thus, within

the national context the management of the services varies in the subsequent manners (PAHO, 2003):

- Service direct managed by the Municipality authorities
- Indirect management by municipal autonomous institutes
- Indirect management by decentralised municipal entities, civil associations, private companies.
- Indirect management by State or National organisations.
- Indirect managed by a legal association of various Municipalities.

The following table (2-3) shows the national institutional framework related to SWMSs and the roles from different stakeholders: public entities such as the Ministries, NGOs, international organisations, private sector and general population. This data was identified by IDB (2010) in the Program to Strengthen National Capacity for Integrated Solid Waste Management in Venezuela (VE-L1031), which makes evident some overlap and responsibility voids existing in the different entities related to the MSWMSs.

Table 2-3 National Institutional Framework related to MSWMSs

Organisations/Stakeholders	Responsibilities
Ministry of the People's Power for the Environment	Major National Environmental Authority
	Monitoring and Control of Activities susceptible to cause negative environmental impacts
	Regulates the location of FDSs, their maximum capacity rate, evaluation of environmental impacts
	Imposes sanctions for breaching environmental law /sanciona ilicitos ambientales
Ministry of the People's Power for Sanitation and Social Development	Coordinates the urban sanitary services at the national, state and municipal scale
	Regulates activities for the implementation of programs related to public health at the national,
	State and Municipal level
	Coordinates programs for epidemiological control and disease prevention
Ministry of the People's Power Infrastructure	Coordinates aspects related to sanitary landfill; design, location, and establishment
Ministry of the People's Power Education, Culture and Sport	Coordinates environmental education within the formal education system
Municipalities	Define the waste collection service management (design, execution and regulation)
	Cooperation with the public health mechanisms
	Propel citizen participation
Intermunicipal Associations	Vinculate the Municipalities in the agreement to share responsibility for MSWM activities
Education Institutions	technical support in the formulation of programs and projects and human resource training
PDVS	Financial and technical support to intermunicipal associations
Private sector	Regulatory compliance for waste generation and proper management
Citizens	Tariff payment for the waste collection system
NGOs	Environmental education
International Organisations	Financial and technical support to public and private institutions, evaluation of environmental impacts

Source: (IDB, 2010)

In respect to the MSWM, the poor administration has prevailed because the urban collection system has been always considered as a governmental responsibility, leaving a side the technical and administrative improvements. As a consequence, the public entities have had to double their functions and efforts; fact that has affected efficiency levels when performing the services of waste collection (Paolini, 2007).

Regarding the waste collection, there is a precarious situation regarding the control and sanctions in the system, and it is due to incorrect planning, budget limitations, outdated tax tariffs and insufficient monetary collection; it is estimated that all the money gathered for the concept of the waste collection service covers 5% to 10% of the operational costs (Acuña and Valera, 2008). Additionally, there is a lack of technical training as well as environmental monitoring. According to the IBD (2010), the large populated centers dispose 60% of the solid municipal waste in open-air dumps or in the course of water bodies; number that increases up to 80% in the medium size cities, and, 100% in small communities where there is no waste collection service. Thus, it could be affirmed that the waste collection service is not constant, since still a portion of the population still burn MSW at a side of the mountain slope, situation which is more common in the deprived and poor sector mostly at the rural areas, although in urban sectors the garbage burning practice is also very common (Gomez 2008).

In accordance to the inventory done in 1999 by the MPPE, there are 234 locations used for FDSs. Zamorano, Paolini, Ramos & Rodriguez (2009), based their research in the inventory and classified the FDSs by four categories:

- Non controlled open-air dump: site of free disposition of residues and waste with variable extension of land, and no environmental control measures, the location may vary from sites with high slopes, terraces, nearby communities are close to these FDSs. These can also intervene, and affect the course of water bodies.
- Partially controlled dumps: place where it was considered the installation of a sanitary landfill, nevertheless, its actual operational structure is uncontrolled and it does not follow the norms, thus it could be considered as an open air dumps.
- Controlled Landfills: final disposition site for residues that were planned as landfills, sanitation measures are taken on site, the waste and residues are weighted and the area and soil are daily covered, and the application of landfill techniques is carried out. Nevertheless, the operational structure does not comply entirely with the regulations, such as conditioning the field, controlling of gas emissions and leachate are poorly implemented.
- Sanitary Landfill: final disposition sites that comply with the following measures: disposing the waste and residues in a planned manner, spread and compacted in layers to reduce their volume, the compacted material should be covered by soil and there should be a system to efficiently manage the gas emissions and leachate (Zamorano et al. 2009).

The following table (2-4) shows how waste is disposed in the four categories at the national level, the data was extracted from Zamorano et al. (2009), nevertheless, current data was collected from an interview with responsible representatives of the Ministry of Environment in the city of Caracas (Guedez, 2011 January 19th). There are three landfills in the country; these are the only ones that are efficiently managed and comply with all the requirements to be classified as sanitary landfills. In La "Bonanza" landfill, located in the Metropolitan area of Caracas, they deposit the wastes in separated impermeable cells; the gas produced is collected through a complex pipe network, as well as the control and treatment of leachate substances in oxidation ponds (Guedez, 2011, January 19th).

In Monagas State another sanitary landfill was opened in the year 2010, (Guedez, 2011, January 19th), and the third disposal site to comply with the regulations is located in Lara State at Torres Municipality, its capacity is 125 t/day, this last one was an open air dumpsite,

before the recent transformation in the year 2009 (Castro, 2011). It is unknown the number of illegal dumping areas at the national level, due to the rapid proliferation of them (Freitez and Rangel, 2008), that is why the following table (2-4) presents an approximated figure in regards to the FDSs classified by non-controlled open-air dumps in the largest cities, the number of non-controlled open-air dumps in the rural areas remains unknown due to the lack of human resources capacity of the environmental authorities and other public institutions (IDB, 2010). From table (2-4), it is evident that there is a lack of correct final disposition of MSW, for the final disposition of MSW, since the majority of these locations are illegally established and they remain unattended by the local environmental authorities (Zamorano et al., 2009).

Table 2-4 Final Disposal of Residues in Venezuela

Category	Quantity of Sites	Disposed Residues (%)
Non controlled open-air Dumps	177	68.17
Partially Controlled Dumps	40	23.36
Controlled Landfills	14	7.61
Sanitary Landfills	3	0.96

Source: modified Zamorano et al. 2009 & Guedez 2011

Due to the chaotic state of the FDSs, the National Assembly announced a state of emergency concerning the environmental impacts of incorrect waste management in 2001, as mentioned in the previous chapter, as a response of this event (Freitez & Rangel, 2008); the MPPE authorities of the 24 states in Venezuela were responsible for the creation of State Plans for waste management, which were supposed to be the guiding instruments to perform the correct operative actions within all the Municipality of each State (Acuña & Valera, 2008). The areas of study for the formulation of the State plans were: social and economic conditions of the populated centers, geographic and environmental conditions to determine the suitability of the locations for the establishment, transformation or closure of FDSs, existing municipal legislative framework, financial requirements for investment, public awareness of environmental impacts of incorrect final disposition of waste, and citizen participation (Acuña & Valera, 2008).

In this order of ideas, the formulation of plans were fulfilled by 15 State only, and in the majority of the cases, the MPPE contracted consulting environmental agencies to carry out the study. The Federal States that formulated the plans in the period of 2002-2004 were: Amazonas, Delta Amacuro, Falcón, Sucre, Nueva Esparta, Táchira and Trujillo. During 2005 the State of Apure, Bolívar, Guárico formulated the plans; subsequently, in the 2006-2007 period, the authorities of the State of Anzoátegui, Barinas, Cojedes, Monajas, and Portuguesa elaborated the plans. In the rest of the states, there was no formulation of plans; such is the case of the MPPE of Lara State which possesses only a document with terms of reference for the integrated MSWM. According to Urdaneta (personal communication, 2011, January 21), the MPPE of Lara has not yet formulated the State plan, and according to Castillo (personal communication 2011, February 11) none of the plans previously elaborated were officially published, thus, there is not current valid State plan for any of the federal entities in Venezuela. The map of formulation of integrated MSWM plans in Venezuela according to States can be found in the appendix VI.

In regards to the only plan that has briefly referred to the subject of solid waste, it could be highlighted the *National Project Simón Bolivar, First Socialist Plan for Economic and Social Development of the Nation 2007-2013* (GBRV 2007). In this plan within the objective II-3.7 which states "Guarantee the production of sustainable benefits from the biosphere" there is the strategy II 3.7.2 which stipulates "The promotion of integrated management of residues, substances, solid waste and hazardous waste" (GBRV, 2007). It is notable in the text the lack of specifications regarding the goals, targets and time framework to meet the above mentioned objective.

Despite Venezuela was one of the first countries in the LAR to establish an environmental legislative instrument in the year 1976 (Freitez & Rangel, 2008), in the last 10 years there have not been significant advances in regards to the SWM as in the rest of the nations within the LAR that have made efforts to transform their SWMSs to comply with national regulation and also international agreements to lower emissions (Freitez & Rangel, 2008). The changes that have been introduced by the public authorities in Venezuela have been band-aid solution that have partially solved the sanitary issues in regards to the FDSs (Paolini, 2007), but little has been done in respect to strategic planning of MSWM since the majority of the preventative measures and planning strategies have been discontinued by the different government administrations in Venezuela (Paolini, 2007). Moreover, there are no incentives for the population to generate changes in regards to the consumption patterns, and reduce the MSW generation, because there is no variation in the service tariffs according to the quantity it is produced, but in respect to the residential characteristic and the economic capability of the household (PAHO, 2005).

According to the PAHO report (2003), although the actions taken in planning, operative, and financial arena have been disperse and there is no real impact in the long time period, it could be highlighted the following experiences in regards of MSWM within the national context (PAHO, 2003):

- Converting open-air dumps into controlled landfills in the State of Mérida, Sucre, and Lara (Torres Municipality)
- The incorporation of microbusinesses and cooperatives to perform the municipal waste recollection services.
- National authorities have created legislative instruments in favor of decentralization, in order to delegate responsibilities and competence to the Municipality.
- Investment in equipment to optimise collection of MSW.

Concerning the financial investment in the sector of MSWM, for the year 2002, it was not considered as a subject of relevant investment, but just in the case to solve a specific issue. There was no financial allocation, for instance, to update inventory of the waste collection system users, and the update of collection tariffs, or the characterisation of residues (PAHO, 2003). Other areas of financial investment suggested by PAHO (2003) were the studies on the index of service quality, and commercial actions plans that could be presented to the private sector as an incentive to establish markets based on MSW sorting and recycling. IN the next section, it will be briefly identified some of the recent projects in relation with the development of an integrated MSWMS in the country.

2.3 International Cooperation

Within the international cooperation the PAHO elaborated a series of reports in the years 2000, 2003, and 2005. These intended to describe the exiting situation of MSWMS, since the national environmental authorities are incapable to carry out a homogeneous study or

program in the majority of the federal entities due to lack of financial resources, lack of technical support and also scarce access to urban deprived sectors and poor access to rural communities (Acuña & Valera, 2008). In respect to the financial investment, the most prominent organisations are the IDB, and the Andean Development Corporation (CAF). These international organisations have been significantly active in the investment for the improvement of the MSWMS in Venezuela especially after the announcement of the national emergency in 2001. Other international agencies such as Japan International Cooperation Agency (JICA), the German Technical Cooperation (GTZ), the Economics and Commercial Department of the Embassy of Spain in Venezuela, and the British Embassy, have supported public Venezuelan institutions in the area of capacity building, and joint efforts with different universities in the country.

The CAF has also collaborated in terms of financial support to elaborate reports, also in 1999 this organization adapted a manual for integrated waste management from Brazil (CAF official website, 2011). It also has propel initiative from the academic arena and private sector such as the project from Procter & Gamble Company and the Central Venezuelan University (UCV) that consisted in the introduction of integrated management of solid waste applying life cycle inventory in the State of Bolivar (CAF official website, 2011). In the past month of February of 2011, the CAF has signed an agreement with the Chacao Municipality Mayor, which consisted in the implementation of a "sustainable management" of solid residues aiming to reduce 40% of the material sent to the sanitary landfill of "La Bonanza", among the goals there is the optimization of the waste collection service, and the inclusion of citizen participation to carry out the selective domestic waste sorting and perform a market research of the recyclable material, as well as the estimations for waste generations within 5 years (Municipality of Chacao official web site, 2011).

On the other hand, the IDB has currently made an agreement with the MPPE which may represent one of the most relevant programs within the international cooperation in the country; the Program to Strengthen National capacity for integrated solid waste management (VE-L1031) consisted in an set of strategies to reduce the environmental and health impacts of the improper solid waste management (MPPE official website, 2010). The loan was for EUR 140.223 million in total for 7 projects in diverse localities within the national context, among the most significant projects it can be highlighted: the study of technologies applied worldwide and their viability in Venezuela, recycling market research report to identify guidelines for the application of the waste hierarchy principles as well as the inclusion of the informal sector (waste scavengers) (MPPE official webpage, 2010). Other projects are related to the technical support for the optimization or closure of FDSs, and creation no transfer centers (IDB official website 2011). Furthermore, within the (VE-L1031) program the IDB also approved a project within the Iribarren and Crespo Municipality, in regards with a study of management model considering the evaluation of the collection service and the tariffs schemes, final disposition of waste, local regulations and "all the systems associated with waste management" (MPPE official website, 2010 pg. 2) for the Iribarren and Crespo Municipality.

3 Legislative framework

3.1 National and Municipal level

As stated before, Venezuela was the pioneer country in the LAR for having the first legislative instrument concerning environmental issues; it could be affirmed that currently, the legislative framework in the national context is constantly changing, essentially due to political reasons, nevertheless, the current administration has tried to focus efforts towards sustainable development, thus, the regulations concerning MWMSs also have been modified in order to comply with the requirements for the integrated management of solid waste. This next section explores the existing legal instruments related to MWMSs.

In respect to the legislative framework concerning MSWM, Venezuela counts with an ample set of law at the national, state and municipal level (PAHO, 2003). The norms and instruments have been created and the regulation considers technical aspects that have to be implemented to the optimization of the MSWM, nevertheless, the majority of the norms were not created with a unified coordination criterion to promote the synergy amongst stakeholders involved (PAHO,2003). Consequently, the MSWM by the public institutions is limited and deficient. Furthermore, in the recent reformation of the law of residues and solid waste, called "Law of Integrated Management of Garbage", it considers new elements to created incentive to the private sector and the participation of the community, nevertheless, this new legislative instrument lacks of quantitative goals or target that could shape the formulation of national or municipal plans for solid waste management.

In the year 2001, due the evident chaotic state of the FDSs in the entire Venezuelan territory, the Legislative Power (National Assembly) declared a national emergency to improve the FDSs facilities or prompt the closure of the sites that were incorrectly managed according to the legislation, thus, the National Executing Unit of Solid Waste Management (NEUSWM) was created (NEUSWM, n.d.). This entity is ascribed to the Ministry of People's Power for Environment (MPPE) in the city of Caracas, and it is responsible to assess the municipality, bring technical support, and proceed to the closure of the FDSs if necessary (NEUSWM, n.d.). As a result of the establishment of this institute, the conditions of certain FDSs have been improved by the operative measures carried by NEUSWS, but regardless of the current upgrading, the future state of these FDSs is destined to be deteriorated due to the lack of preventative measures applied by the institute to correct the current practices at FDSs (Freitez & Rangel, 2008).

Amongst the aspects related to MWMS, the Constitution of the Bolivarian Republic of Venezuela ([CBRV] 1999) in its article 83, it contemplates the duty of the State to promote policies that are orientated to preserve the health of all population, collective welfare by providing access to public services of waste sanitation. Moreover, the CBRV in the article 127, 129, 156 establishes the State responsibility to preserve the environment, as well as the application of conservation principles, environmental and public health improvements. (GBRV, 1999). Furthermore, in the article 178, ordinal 4 it stipulates the Municipality responsibility to protect the environment, cooperate with the public sanitation process, and the responsibility to run the urban waste sanitation system, which consists on the maintenance of public hygiene, collection, treatment, and final disposition of municipal waste (GBRV, 1999).

The Organic Environmental law stipulates that the accumulation of residues and waste is a harmful activity causing negative environmental impacts, obviating any specific aspect regarding solid residues or municipal waste. The Criminal Environmental Law (1992) in its article 28 and 35, stipulates the sanction for polluting by: pouring, throwing, depositing or infiltrating any type of waste in a watershed, basin, aquifer, lake, water catchment or water supply area, coastal and marine ecosystem, for those who pollute these areas, the sanction is from 3 months of prison to 1 year, and a fine of 300-1 000 days of minimal wage. In the article 42 the same sanctions corresponds to those who contaminate the soil with any type of waste, including solid residues, not following the technical norms of final disposition (GBRV, 1992a).

Furthermore the Law of Public Municipal Power (2005) in its article 37, ordinal 7, it establishes the responsibility of the municipality and districts' authorities to concentrate efforts for environmental protection. Also promotes the cooperation with the agency liable of providing the waste collection service and sanitation measures, in its article 56 (GBRV, 2005). Also, the article 64 stipulates the responsibility of the Municipality to manage solid waste, and article 70 stated that the Municipality should promote the creation of cooperative, public-private partnerships to facilitate the participation of all sectors of the community (GBRV, 2005).

The Decree 2216 Norms for the Management of domestic, commercial, industrial, and non-hazardous waste (1992), is the only document dictating specific norms regarding MSW. This decree stipulates in its article 2, all the stages of residues for its integrated management, promoting the prevention of environmental impacts, stating all the phases of the waste hierarchy (GBRVB 1992). Furthermore, the decree underlines the responsibility of Municipalities for the solid waste management, specifying the role of the current MPPE to assess and provide technical and logistic support to any activity related to waste management (Article 3), as well as the requirements for the installation of sanitary landfills are described (Article 26).

Concerning the municipal regulation, the ordinances are focus on organising the entities that are involved in the MWMS from a bottom-top approach. the Ordinance for the Creation of the Municipal Institute of Urban Sanitation and Domiciliary Service of Barquisimeto (IMAUBAR) stipulates in its article 3 that the institute will establish a contract with a public entity or private company to collect transport and dispose waste, enabling the operative entity contracted to collect the tariffs imposed by IMAUBAR to the users of the urban sanitation service, in this case the Municipality of Iribarren (IMAUBAR, 1990). In the same order of ideas, the Municipal Resolution n° 13-2009 (IMAUBAR, 2009), stipulates the tariffs' rate according to residential sector and type of residence (Article 2), in accordance to article 3 and 4, for the commercial and industrial sector the tariff also varies according to the type of commercial activity and size of the industry that uses the urban sanitation service (IMAUBAR, 2009).

3.2 Relevant Aspects from the legislation concerning residues

- The CBRV establishes the municipality exclusive responsibility for management of the urban waste sanitary system in its article 178 ordinal 4.
- Organic Law of Municipal Regime (GBRV, 2005) establishes the responsibility of the municipality and districts' authorities to concentrate efforts for environmental protection, and cooperation with the organisation liable of providing the waste

collection service, and also promotes the creation of social enterprises, cooperatives, and public-private partnerships to facilitate financial and administrative management.

- Organic Law of Environment (GBRV, 2006): establishes that the accumulation of residues and waste is an activity susceptible to create negative environmental impacts.
- Criminal Environmental Law (1992): stipulates sanctions for those who pollute the environment by incorporating any type of waste, including solid residues. (Article 42). The MPPE is the responsible entity to collect all the fines.
- Decree 2216 (1992) is the only document that provides technical norms in for domestic, commercial and industrial waste management.
- Municipal Ordinances and Resolutions of Iribarren (n° 1672, 2977, 576) stipulate the organisation and attributions of IMAUBAR, as well as the tariffs for the urban sanitation service.
- The financial sanctions stipulated in the municipal ordinance n°576 are significantly updated, establishing payment fees for severe to very severe environmental and sanitation violations between EUR 0.16-16.
- The municipal ordinance n°2981 (2009) for the Municipal budget allocation, in its article 14 gives priority to the projects implemented by IMAUBAR concerning environmental educations.

3.3 New Legislative instrument and challenges for planning

The Law on Residues and Solid Waste (GBRV, 2004) was recently modified and approved on December 30th of 2010, as the Law of Local Councils for Public Planning. The current name of the regulation is Law of Integrated Management of Garbage (LIMG) (GBRV, 2010). This law is the current legal instrument to apply norms concerning all phases of the waste management that came into force the 30th of March of 2011. The debate concerning the formulation of the first draft (January, 2010) for this law was given by various authorities from the different Ministries above illustrated in table, Municipalities' authorities, such as the representatives of IMAUBAR, as other representatives from other states in Venezuela. Also the participation and critical perspective of experts on solid waste management, planning and consulting agencies was taken into consideration, having as an output a document which suggested dramatic transformations concerning the duties of the existing public organizations as well as the creation of a more powerful and independent entity in terms of national financial budget allocation. The discussions led to the formulation of a final version which is very similar to Law on Residues and Solid Waste from 2004, than the first draft presented in January 2010 (Castillos, 2011).

Amongst the relevant changes, in the article 3 it is stipulated that "all aspects related to the integrated management of solid waste is consider of public use and social interest", to legally recognise and underline the social purpose that all entities share in the subject of waste management (GBRV, 2010) well as transference transport, and final disposition of solid waste (Article 7, LIMG). Furthermore, the National Council of Integrated Management of Residues and Waste (NCW) will be created; this agency that will be attached to 8 Ministries and the MPPE will be the leading entity (Article 11).

In this order of ideas, the LIMG stipulates in the article 4 that the State has the duty to continuously, effectively and regularly provide an integrated management of residues and waste, following principles of co-responsibility of the organized communities, nevertheless, in article 10, this law stipulates that the municipality is the only entity directly responsible to implement the policies that the State and national authorities formulate regarding the integrated management of residues and waste. Another prominent change regarding the duty

of the federal entities (states and capital districts) established in article 8, is the coordination of final disposition and transfer of solid waste, the federal entities' authorities will decide which organisation (public entity or private company) will provide the final disposition and transference of solid waste (GBRV, 2010).Moreover, in the article 9, it is stated that the municipality is the one that establishes the tariffs to be paid by the waste collection service users, thus, the municipality is the authority responsible to manage the waste collection service following any type of the above mentioned manners referred in section (2.2), associated to establish a parallel plan to deal with waste in an integrated manner (GBRV, 2010).

Likewise, the LIMG in its article 27 establishes that the integrated management also aims to prolong the life cycle of all reusable material, stimulating economic activities that will slow the process of final disposition of waste (GBRV, 2010).Thus, there will be fiscal and economic incentives for those companies that will reduce the production of disposable waste as well as credits to organized communities that will present a project within the framework of integrated waste management. Furthermore, another incentive is the tax exoneration for those who apply cleaner technology techniques, sorting and recycling methods in their production processes (Article 103 to article 112, LIMG 2010). On the other hand, in the article 120 and 121 of the LIMG, the fines vary from 10-100 tributary units for the minor law breaching, serious breach of this law vary from 101-199 tributary units, and for the very serious breach of this law form 200-300 tributary units. The current value of the tributary unit for the year 2010 is 76 BFs, which converted is EUR 12.20 (SENIAT Official web site, 2011). The entity responsible to collect the fines is the MPPE.

Regarding the informal sector; people who work at the final disposition sites, classifying the residues, according to article 65, they will be prohibited to carry out any type of selective sorting or classification and selling the material at the final disposal sites (GBRV, 2010), thus, in article 66 the LIMG established that the people who illegally work at the disposal site, they will have the priority to conform "collection routes" from the locations of waste generation and transference strategic points (GBRV, 2010). It is relevant to highlight that in the case of this article it is not specified which authority is going to give support to this sector, and how these "collection routes" are going to be designed, organised and it is unknown the benefits or the implications for this social group when it is referred in the text "as having the priority" to conform the so called collective routes. Furthermore, in the article 70 it is stipulated the closure of open air dumpsites that do not comply with the requirements for sanitary landfills; this will be executed after a period of 180 from December 30 of 2010, (GBRV, 2010). Moreover, if it is not suitable to convert the open air dumpsites into landfills, these places would subject of a post-closure sanitary measures that will assure that the disposal site will not cause more environmental impacts. The fine for non-compliance of the closure of the final disposition sites will be 10 tributary units per day of delay.

In regards to the other innovative aspects of the new legislative instrument, the incorporation of the deposit and refund scheme (Article 35) should be stressed. Likewise, the product of massive consumption should provide adequate identification to deliver information to users, by initiating ecolabel systems or any other informative instrument to propel sustainable household consumption (Article 49). In this order of ideas, the state also will give economic incentives to businesses implementing cleaner technology, and the generation of long lifecycle products (Article 106) (GBRV, 2010).

It is notable that there is an integration of innovative concepts regarding SWM in the LIMG, such as the above mentioned schemes, waste management facilities, and the integration of all

social sectors to effectively minimize waste generation. The new law propels a change of the SWM model in Venezuela, which in other countries of the LAR has been already put into practice thanks to the efforts allocated not only to develop the legislation but also endeavor strategic planning for the development of the SWMSs. This panorama significantly differs in the Venezuelan context, since it may be more difficult to apply and enforce the new concepts constituted in the LIMG since there are no specific guidelines to orient the application of all the new elements. This reason deepens the necessity of a national plan to strategically achieve what it is already established in the regulation.

3.3.1 Relevant aspects from the LIMG in the context of Municipalities

- The time period for municipalities to create Municipal Plan for Integrated Management of Solid Waste will be six months after the validation of the National Plan; this means that if there is no delay on the elaboration of the National Plan, Municipal Plans should be created not later than September 30th 2012 (Article 25).
- Incorporation of the waste hierarchy principle to guide norms, plans, and programs to be created by the national environmental and municipal authorities (Article 15).
- Entity responsible for the coordination of final disposition and transfer solid waste is the federal state (capital district), authorities instead of the Municipality authorities. State authorities will authorise public entities/private companies to carry out the final disposition of MSW (Article 8).
- Responsibilities shifted from the Municipality authorities to the MPPE(Article 12)
- The establishment of a differentiation of collection service in accordance with the waste composition taking into account physical, chemical, biological composition (Article 23).
- The integrated SWM will be run by a centralised manner, the NCW become the major entity of coordination among federal states (Article 19)
- The transference of waste as an essential phase of the system to improve the quality of the collection service (Article 51, 121)
- The creation of the NCW, attached to 8 Ministries, was supposed to be carried out before the last day of April 2011; nevertheless, with permission for extending the deadline just once after 30th of March. This entity will coordinate actions to be taken at the Municipal level, once the National Plan for Integrated MSWM will be created.
- Formulation of technical norms regarding solid residues and waste by the MPPE and NCW 120 days after 30th March.
- The implementation of a National plan for integrated management of MSW, with a deadline of 30th March, 2012 and a validation for 10 years, including a revision each 5 years.
- The NCW became responsible for technical support to the Municipalities, in regards to the management of FDSs.
- MPPE responsible to carry out the inventory of all the FDSs (third transitional provisions) and submission of report 90 days after 30th March 2011.
- Submission of Adequation plans of FDSs 180 days after 30th March 2011 by the Municipal authority responsible for MSWM.
- Elimination of sorting and extraction of recyclable material at the final disposition sites.
- Sanitation and elimination of final disposition sites different than sanitary landfills.

- Establishment of updated fines and penalties for minor, severe and very severe environmental breaches in the local legislation, and ordinances
- The incorporation of the waste scavengers in the formal sector by promotion "collection routes" which are based on selective sorting.
- The promotion of economic incentives to the private sector and large waste generators.
- Large waste generators should count with a minimization waste program in association with the Municipalities
- The State responsible to promote the reduction of disposable material use, by enforcing the large generators to establish their own collection, treatment and final disposition system.

On one hand it is prominent the efforts of legislators put to create a legislative framework in accordance with the integrated perspective on waste management in the LIMG, but it is relevant to underline that the shifted responsibility to the federal entities of coordinating the final disposition of MSW is an aspect that may lead to a chaotic situation, when decisions will need to be taken concerning the execution of a tendering process for private companies to perform the waste collection service, that in the past the municipalities were the exclusive entity responsible for the contract and approval of tenders. From now it is uncertain how the federal entities and the Municipalities are going to coordinate actions, since in the CBRV the exclusive responsibility for MSWM it assigned to the Municipalities. Another negative aspect associated with the article 19 stating that the planning of solid waste will be performed in a centralized manner, may lead to a chaotic budgetary situation, since financial resources might be allocated not taking into account the necessities of specific Municipalities.

Another implication for Iribarren Municipality is that there has to be modifications of the local ordinances and decrees that currently regulate the MSWMS, with the purpose of obeying the LIMG. One of the reasons for these changes is the prohibition of the recyclable material extraction (Article 65) at the FDSs, in the case of Iribarren at Pavia landfill (GBRV, 2010). The current Municipal Ordinance by IMAUBAR (2009) stipulates extraction fees for those who work in association with the *gancheros* (waste scavengers) and with private collection companies in Iribarren, thus the eradication of recyclable material extraction also means the elimination of tariff systems, thus, ordinances will have to be modified. The prohibition also has a negative impact on the current income of IMAUBAR, since the institution financially benefits from the extraction of recyclable material, thus, keep charging fees for extraction would be a law breach. The prohibition of recyclable material extraction is a norm that can bring negative environmental repercussions due to the lack of infrastructure to support collection of material outside Pavia, thus, higher quantities of waste will be disposed without proper treatment.

Likewise, changes in the Municipal Ordinances have to consider the new roles of NCW in association with the MPPE, and also the new type of "socialist enterprises" which is promoted by the LIMG and defined in the article 17 as "enterprises that will provide a service according to the necessities of the localities, that will have the power to coordinate and supervise activities concerning MSWM (Article 18 from GBRV, 2010) with the local authorities, that in the case of Iribarren is IMAUBAR. This new mandate is an evidence of the fragile points of the legislative document, since the exclusive responsibility to coordinate, plan and supervise of the Municipality will be shared with this new type of organisation that is not nationally contemplated in other legal texts. Furthermore, if one is aware of the typical structure of past planning experiences, and the entities hierarchical system, it could be expected for the National authorities to commence the planning process; nevertheless, in the

Venezuelan context it seems that the system works differently and backwards, due to the past and failed attempt of all the Federal Entities' Environmental Authorities to conduct the formulation of plans for the integrated waste management at the Federal State level (Castillo, March 7th personal communication, Urdaneta, February 14th, 2011), when these do not have the exclusive responsibility for the residues and waste management as the Municipalities do (CBRB, 1999).

4 The case of Iribarren Municipality

4.1 Current state of MSWMS

According to the projections of the 2001 census, Iribarren Municipality's population is 1 073 934 (PROINLARA, 2010), with an annual growth rate of 2.4 (NIS, 2010), the Municipality counts with 10 districts. In regards to the rate of generation per capita, it is 0.80 kg/day, and annually it is produced 300 701 tons of unclassified waste, as illustrated in table 2-2. The prevailing SWM consists in the same dynamic of: waste generation, waste collection and final disposal system, as in the national context (Zamorano et al. 2009).

The situation regarding MSWM at Iribarren Municipality does not significantly differs from the conditions prevailing in the national territory; the efforts made among institutions are uncoordinated, reflecting an inefficient management of economic resources in the MSWMS arena (Mendoza, 2009). The institutional scheme shows a significant problem; there is no coordination and poor communication among the different departments within the same institutions (Bastidas 2011, 2nd February), there is a lack of continuity of the projects proposed by former authorities and public sector (Bastidas 2011, 2nd February). In the regional level, the lack of communication is evident, since by February 2011, the National authorities from the Ministry of Environment had not informed or communicated to the Municipal responsible entities for the waste management, in this case IMAUBAR, about the new reformation of the LIMG from 2010.

On the other side, it could be affirmed that there is a commitment towards sustainability by the local political authorities (IMAUBAR 2009); this could be observed in the promotion of Iribarren as a "Sustainable Municipality", in many expensive billboard within the circumscription of the Municipality. Nevertheless, there is a lot of financial investment for publicity and a lack of environmental education campaigns, thus, it could be said that there is a significantly strong "politicisation" of all the projects related to waste management (Bastidas 2011, 2nd February), as it is a common characteristic in all the sectors where the National, State and Municipal Administration invest money (see appendix XIII). Additionally, another negative aspects linked to the political instability at all levels of governance is the reticence of private sector investment, thus, at the current time, there is limited companies encourage to venture in the recycling business (Paolini 2011, 13th January & Bastidas 2011, 2nd February).

In this order of ideas, the Reference Terms document by the MPPE-Lara (2006), stipulates in its content that there has been technical assistance assigned to Iribarren Municipality in various times concerning the final disposition management of waste and residues, mostly by the MPPE authorities that are aware of the existing problems. Authors such as Freitez and Rangel (2008), MPPE-Lara (2007), Mendoza (2009) as well as Paolini et al. (2008) point out the major sanitary and social problems associated with MSWMS at Iribarren Municipality, these are:

- Constant Proliferation of illegal dumps
- Blockade of road drainage by solid residues
- Proliferation of infectious disease agents among deprived social sectors where the urban waste collection services is not available.
- Lack of a proper infrastructure for waste sorting or selective separation
- Absence of recycling companies within the circumscription of Iribarren Municipality.

- Wide involvement of various groups within the informal sector that have established a market of recyclable material.
- Prevalence of the inappropriate working conditions of the informal sector.
- Infectious medical waste and organic waste coming from hospital treat as common solid waste in all the management stages.
- Racing and grazing of animals for such as goats and pigs within Pavia landfill
- Not sufficient transportation units to perform the waste collection service.
- Scarce community awareness of environmental impacts from improper final disposition of waste.

4.2 Management of Pavia as the main FDS

In Lara State there are seven disposal sites; Pavia is the largest controlled landfill, as it was previously classified by Zamorano et al. (2009), due to the landfilling techniques that are employed there. Currently, the public institution responsible for the waste management is IMAUBAR, which is associated with two private companies (SATECA and URBASER) that provide the service of waste collection and transport it to Pavia (Bastidas, 2005). Essentially, when the solid residues are transported to Pavia, the material is weighted and taken to the terraces where the groups of *gancheros* carry out the solid waste sorting; afterwards the *gancheros* have performed the selection, the rest of the residues are disposed in cells, this process will be explained in the subsequent parts of this section.

Pavia was created in the year 1996 (IMAUBAR, 2009) as a Non-hazardous waste deposit, although it currently receives residues ((municipal, industrial, hazardous, medical infectious) from Iribarren and Palavecino Municipality as well as garbage from two more municipalities out of Lara State (Freitez and Rangel, 2008, Rodriguez, February 3rd, 2011). The fact that Pavia is utilised as the FDS for other Municipalities is not on a regular basis circumstances. In order to balance and divert waste to be sent to Pavia, the installation of a new landfill in Torres Municipality has been completed, where the residues that do not correspond to Iribarren are supposed to be deposited. Its construction is very recent (2009), and there is limited information about the current management of this new sanitary landfill, nevertheless, it is known that around 184 000 inhabitants of Torres municipality are going to benefit from this project (Castro, 2011).

Additionally, Paolini et al. (2008) in their evaluation of the FDSs in Lara States, it was affirmed that besides Pavia, the rest of the FDSs five (5) are non-controlled open air dumpsites; there are Los Jebes (Jimenez Municipality), Los Palmares (Moran), Curva del Viento (Andres Eloy Blanco Municipality), Guanarito (Urdaneta Municipality), La Pica (Crespo Municipality), within the results of the above mentioned study, Paolini et al. (2008) concluded that Pavia and La Pica FDSs were the environmental impacts are significantly low in comparison with the rest of the location for waste disposal in Lara State.

In Pavia, the responsible entity applies few landfilling techniques as an attempt to comply with the regulations. It is located in an arid and plane area, where the depletion of health of ecosystems has also contributed to deteriorate the living condition of the nearby communities around the FDS sector (Gomez, 2008). Another social problem inside the Pavia controlled landfill is that the municipal police authorities are unable to regulate the illegal activities that take place in Pavia; such as delinquency and violent incidents related to the illegal market established by the *gancheros*, intentional started fires aiming to disturb the operational procedures inside the controlled landfills(Paolini 2007), as a result of this situation the Municipality authorities decided to remove the members of the police body

from Pavia (Zambrano, February 2nd 2011) instead of intensify the presence of legal authorities at the FDS, fact that may lead to a more chaotic management of the Pavia landfill.

In respect to the quantity of waste that is disposed at Pavia Landfill, the following table (4-1) shows the detail of the organic and non-organic components that prevail in the above mentioned location. This shows that previous efforts concerning the characterisation of solid waste disposed at Pavia has been previously done, and that based the most significant quantities are organic residues coming from households, there is a need to involve the community of Iribarren in the process of selective sorting in order to divert waste from the landfill, and also to use the organic matter as an input for production of energy or the production of compost.

Table 4-1Charactetisation of monthly disposed waste at Pavia

Characterisation of monthly Disposed waste in Pavia (2004)		
Type of waste	**(Weight /Ton)**	**%**
Organic domestic residues	13 194.88	68.72
Glass	119.79	0.62
Cardboard and Paper	815.98	4.25
Hard Pastic	86.21	0.45
Textiles	69.86	0.36
Copper	4.48	0.02
Small metal scrap pieces	162.18	0.84
Long metal scrap pieces	89.24	0.46
Brass	108.78	0.57
Tannery sludge	32.04	0.17
Scrap medium size metal	188.68	0.98
Tires and rubber	187.23	0.98
Parts of animals	9.02	0.05
Animals' skins	302.13	1.57
small wooden pieces	3.17	0.02
Mixed waste	646.31	3.37
Construction and demolition debris	2680.30	13.96
Sewage sludge	8.92	0.05
Washed sludge and grease	12.26	0.06
Sawdust	158.54	0.83
Ceramic powder	213.18	1.11
Fiberglass	4.75	0.02
Waste from independent sources	102.09	0.53
Total residues	19 200.03	100%

Source: (Bastidas, 2005)

On the other hand, Freitez and Rangel (2008) in their research, established a different classification of residues disposed at Pavia landfill, taking into account non-organic waste, also it is notable a variation of quantities, table (4-2) illustrates the results of their study. The figures for recyclable material are significantly lower than the ones calculated by the IMAUBAR authorities in 2004, Freitez & Rangel (2008) show a more detailed composition of metals, including aluminium, iron.

Table 4-2 Characterization of monthly recyclable material waste at Pavia Landfill

Monthly Characterization of recyclable material at Pavia Landfill		
	Ton/Month	**Percentage**
Glass	36.17	7.32
Cardboard/Paper	246.41	49.87
Hard Pastic	26.03	5.27
Textiles	21.09	4.27
Aluminium	33.26	6.73
Iron	21.01	4.25
Copper	1.35	0.27
Small metal scrap pieces	48.98	9.91
Long metal scrap pieces	26.95	5.45
Brass	32.85	6.65
Total	494.10	100

Source: Freitez & Rangel (2008)

The local authorities of Lara State have announced the closure of Pavia since according their calculations it is going to reach the maximum capacity in 3 years if the current management is not improved and the population and waste generation rate keep incrementing (Bastidas, 2011, February 2nd). At the present it is already causing sanitary problems since in some areas of Pavia, the rubbish is piled up and it has reached the roads and main avenues (Castro, 2011). Nevertheless, the uncertainty and lack of plans for building a new final disposition site is a major concern at the municipal level (Lameda, 2011 January 7th). There have been conversations among local authorities and some officers from the Minister of Environment, but no further information of the potential location for a new FDS has been pronounced (Lameda, 2011 January 7th).

As a final argument to discuss in this section, it was confirmed by personal communications of IMAUBAR staff (López, and Rodriguez, 2011 May 17th) that at Pavia landfill and local authorities has not been able to eradicate the existent market of recyclable material at the FDS, due to the significant number of individuals from the informal sector economically benefiting from sorting and selling solid waste. Also, private companies will be affected by the reduction of the amount of waste recuperated at the landfill. Nevertheless, the other stakeholder that benefits from tariff extraction fee is IMAUBAR itself. At the 2 site visits conducted in Pavia, during the month of February the same market was identify by the presence of stakeholders, nevertheless, the LIMG entering into force was March 30th, currently it was confirmed that the extraction of recyclable material is still a regular practice.

4.3 Treatment of MSW

The treatment of waste and residues at Pavia landfill consist in a simple application of landfill techniques: the residues are placed in terraces according to the physical characteristics, and spread in compacted layers covered by dust (MPPE, 2006). The installation of a few numbers of pipes was carried out to control the gas emissions, but in the current time these are not functioning; nonetheless, in addition, is no control of substance leachates (Zambrano, February 2nd, 2011). Moreover, in a report of operational activities at Pavia Landfill (IMAUBAR, n.d.), it is described in detail the different treatment given to residential, or in this case MSW, as a complementary source of information Rodriguez (February 3rd , 2011)

described the different phases of solid waste from the moment this material is brought to Pavia :

- Transportation units (trucks) stop ever at the landfill weight scale.
- Deposition of waste by the private companies SATECA or Urbaser at the central yard of the landfill.
- Selection of waste and recyclable material by the "*gancheros*".
- Removal of solid residues from the central yard by the service company "Construcciones y Transporte" and placement of residues at the specific terrace for residential solid waste.
- Spreading of the solid residues and compaction process with crawlers D8-D9.
- Coverage of the solid residues with dust.

4.4 Environmental aspects and impacts of MSWM in Iribarren

Among the environmental impacts of improper MSWMS at Iribarren, it is important to highlight that there are impacts within the urban sector, at the FDS, which in this case is Pavia, and also in sub-urban areas where erroneous practices carried out by Iribarren citizens such as the accumulation of residues and also waste burning are still very common (Freitez & Rangel, 2008). This section briefly points out the most relevant environmental impacts affecting Iribarren Municipality due to the current MSWMS.

In the case of Pavia, according to Paolini (2007) the presence of aquifers is discontinuous, due to their semi confined physical characteristic and representing a minor risk of affecting groundwater supply. On the other side, there is the presence of surface water bodies, and intermittent water streams (3) which are affected by the leachate from the solid residues because of the mix, incrementing the organic content of the diminishing the oxygen and augment of odours. Along with this, in Pavia the deposit of demolition debris and the contact with runoff water generates sulfate, carbonate and other soluble salts that can affect the soil composition (Bastidas, 2005).

The generation of methane gas is a common characteristic of landfills, as well as in Pavia, produced by the anaerobic fermentation of organic matter. There is a very significant risk of inflammability and gas explosion attributable to the lack of gas control at the FDS, since the landfill pipe system or fumarole implemented more than a decade before, it stopped functioning, another cause of fires is the insufficient coverage of the residues and also low levels of compaction (Paolini, 2007). The production of other GHGs also is part of the atmospheric contamination that increases the ozone depletion, such as vinyl chloride, benzene, trichloroethylene and methylene chloride, these gases are commonly found at the landfills where there is a primitive waste separation, nevertheless, there are no studies on Pavia regarding these substances (Paolini, 2007). On the other hand, at the sub-urban areas, atmospheric pollution is produced by the abundant emissions of sulfur dioxide, and nitrogen oxide from the garbage burning at illegal dumps, representing a risk for human health because of the respiratory diseases, and exposure to carcinogenic substances.

The soils at Pavia landfill are mainly *aridisoils*, and they are dried out from 6 to 9 months and with a high percentage of clay and silt (IMAUBAR, 2009), lately presenting a salinization rate due to the natural conditions of the climate at the area. In accordance to Gomez (2008), in Pavia, there is the presence of the following heavy metal such as lead, cadmium, copper, chromium, nickel, silver and manganese. The elements such as lead and cadmium slightly exceed the values permitted by the technical norm *COVENIN Nº 2797-91* on measures to prevent leachate contamination. Also these elements are likely to migrate through runoff water as well as airstreams, occasioning a risk for the biodiversity of nearby ecosystems and

also a risk for the inhabitants of the Pavia sector. In appendix XI the amount of lead mg/kg found at the different places were the sample was taken at Pavia landfill.

4.5 Municipal Institute for Urban Sanitation of Barquisimeto (IMAUBAR) as the responsible public entity for MSWM

As stated before, the municipalities have exclusive responsibility for the management of waste and residues according to the CBRV (1999) and the Organic Law of Municipal Regime (GBRV 1989). Therefore, The Municipal Institute of Urban Sanitation and Domiciliary Service of Barquisimeto (IMAUBAR) was created in 1988 by the 545 decree as an autonomous and decentralised public para-municipal entity, responsible for the administration of a private company contract and the exclusive management of Pavia, which by the year 1988 was an open-air dump (Mendoza, 2009). This is an institute that fits into the category of public-private partnership entity, by the year 1990, there were established the responsibilities of this institute, by the ordinance n°576; "program, plan, organize, coordinate, regulate and control all the activities related to collection, transport, final disposition, treatment, marketing of waste and residues of any kind within Iribarren Municipality, as well as setting up tariffs for the public urban sanitation service" (IMAUBAR, 1990).

At present, the IMAUBAR organization and management system shows a typical structure of a public entity, instead of a municipal corporation (Mendoza 2009), nonetheless, amongst the institutional endowment of IMAUBAR, there are the following aspects (Mendoza, 2009):

1. The economic surplus from the fee payment for the management of the urban sanitation service
2. The economic surplus from the fees charged (at the exit) at the Pavia landfill to representatives of recyclable matierla collection companies, which according to the recent legal regulation it is a banned activity to perform at the FDSs.
3. The economic surplus from the fees charge (at the entrance) to particular individuals that wish to dispose any sort of waste contemplated in the municipal ordinance.
4. Revenues from the contracts or tenders given by IMAUBAR
5. Contributions and donations from private companies, NGO's among other agencies
6. Annual financialallocation from the Municipal authority according to the budget ordinance.

The institute has its own machinery in the case of emergency when the contracted companies are unable to cover the collection routes (IMAUBAR, 2009). According to the Municipal ordinance in the art 52 (IMAUBAR, 1990) IMAUBAR shall put the contract out to tender; the maximum term contract is 20 years, and within that scheme, IMAUBAR competencies are to administrate and organize the service of public urban sanitation associated with the private company that has participated and won the tender.

Moreover, at the municipal level, the ordinance of the Municipal Institute of Domiciliary and Urban Sanitary Service (IMAUBAR, 1990) states the creation and duties of this entity. In the article 2 of the municipal ordinance, it states that IMAUBAR has the competency to plan, program, organise, coordinate, regulate, control the urban sanitary service which consist in the collection, transport, final disposition, treatment and commercialisation of any type of waste, excepting hazardous, as well as all that concerns the payment of the service's tariffs. This clearly contradicts the recent legislation, since now the responsible organisation to establish tariffs is the NCW (GBRV, 2010). Thus, a reformation of the municipal ordinances

is necessary in order to coherently assign responsibilities and attributions to the pertinent institutions.

The directive board within IMAUBAR is integrated by 7 members that shall be elected every 3 years (IMAUBAR, 1990). This group shall maintain constant feedback regarding the quality of the service that IMAUBAR provides with representatives of the consultative council, integrated by research institutions, the Ministry of Environment, Ministry of Education, labor union of IMAUBAR, National Guard and the Lara State Executive (IMAUBAR, 1990). According to the research results of Mendoza (2009), IMAUBAR did not count with an organizational chart neither with a manual for the logistics of the department and their specific functions. In addition to this, the formulation of an operative plan for collection, transport, and final disposition of waste has been tried to solve the absence of a local plan for integrated waste management (Mendoza, 2009), absence which is a common situation in all the Municipalities among the national territory as previously mentioned.

According to IMAUBAR (2009) the collected waste was 298 592 tons of solid waste for the year 2009, which reported an increment of 13.29% in comparison to the year 2008. The total investment in the year 2009 for improvements of the waste management was EUR 1 614 233 (IMAUBAR, 2010), nevertheless, and according to Lopez (January 4th, 2011), the only direct income of this institute is from the charge of tariffs paid by the users of the service, and the particular users of the final disposition site (Pavia). Nevertheless, the revenues from the tariffs just cover operational costs from 5 to 10 %, and IMAUBAR has a significant large debt with the operative companies which collect the residues and waste Lopez (January 4th, 2011). Currently, IMAUBAR is not managed in a cost effective manner, factor that makes it more dependent of the public budget assigned to municipalities which has always been significantly limited in comparison to other areas of investments of the Municipality's authorities (Bastidas, February 2nd, 2011).

4.5.1 Tariff systems

The IMAUBAR has set a tariff system not just for the provision of the urban waste collection services, but also tariff feeds at the Pavia landfill, as a control measure due to the chaotic state of the landfill in the period 1997-2008 (Bastidas, February 7th, 2011). In the following table (4-3), it is illustrated the updated tariff regime for the provision of the residential, commercial, and industrial waste collection service of Iribarren Municipality, in accordance with the Municipal Resolution n°2976 (IMAUBAR, 2009).

According to the resolution n°2976, the charge for the collection fee is based on the characteristics of the residence, which is meant to set tariff according to socioeconomic status classification, thus, residence type A consists in a gate residence, mansion, house, or apartment built with high quality materials, with recreation areas, with all the public services are provided; water, electricity and urban waste collection service. The type B consists on a house, apartment, located in a closed neighbourhood with the provision of public service. Type C; house or apartment built with less quality materials, where there is a provision of public service type D; house not properly built, that is not included in the sectorial plan of the Municipality, and where there are no provision of water or electricity by the Municipal authorities but improvised and illegal power supply. At last, the type E consists on houses built with waste material like cardboard, tin, wood, this does not appear in the sectorial plan of the Municipality, and there is a similar situation with the lack of provision of services above mentioned for type D.

Table 4-3 Final disposition tariff for MSW at Pavia Landfill

Final disposition tariff fee for MSW at Pavia Landfill	
Type of waste	Tariff fee equivalent in EUR per metric ton
Domestic/Residential waste	
Residence type A	0.79
Residence Type B	0.52
Residence Type C	0.25
Residence Type D	0.13
Residence Type E	0.04
Commercial Sector	
Average of Commercial waste type	5.16
Industrial Sector average fee	
Average of Industrial waste type	4.37

Source: IMAUBAR (2009) & collected documents at Pavia landfill administrative office

It is relevant to underline that the tariff fees recently updated in the resolution n°2976 are significantly lower than the tariff fees imposed by other Municipalities in the LAR. For example, at the landfills in Lima, Peru, the tariff fee per metric ton for residential and domestic waste is EUR 4.79(Ministry of Environment of Peru, n.d.). Another example of higher fees for the final disposition of waste is in Nogales Municipality in Mexico, the fee per metric ton of municipal solid waste is EUR 6.5 (Maldonado, 2008). In the national context, there were no ordinances or municipal resolutions found describing the tariff fees within the rest of the controlled landfills or sanitary landfills, in order to compare them with the Pavia tariffs fees.

On the other hand, the municipal ordinance that stipulates the prohibition for disposing hazardous waste inside the landfill facilities is not correctly followed at Pavia landfill, since the following tariff fees were assigned to different type of residues, including hazardous and sewage sludge, and infectious medical waste amongst other types. In appendix IX it is illustrated the tariff fees imposed according to the classification, the average tariff fee for the hazardous waste is EUR 2.10, which is significantly lower than in other Municipalities in the LAR, for instance, in the case of Azogues Municipality at the FDS in Ecuador; the tariff fee per metric ton of hazardous waste is EUR 62 (Azogue Municipality Secretary Department, 2010).

Likewise, the tariff fee for waste collection service in other Municipalities in la LAR are higher than in Venezuela; the Municipality of Quito charges EUR 34 for the waste collection service (Municipal District of Quito, 2007), and in the Municipality of San Nicolás (Argentina) the price is EUR. Concerning the tariff system for the urban waste collection services in Iribarren, IMAUBAR also updated the fees; nevertheless, these are very low and do not promote the minimization of generation in the household, commercial or industrial sector (Zambrano, February 3rd 2011). The payment process of the urban waste collection service consists of a charge fee in the electric service bill, which the members of Iribarren Municipality are not obligated to pay. Currently, there are no enforcement instruments stipulating sanctions for the individuals refusing to pay for the service. The following table (4-4) shows the waste collection tariff fee which is lower than the other tariffs in the LAR.

Table 4-4 Monthly Tariff Fee Final for urban waste collection service of Iribarren

Monthly Tariff Fee for urban waste collection service of Iribarren	
Type of waste	**Tariff fee equivalent in EUR per metric ton**
Domestic/Residential waste	
Residence type A	9.4
Residence Type B	6.8
Residence Type C	3.52
Residence Type D	1.71
Commercial Sector	
Average of Commercial waste type	65.61
Industrial Sector average fee	
Average of Industrial waste type	48.05

Source: IMAUBAR (2009) & collected documents at Pavia landfill administrative office

4.5.2 Initiatives of IMAUBAR

In regards to the programs and projects initiated in the past, coordinated by IMAUBAR, according to Bastidas (February 7th, 2011) there was an attempt in the year 1999 to formalize the activity of the "gancheros" at the Pavia landfill. It consisted on the identification of each one of the informal sector group members by a license or accreditation to be able to collect recyclable material. Furthermore, a schedule was established for the equal exploitation of the potentialities of the disposed waste at Pavia by all the gancheros, (Bastidas, February 7th, 2011), and the provision of the adequate equipment to collect waste was also provided. The purpose of this project was twofold: firstly, improve working conditions of the gancheros, and secondly establish an inventory of reclyclable material for other potential programs to transform the dynamics of waste flows at Pavia landfill (Bastidas, February 7th, 2011). Later on, when the responsible employee to coordinate the program (Augusto Bastidas) left, the manager position, the execution of this project ceased and the gancheros starting performing their activities as before the implementation of the program.

A second initiative during the time Mr. Bastidas was responsible for the coordination of Pavia landfill, the Municipality's authorities invited a Colombian entrepreneur and president of a recycling cooperative to dictate talks to the group of gancheros. This person went to Barquisimeto (Iribarren Capital District), various times, but due to the attempt of the Municipal authorities to politise the initiative by advertise the program created in Colombia as an initiative from IMAUBAR, the person left and the education campaigns to the gancheros' community ended (Bastidas, February 7th, 2011). During the interview with Bastidas (February 7th, 2011), he mentioned that none of these initiatives were documented, further research in regards to these topics was carried out but no records of the programs were found.

More recently, In IMAUBAR, the department of Environmental Sanitation and Environmental Education is the responsible to carry out various projects. In the year 2010 IMAUBAR was awarded as "the eco-efficient public institution of the year" by VITALIS; which is a prominent Venezuelan environmental NGO created in 2000. The award was given due to the implementation of the voluntary program called "Certification: Schools Free of Waste", which aims to promote the culture of "the three Rs" reduce-recycle-reuse in the formal education, at the public and private educational institutions within Iribarren Municipality (IMAUBAR, 2010). The project counts with five phases: visit the schools and

inform authorities of the certification programme, subsequently, visit schools to instruct the personnel of the institution about how to implement actions in every academic subject. The third phase is to put into practice all the activities planned by the schools' personnel and IMAUBAR collaborator, then the fourth phase is the monitoring and motivation to continue all the activities to finally achieve the certification as the final phase.

The goal of this program is to establish a system to evaluate, revise and transform how the students relate to the environment, raising awareness among the young generations (IMAUBAR, 2010). At the moment the program has been implemented by 7 public schools, none of them have received the certification, since the participating institutions are going through the monitoring process (Lopez, January 4th 2011). Nonetheless, the expected results are essentially the incorporation of the environmental component in all the levels of primary and secondary education, subsequently, installing a waste management system at schools to facilitate material to recycling companies (Lopez, January 4th 2011). These type of projects aim to have a long term impact on the reduction of the quantity of waste sent to the final disposition sites, however, these program are in an initial phase and there is a lack of monitoring by the IMAUBAR authorities, situation that is not likely to improve due to the efforts allocation of the institute to comply with the LIMG (Lopez, January 4th 2011).

IMAUBAR also has implemented another programme called "Environmental Screens*" (Pantallas Ecologicas),* recycling project. A total of 25 separate collection stations were set up for the pilot program at strategic points in the city of Barquisimeto (IMAUBAR 2009). During 2010 more than 200 "Environmental Screens" were installed in the different urban and rural district areas, nevertheless the goal at the initialization of the project was the installation of 1000 "Environmental Screens", the total investment was EUR 845 350 (IMAUBAR, 2010). The project aims to start the separated collection system in no less than 20%. The stations count with four containers divided by: organic waste, paper and cardboard, glass and plastic. This program is a relevant effort for encouraging people to separate residues, nevertheless, the residues are transported in the same units usually utilised to transport urban waste, by the same two companies responsible for the urban sanitation service and the material previously sorted is mixed with all the resting waste that is disposed in Pavia (Lopez 2010). For this reason, it is essential to point out that the program at this stage does not have an impact of reducing the quantity of waste that ends at the final disposition site, unless different transport units are allocated to collect all the sorted material at the "Environmental Screens", taking the material to the different recycling companies in the municipality.

Additionally, there is not a proper monitoring system within the program to calculate the quantity of residues that is collected at the "Environmental Screens", or a monitoring plan to check if the community is sorting the material in a correct manner. Besides this, it is acknowledged by the entity's authority that an education campaign is necessary in order to cause a larger change towards recycling in the population of Barquisimeto (Lopez 2010).

IMAUBAR has effectively created channel of communication to promote recycling and environmental education, the weekly radio program "Barquisimeto Recycles" started airing in March of 2010 (IMAUBAR, 2009). The future projects for the year 2011 that involve national investment in Iribarren Municipality are the following: establishment of a transference station for the improvement of the collection service in the northern part of Iribarren, strategic associations with malls to implement a program of selective recollection of food (to subsequently use as organic matter), and selective recollection of residues in communities (IMAUBAR 2009).

As a final comment, in accordance to the official project presented for the construction of the transference station, the purpose of this facility will consist in the minimisation of waste transported to Pavia landfill, by the application of partial treatment of municipal waste collected in the northern part of the Iribarren, this means just the compaction of residues (IMAUBAR, 2009). This project also evidences the lack of strategic planning for integrated solid waste management because there is no consideration in the project of the risk that at this future facility, the similar sanitary problematic situation of the presence of the informal sector as it exists at the Pavia facilities will be reproduced at the transference station.

4.6 Other stakeholders influencing the MSWMS in Iribarren

4.6.1 Ministry of the People's Power for the Environment of Lara

Since the creation of the Law of Solid Residues and Waste (2004), the MPPE has been responsible for the technical assistance to municipalities for the management of the FDSs, as well as the technical assistance in order to permit the installation of a new FDS. Moreover, this entity is responsible for monitoring and control of any activity susceptible to degrade the environment (Article 2, Official Gazette, 2006). Hence, concerning the entry of hazardous waste disposed at Pavia landfill, the generators are obligated to perform laboratory analysis and present the results to the MPPE, as parts as the duty to the monitor of susceptible activities to degrade the environment, nevertheless, in reality the laboratory analysis are seldom carried out by the MPPE (Urdaneta, February 14th, 2011).

On the other hand, in the year 2006, the MPPE authorities of Lara State started the pertinent research and studies for the formulation of the Plan for the Integrated Waste Management of Lara State (Urdaneta, February 14th, 2011). For the recent time, all the advances they have made are concentrated in the Term References document, which is not yet finished (MPPE, 2006). The document specifies the following:

- Diagnosis: environmental characterization of the territory of Iribarren, environmental vulnerability assessment, socioeconomic characteristics, legal framework, evaluation of all the phases of residues, waste and residues characterization, and the evaluation of the waste collection service efficiency, institutional aspects related to the management of residues.

- Presentation of the plan to Municipal authorities to promote consensus in the decision making process, formulation of plan and implementation of strategies, and further monitoring measures (MPPE, 2006).

Along with the duties of MPPE of Lara state above mentioned, this public institution has carried out diverse educational and formative workshops in the rural communities, these include public talks about environmental aspects related to waste burning practices which are still very common not just in rural communities where these is no access to the waste collection service, but also in the urban deprived social sectors generally called "barrios" far and wide spread at Iribarren (Urdaneta, February 14th, 2011). Also, the MPPE authorities have carried out capacity building activities such as meeting and presentations for individuals who work in the waste management sector but are still not legally constituted.

Concerning the recent projects related to Iribarren, recently approved by the Executing Unit of Solid Waste, which is one of the entities attached to the Directive of the Ministry of Environment in the city of Caracas, this organisation has approved technical support to develop evaluation of the different phases of the waste management at the Iribarren and

Crespo Municipalities, to assess the feasibility to have a joint agreement to utilise a common sanitary landfill (MPPE, n.d.)

4.6.2 Private sector

In this section, the role of the two private companies contracted by IMAUBAR is going to be described. These two companies do not compete with each other, since IMAUBAR has set the collection routes and divided the area of service performance in two sectors, the southern part of Iribarren (SATECA), and the Northern sector. The data collected is from key aspects identified during the interviews, bibliographic material, as well as public information available at the websites of both companies, which is scarce since the above mentioned reasons in chapter 1.

SATECA

SATECA is an acronym for *Technical Corporation for Environmental Conservation*. It is a Venezuelan private company founded in 1982, in Zulia State. In 1983, this company was one of the pioneers to participate in the privatization of the urban waste collection system (SATECA, n.d.). In 1998, the company won the tendering process, signing a contract for 12 years (Mendoza, 2009). At the moment, it is responsible for the urban sanitary service of the Southern part of the municipality, being responsible for covering 42 routes, with a variable frequency of collection that depends on the characteristic of the residential areas (Mendoza, 2009). The mission of SATECA is to provide the collection, treatment and final disposition of waste and urban solid waste, generated by the households, commercial activities, and industrial sector. In the same order of ideas, its vision is to become the leader company of environmental sanitation, providing a good quality service, with high technology equipment (SATECA, nod).

Presently, SATECA counts with 20 compactor trucks, 5 dump trucks, and 4 trucks for personnel transportation (Freights & Rangel 2008). These authors also stated in their research that a comparison of current rates and costs of the company show that, by average, by the end of a month, and after making the payment according to the tender, SATECA obtains the amount of EUR 56 018, that is meant to be allocated for the company operative cost which in total is EUR 141 000, representing an evident financial imbalance of EUR 84 950 (Freitez & Rangel, 2008). In addition, according to the organisational structure of the company in Iribarren Municipality, there is no environmental sanitation department, neither a quality department (SATECA, n.d.), fact that is curious due to the acronym of the company, besides the internal policy of the company.

As additional information, this private business is responsible for providing the urban sanitary service of four municipalities, in the national context. According to Paolini (January, 13th ,2011), the service performed by this company varies within each municipality, at present being highly efficient in Chacao Municipality, since the number of technical equipment acquired during 2010 is larger, there are more personnel employed (180 employees) and the Municipalities authorities have put pressure on the company due to protests carried out by inhabitants of the municipality for the inefficiency of service in the year since the routes of collections were not entirely covered.

Among the current issues that SATECA faces, there is the incapacity to cover all the routes that are contemplated in the operative plan of the company. This is due to various factors: the access to some of the street is scarce because of periodically asphalt road reparation and poor illumination systems in some sectors. In this order of ideas, another limitation is the

topography of certain areas that limits the capacity of the trucks since when it is almost full the driver is not allowed to go up hill. Finally the current poor quality of the roads lowers the life quality of the compactor trucks. In addition, Ferrer (February 11th, 2011) stated in the interview that they are working on the statistic report of the year 2010, and that SATECA administration in Iribarren Municipality is not currently involved in any sort of recycling initiative, but just the transport of waste to Pavia dumpsite (Ferrer, 11th, 2011).

URBASER

This is a Spanish private company with spread worldwide. It is responsible among other goals, for the urban sanitation services. At the international level, this business has implemented integrated management systems such as ISO-9001, ISO-14001 and ISO 18001, and URBASER also concentrates efforts in the research and innovation field (URBASER official web-page, 2011).

In the case of Iribarren Municipality, Urbaser won the tendering process in 1994 for a period of 10 years (Mendoza, 2009), and it provides the service in the Northern part. With an ampler profile than SATECA, worldwide, it counts with less equipment; 14 compactor trucks, and 6 dump trucks, 5 vans and 4 motorcycles for supervision and technical support (Freitez and Rangel 2008). URBASER performs 5 routes during the morning, afternoon and evening shifts schedule, with a daily collection rate of 70 tons of solid residues. In accordance to Calderón (January 27th, 2011) Urbaser is in close contact with the personnel and administrative staff of IMAUBAR, entity that permanently assesses and supervises the operative plan of Urbaser, in the case of a contingency measure. Amongst the relevant aspects discussed in the interview, Calderon affirmed that the company is constant interaction with the community members by the public talks and presentations organised by IMAUBAR.

Among other aspects of Eraser, Calderon (January 27th, 2011), mentioned that the company has offered to the Municipality to include the service for final disposition waste treatment, since Eraser provides this service in other countries within the LAR (Panamá). Calderón admitted that there is no real interest of the Municipality to change the system, and especially on the subject of extending the lifespan of Pavia landfill, Calderon said, amid the aspect to correct in Pavia is the implementation of a drainage layer within the cells.

In contrast with the information available on URBASER website, during the year 2009, there were a series of irregularities in regards with the health and safety of the company's employees (Arraez, 2009). By that time, 12 of the compactor trucks and 8 of the dump units presented serious mechanical defects, causing severe occupational accidents which one of them resulted in the death of an employee (Arraez 2009). This evidences the disarticulation of the company's principles and goals and the actual service quality that they provide.

4.6.3 Waste collection companies in Iribarren

In the area of Iribarren there is no infrastructure for waste recycling, nevertheless, there is a large group of companies that contribute to the recovery of waste. According to the Environmental Heritage Service (2003),the definition of recovery that has been taken from the OECD-Eurostat Joint Questionnaire on Waste, stipulates that term consists in "any waste management operation that diverts a waste material from the waste stream, and which results in a certain product with a potential economic or ecological benefit", the operations may consist on "recycling, energy recovery, re-use a fuel, biological recovery, composting and re-use" (Environmental Heritage Service, 2003). For the particular case of Iribarren

Municipality, the operation that takes place in the different companies that collect waste is the selection of waste to be re-used (Freitez and Rangel, 2008). In figure 4-1 it is illustrated the numbers of registered companies (which in most of the cases are small businesses) that are dedicated to collect recyclable material. There is no differentiation of the primary source of these businesses, where the material is gathered, nonetheless, these are variable depending on the type of material collected.

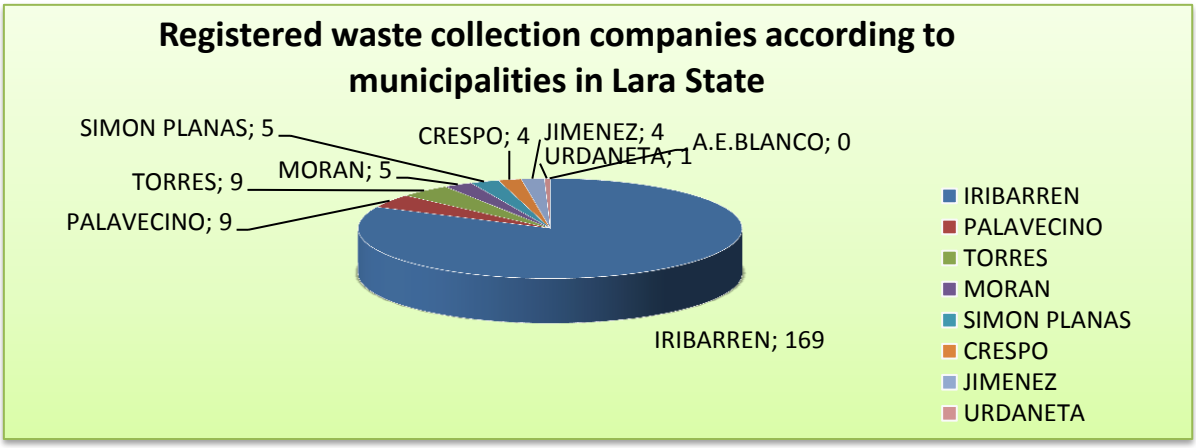

Figure 4-1Registered waste collection companies according to municipalities in Lara State

Source: Urdaneta (2007)

In line with the data provided by IMAUBAR (2009), there are four categories of private small businesses, which are classified as collectors, and they deal with certain type of residues in Iribarren Municipality. The first group collects paper, cardboard and newspaper, the private businesses are: *Recicladora Terepaima, Pavenpe, REPACA, SMURFIT*. The second group of companies *(Metalum, Chino Canonico recycling center)* collects aluminum, bronze, copper, batteries and scrap metal. In addition to this, the glass is collected by *Vidrios Pavia* Company. The plastic is collected by: *Recicladora Plastiven, Madera Plastica VENRECICLA*. Metalum and Recuperadora Jose Amaro were some of the small businesses visited for the purpose of the study, at Metalum, the monthly metal scrap collection average rate is 14 tons, while aluminium is 9 tons, and likewise the copper collection is less than 1 ton per month, their major providers are collectors that work in association with the gancheros, transporting the recyclable material from Pavia landfill (Marchán, February 8th, 2011).

Recuperadora Jose Amaro's primary source of material are the collectors at Pavia, this small business collects glass and plastic, having a rate collection of 0.901 tons per month of glass, in the meantime that the monthly the collection average rate is 1.83 tons of hard plastic recyclable material (López, February 7th 2011). None of the interviewees at these companies showed an especial interest on the topic of the increment of recycling at Iribarren Municipality, one of them stating that she had not heard about any recycling initiative neither from IMAUBAR or the MPPE (Marchán). On the other side, Lopez, affirmed seeing one of the "ecological screens" at the commercial sector center in the city of Barquisimeto, but this individual was unsure about the impact of the augment of recycling for the Metalum private business (López, February 7th 2011).

Some of these companies in Iribarren work independently with no alliance with IMAUBAR, SATECA or URBASER; they collect the residues from different commercial centers, and

shopping malls, likewise from public institutions, and large private companies (Belisario, February 7th, 2011). In addition they also receive and buy for a very low price the material in their facilities from citizens who sort the recyclable material generated at the household. One of these registered businesses that functions in association with MAMPA-Maracay is Repaca-Barquisimeto business, this is one of the places where site visits were carried out. It was founded in 1988, and it collects paper, newspapers and cardboard (Belisario February 7th, 2011). The company counts with 2 trucks to transport the material to MAMPA- Maracay, which is a paper recycling company that owns a series of paper mills, and it is located outside Lara State, Belisario stated in the interview that there is no formal agreement to provide MAMPA, nevertheless, this is a large buyer and it is within the best interest of Repaca to keep close relation with them, especially because the market conditions are favorable to Belisario's company (Belisario February 7th, 2011). Moreover, the price paid for cardboard by Repaca- Barquisimeto is EUR 0.32 per kilo, while the same amount of material is sold to MAMPA-Maracay for EUR 1.29.

Repaca- Barquisimeto monthly collects between 140 to 160 tons of cardboard waste, and the major providers are large commercial establishments such as Macro and Chaliki, that monthly provide Repaca with 3 tons of cardboard. As a final stage of the interview, the discussion was oriented towards the entrepreneur's perception of the augment of recycling in the Municipality, affirming that it may positively influence his business because more manageable material would be available reducing the residual portion generated in Repaca (Belisario February 7th, 2011). As supplementary information, it is important to mention that none of the interviewees had any knowledge of the recently approved legislative instrument (LIMG). As an additional information (IMAUBAR, n.d.), during the period when Augusto Bastidas was the manager of Pavia landfill the average figures of recovered material was calculated in the second semester of 2004. The data in table 4-5 shows the classification, quantities, and total recovered recyclable material at Pavia landfill.

Table 4-5 Average characterization of recycled material at Pavia

Average characterisation of recycled material at Pavia for the 2nd semester of 2004 of collection waste companies tons	
Paper	19.49
Newsprint	5.19
White Glass	2.82
Green Glass	12.64
Brown Glass	0.19
Aluminium	0.63
Copper	0.09
Hard Plastic	93.41
Plastic Blow	210.64
Plastic Linked	207.04
Plasic film	5.61
Gaver	0.08
Batteries	0.02
Scrap	0
Laton	0.94
Bags	0.04
SIOSCA total	558.87
Gancheros in association with Collection companies (cardboard, white glass, plastic)	1 636
TOTAL	**2 194.87**

Source: Bastidas (n.d.)

4.6.4 Informal Sector: The *Gancheros* and *Collectors*

Commonly, in developed countries, there is a differentiation between private small business/medium size companies that recuperate any type of waste, and people who work in the informal sector; individuals that most of the times belong to a deprived social level (Gomez 2008). According to a report from the PAHO (2003), table 4-6 illustrates the classification of the different group of waste scavengers by large, medium, and small population centers (PC) in the national territory. Since there have not been any significant improvement of the waste management at the FDSs, and the municipal solid generation rate has augmented since 2003, it is likely that the number of individuals performing solid waste sorting at the FDSs has increased, that is why a percentage of the different groups of waste scavengers have been provided, nevertheless, there are not more recent figures referring to the individuals in the waste sorting informal sector. Although Iribarren Municipality fits into the category of large population center, according to the literature review the existing number of gancheros at Pavia Landfill is lower than the one established by PAHO.

Table 4-6 Classification of gancheros according to population centers, gender and age in Venezuela

Classification of gancheros groups according to population centers, gender and age in Venezuela (PAHO, 2003)			
Group	Large PC	Medium PC	Small PC
Children	66 Individuals (7.7 %)	35 Individuals (15%)	31 Individuals (29.2 %)
Women	261 Individuals (30.7 %)	40 Individuals (17.2%)	33 Individuals (31.2%)
Men	522 Individuals (61.6 %)	157 Individuals (67.6%)	42 Individuals (36.6 %)
Total	849 individuals	232 individuals	106 individuals

Source: PAHO, 2003

This differentiation among these two sectors is not significantly obvious in the case of Iribarren Municipality, where the collector's small companies sector receives supplies from individuals that recollect residues, not just at Pavia Landfill but also in all the Municipality territory (Gomez, 2008). At the present the number of people working at Pavia in the informal sector is 154 individuals (Urdaneta, February 14th, 2011); they work in direct contact with mixed waste at Pavia landfill, since the recuperation of material at the final disposition sites is manually done. The other group of individuals working in contact on a daily basis with the gancheros and also with the private collection companies are the "collectors" or "buyers", who, essentially are the intermediate channel that deals low prices with the gancheros to transport the recyclable material to the company's facilities (Alvarado, Escobar and Lana, February 10th, 2011). The current number of intermediaries is unknown since some of them work in the company, while other group collects the material and independently transport it further in the national territory and outside Venezuela (Rodriguez, February 3rd, 2011), nevertheless, Mendoza (2009) states that by the year 2009 the number of collectors was 60.

The *gancheros*; called this way since they use a hook (in Spanish, "gancho") to perform their activities. They are exposed a large number of diseases connected to the respiratory system, illness transmitted from water pollution that lead to gastrointestinal contagious diseases, dermatology problems, amongst other. These are the most common diseases: amebiasis, diarrhea, dengue, hemorrhagic dengue, scabies, leprosy, acute tonsillitis, acute pharyngitis, asthma, suspicious rabies bites from dogs, urticarial, conjunctivitis, and superficial mycosis (Freitez and Rangel, 2008).Furthermore, it is important to notice that Pavia also receives medical waste from hospitals when the incinerators of these institutions are not functioning,

(IMAUBAR, 2009). This fact also augments the risks of the individuals to get not just illness associated with incorrect disposition of wastes but a larger number of diseases. IMAUBAR also established a system of license to be able to collect waste a Pavia; one of the requisites is to be over 18 years old, it is obvious that there is a lack of monitoring at the dumpsite since a significant number of children work in groups at Pavia. Such as the case of one of the interviewees that is 25 years old and started working at Pavia when he was 5 years old (Garcia, February 10th 2011).
According to VITALIS (2011, Official website), the average percentage of recovered material in Venezuela varies from 10%-20% from the virgin material, thus, the quality of the product is very low, which limits its marketing. On the other hand, Paolini (2007) shows that the recovered material at the Pavia landfill is significantly higher than the average national rate shown by VITALIS. In appendix VIII it is shown the figures determined by Paolini.

It could be affirmed that the rate of recyclable material collection is significantly high, and that it is evident that there is a market and a complex system existing at Pavia from a long time, nevertheless, Bastidas (2005) in a report of Management at Pavia landfill affirmed that by the year 2005, the total amount of waste entering at Pavia was 700 tons, and that 4.5% was the approximate rate of recyclable material manually collected by the gancheros.

In the following figure (4-2) it is briefly illustrated the dynamics of waste flows in the Municipality, giving emphasis on the recyclable material flow once it is disposed at Pavia, and illustrating the stakeholders in the market and money flows.

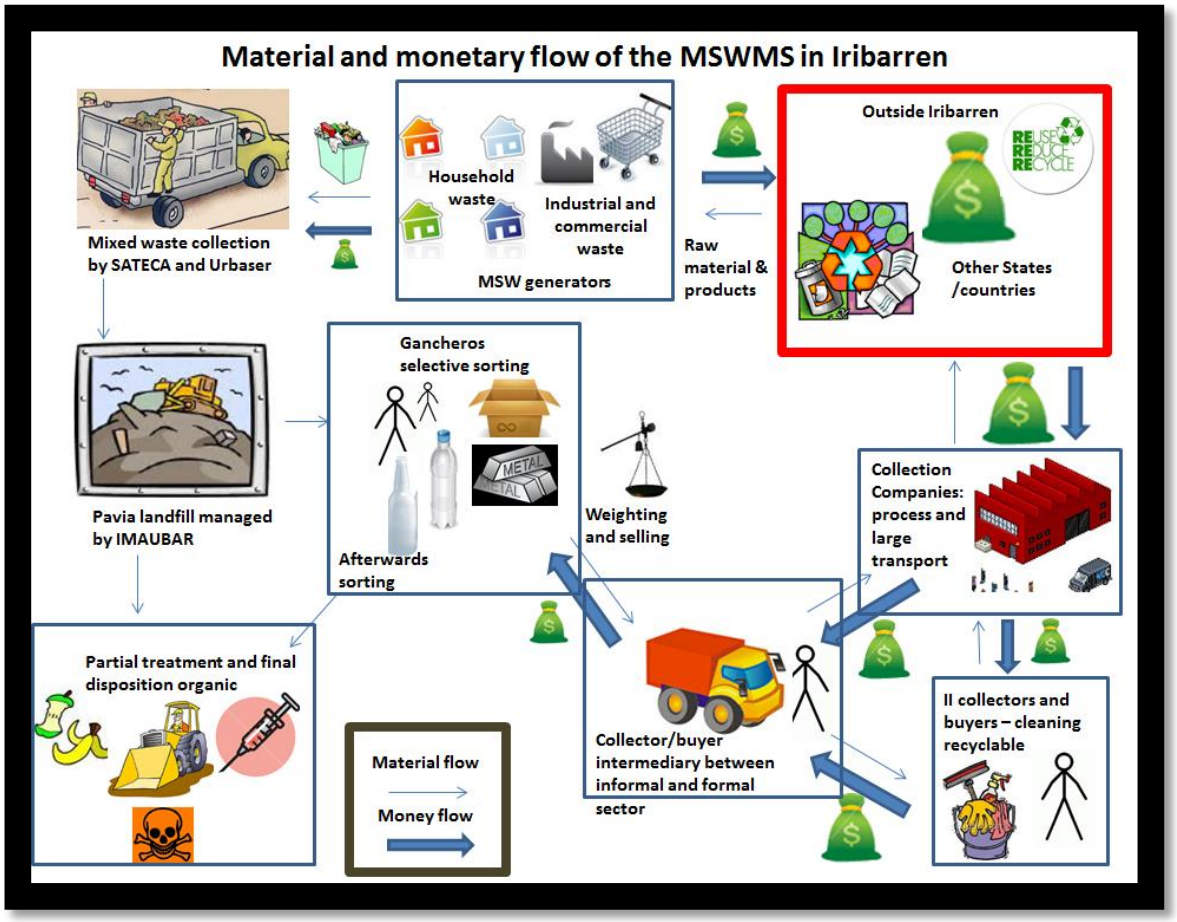

Figure 4-2 Dynamics of MSW flows in Iribarren Municipality

5 Results and Analysis: Stakeholder's viewpoints, SWOT profile of MSWM in Iribarren and planning guidelines for IMAUBAR

As stated in chapter 1, the elaboration of semi-structured questionnaires was carried out taking into consideration the area of expertise, roles and necessities of the stakeholder in the MSWMS in Iribarren. Thus, in accordance with the interviews and application of semi-structure questionnaires, significant concerns, priorities and actions to be taken for the improvement of the MSWMS in Iribarren were detected; section 5.1 shows the information gathered. It was decided to illustrate the information in this manner, due to the formulation of different questionnairs according to the area of knowledge of the individuals that represented the stakeholders.

Section 5.2 clusters the data to create the SWOT profile, based on the information previously presented from the literature review, legal framework, interview and questionnaires' material describing the current situation of Iribarren Municipality concerning MSW and its responsible entity for its management. The subsequent factors were indemnified; internal (strengths and weaknesses) and external factors (threats and opportunities) following the criteria previously explained in chapter 1; organizational aspects, environmental and socioeconomic aspects. Section 5.3 consists on the ranking of strategies to formulate planning guidelines, and finally section 5.4 provides the analysis of the study.

5.1 Results of the interviews: identifying priorities according to stakeholders in Iribarren Municipality

5.1.1 Experts and Academics

In reference to the problems that Pavia landfill presents, there was an emphasis on the lack of institutional capacity of IMAUBAR to control and impose order at the landfill facilities. Concerning the environmental aspects, Paolini affirmed that the infiltration of leachate due to lack of impermeable plastic layer, besides that, the atmospheric contamination caused by the scarce gas control of the landfill, which she stated that a decade ago, a pipe system was implemented to liberate methane gas, but she said it was not a proper system since the gas emissions were still released.

Lameda, referred to the previous management of Pavia landfill during the time when Pavia was coordinated by Augusto Bastidas, sustaining that by 2000-2005 there was an effective identification system for the gancheros, promoting a more organised and relatively safer environmental conditions thanks to the past corrective methods apply in the facility, such as the partial gas control system, and proper disposal of infectious medical waste and the implementation of a weighting system. In regards to the detection of institutional limitations of IMAUBAR, Lameda affirmed the financial crisis as an indicator of the incorrect management, as well as the low tariffs for waste collection service. In this sense, the lack of public awareness and environmental campaigns was also identified; Lameda stated "it is irrelevant the installation of recycling bins if no one tells you how to sort the waste", she also referred to the lack of recycling culture in Iribarren, as a starting point to tackle by the Municipality.

Another expert interviewed was Augusto Bastidas, who was the former coordinator of Pavia. He affirmed that there is a lack of communication amongst IMAUBAR department, making the integrated management a difficult aspect to accomplish. He also made a reference

of soil pollution by metals, which was one of the challenges when he was working at Pavia. Another challenge that was mentioned was the presence of gancheros in the Pavia installations, affirming that they should be removed from Pavia. He also talked about the major challenge which is environmental education in Iribarren, stating that the education should be linked to the social, economic and environmental reality of the Municipality. Another issue brought up was the participation of the private sector to create marketing channels of recyclable material and promote union among this sector and the gancheros. Besides that he is in favor of international cooperation; in the years of working at Pavia, he obtained financial support to invite a Colombian expert on waste small enterprise cooperative, in order to promote education amongst gancheros, but he affirms that this type of organisation fits the most when there is management guidance from institutions involved, propelling small recycling businesses. On the topic of municipal planning, Bastidas believes in initiatives such as the one in Curitiba.

Bastidas was one of the experts that participated in the consensus for the elaboration of LIMG, his opinion about the content of the law is very negative, affirming that the law was created to centralise instead of promoting independence of the Municipalities in their exclusive responsibility of MSWM. The interview finalised by the affirmation that smaller Municipalities have a better chance than Iribarren, and that Pavia should be closed before it reaches its maximum capacity, and that the MPPE and Iribarren Municipality should make efforts to evaluate new locations for the installation of a landfill.

5.1.2 IMAUBAR staff

The interviewees from IMAUBAR staff were 3 individuals, 1 of them (Lopez) works at the IMAUBAR headquarters in Barquisimeto, as the environmental education coordination department, and 2 of them work at the Pavia landfill facilities (Rodriguez and Zambrano). Moving forward the topic of IMAUBAR initiatives, Lopez referred to the environmental education programs such as "environmental certification school program", "Barquisimeto recycles" and the radio show for promoting the recycling culture, which no longer exists. Lopez made emphasis in the lack of monitoring of recent projects, affirming that the number of school currently participating in the certification programs are 7 public institutions in total, but still no report of the results have been elaborated, besides keeping records of the photography records taken at the education facilities. Lopez also mentioned that the current award received by the VITALIS NGO for the program "Barquisimeto Recycles" has been a positive incentive to the IMAUBAR staff.

In the areas for improvement Lopez affirmed that the project "Barquisimeto Recycles" (previously explained in section 4.5.2) did not count with enough media support, and that IMAUBAR failed to promote an educational campaign, which should have been the prior step for this project. Among the obstacles, it was stated that the there is a large debt with private collection companies, because of insufficient waste collection tariffs, thus one of the major challenges is for IMAUBAR to become a more cost efficient para-municipal institution, in regards to the questions about the management of Pavia landfill. Likewise, the employees working at Pavia landfill were asked about quantities and approximated waste recycled, they both were hesitating to give an answer since currently there is no estimation or monitoring of the characterization of the waste that is disposed or extracted at Pavia landfill. Concerning the positive practices implemented at Pavia, it was affirmed that a weighting system has been implemented of the disposed and material extracted, and that organic waste from industries (particular companies that dispose their waste at Pavia) goes to a different cell. On the other hand, the problems described by the IMAUBAR employees were the following: lack of safety in regards to criminal and vandalic groups that surround Pavia areas

due to the lack to fences, constant anarchic behavior of some groups of gancheros, constant explosions caused by the methane gas proliferation which puts in danger a large part of the gancheros. Finally, the interviewees referred to the financial debs which prevent IMAUBAR to invest in more equipment for waste treatment.

5.1.3 Ministry of People's Power for the Environment

In accordance with the information provided by one of the local authorities responsible for coordination of the Environmental Quality Department of MPPE in Lara, Urdaneta affirmed that one the initiatives taken by the local authorities has been the formulation of a document of Reference Terms to create the State Plan for Integrated Waste Management in 2006. Likewise, she stated that the MPPE authorities have carried out inspections of Pavia landfill, but recently (since 2006) there is no documentation from MPPE efforts.

In respect to the positive initiatives by the MPPE, the interviewee affirmed that the Ministry constantly performs organised talks and workshops with a group of collection waste small businesses to control and monitor activities related to the extraction of recyclable material at Pavia, as well as collectors among the urban area of Lara State, nevertheless, Urdaneta states that the guidance given by authorities has not been completely effective for the conformation of small cooperatives dedicated to collect recyclable material. Also, it was stated the current challenge of controlling the gancheros at the FDS, as the major challenge of promoting waste sorting from the household level, problem that could be solved by the implementation of an effective recycling public campaign. On the other hand, she mentioned that the current problematic situation at IMAUBAR is associated with limited operative mechanisms and lack of proper MSW treatment at Pavia landfill. On the subject of the recent legislative instrument creation (LIMG), the MPPE authorities involved in the consensus process mentioned that the role of the MPPE local authorities still remains as a monitoring and control entity, nevertheless, the MPPE in Caracas has the new responsibility to conform the National Council of Integrated Management of Residues and Waste. When this organisation will be created it will have the responsibility for planning the National Plan for Integrated Management of Solid Waste and Residues.

5.1.4 Private Sector

In accordance with representative from the waste collection service companies, the private businesses keep close contact with IMAUBAR authorities, this is due to the coordination, planning and monitoring of collection routes, as well as when special operations in other sectors of the Municipality are needed, where there is difficult access. Besides that, there are no more activities performed in cooperation with the para-municipal institute. The representatives of both companies affirmed that none of the companies that involved in any project related to selective sorting or recyclable campaign in Iribarren Municipality, nevertheless, SATECA representative stated that the company in other municipalities in the national territory is performing activity along with the community. On the other side, Urbaser representative stated that the scope of the company in other countries in the LAR is larger, implementing integrated management at the FDSs. In regards to the limitations of IMAUBAR affecting both waste collection companies, it was mentioned the lack of safety at Pavia landfill by the Urbaser representative; he affirmed to know an employee of the company who was victim of a robbery; individuals inside Pavia took the truck of the company. This is an obvious disincentive to the employees, as well as the demotivation caused by the delays of the paycheck by IMAUBAR, having large debts with both private companies.

On the other hand, representatives from waste collection small businesses were interviewed, but most of the question asked were related to quantity of recyclable collected material and the process of waste before being taken to another federal state or sent to Colombia. One of the interviewees affirmed to have participated in an inventory activity organised by IMAUBAR, before the year 2000, but currently he affirms that the contact is scarce. Nevertheless, a few questions were addressed in reference to aspects to be improved; the interviewees accorded that it would be more beneficial to them if there was a recycling company within Lara State, and even more convenient in the industrial area of Barquisimeto. Another question was asked about their perception of the implementation of recycling as a common practice by the citizens of Iribarren and MAMPA representative affirmed that it would be better for his businesses since there would be more material in good conditions and more manageable, nevertheless, the representative changed their approaches when the topic of the "collection routes" was brought up, having a dubious attitude about the implementation of this system and the social reinsertion of the rancheros.

5.1.5 Informal sector

This sector is publically known for being formed by two groups of workers, as explained in the previous chapter. The interviewees from both groups were also asked mainly about their daily tasks and what they do with the waste and how the get profits. Nonetheless, the questions related to their connection to IMAUBAR were addressed to find out about their daily exposure to dangerous labor conditions. In the first place, these were asked about the identification system implemented by IMAUBAR authorities in previous years, and they described that it was beneficial while it lasted, since there was an order implemented and they did not have to "fight" for recyclable material. They described as the daily problems violence between different gancheros group since some of them work associated and some work independently. They affirmed that implementing safety methods would be positive for the performance of their activities, and one of them said that he would not let children work at Pavia landfill. In regards to the subject of working outside Pavia two of them showed interest while one of them affirmed that he had lived there since he was 5 years old and that he did not know anything else to do. In regards to the responses from the collectors' group in regards to the safety subject, one of them affirmed to be a victim of crime, while another collector affirmed to take an automatic weapon during the night shifts, thus, their perspective about the reinstallation of the police module was positive. Besides the safety topic, the collectors brought the issue of implementing recycling transfer plant, since one of them used to work in La Bonanza (Caracas) and the interviewee commented that it was a safer working environment and he used to collect more recyclable material.

5.1.6 Final observation of the stakeholders' viewpoint

As a starting point of all the interviews for the majority of the stakeholders (excepting the informal sector) these were asked if they knew about a plan for municipal solid waste in Iribarren, which in the case of IMAUBAR, SATECA and Urbaser the staff referred to the existence of an operative plan for SWM, instead of an integrated plan for solid waste. As the closure point of all the interviews, there was a question examining their knowledge of the existence of the LIMG; it was alarming that just 6 individuals out of 19 did not know about the LIMG, including two of the IMAUBAR employees, fact that leads to affirm the urgent necessity of implementing information dissemination regarding the new legal regulation and the implications for Iribarren Municipality. Another issue to tackle according to stakeholders was the lack of environmental education, and recycling culture, thus, public awareness campaigns were suggested by some of the interviewees.

Concerning the priorities identified, the stakeholders' representative as well as experts (besides MPPE authority) agreed with each other about the financial limitations of IMAUBAR, nonetheless, and just a small part of the interviewees mentioned the raise of tariff as a measure to increase profitability. On the other hand, the safety problem was identified by all the stakeholders as a prevailing situation at Pavia landfill, and the common solution was the reincorporation of the local police body, although during the time of incorporation this entity was not completely effective according to Bastidas (February 2nd 2011)

5.2 SWOT matrices: Identification of SWOT elements influencing IMAUBAR

This section presents the internal and external factors of the MSWMS influencing IMAUBAR according to the LIMG, identified in the literature review and the data gathered from stakeholders. In this section, the SWOT profile is illustrated in tables (5-1), (5-2) and (5-3) according to the criteria to cluster the characteristics of the MSWMS in Iribarren influencing IMAUBAR effectiveness.

5.2.1 Institutional aspects SWOT Profile

Table 5-1 Institutional aspects SWOT Profile

Institutional aspects matrix		
	Strengths	**Weaknesses**
Internal characteristics	-Autonomous decentralized Municipal Corporation with power to modify and adequate norms in accordance with the National legislation - Attention of IMAUBAR authorities to updated municipal resolution of tariff system according to residential areas - Institutional presence and participation of MPPE authorities in the decision-making processes at IMAUBAR -Initialization of voluntary selective sorting program by IMAUBAR in the urban areas of Iribarren Municipality. -Implementation of recycling educational campaigns and voluntary programs at primary and secondary schools by IMAUBAR. -It is established in the legislation the promotion of IMAUBAR alliances with other public-private organizations	- Limited knowledge about approval status of the new legislative instrument among IMAUBAR staff, and rest of stakeholders in the MSWMS in Iribarren. -Financial administration of IMAUBAR not runs in a cost-effective manner. Existent debts with the two private companies that perform the waste collection service. - Scarce dissemination of information concerning ongoing projects of IMAUBAR to the community as well as scarce communication amongst the IMAUBAR departments. -Low monitoring of IMAUBAR ongoing programs and scarce institutional transparency. -No integrated vision and incorporation of waste hierarchy in the existing waste management by IMAUBAR. -High reliance of IMAUBAR on the waste collection service companies to improve the collection waste system in the Municipality. -Unsuitable and unrealistic price for the provision of waste collection services and final disposition

		fees at Pavia. - Two private collection companies are not run in a cost efficient manner, with a rate of users' dissatisfaction that varies depending on the residential area. - Law prohibition of extraction of recyclable material at Pavia will diminish IMAUBAR income.
External Factors	**Opportunities** - International budgetary and technical aid from IDB to perform a study of integrated management of MSW model for Iribarren Municipality. - Existence of Municipal plans for the integrated waste management in Municipalities of LAR with similar characteristics as Iribarren. - Technical support by academic institutions, public research institutes, NGOs addressing the financial administration current problems at IMAUBAR. - Inter-institutional assistance from public entities for the consolidation of organizational aspects - Partial recompense for the elimination of extraction tariffs at Pavia landfill by incrementing tariffs of the urban waste collection service.	**Threats** - Increase of the IMAUBAR debt with SATECA and Urbaser due to the current prohibition of recyclable material extraction that eliminated one way of financial income for IMAUBAR - Not sufficient financial resource allocation from Municipal authorities for the implementation of a new FDS when Pavia will reach its maximum capacity. - Potentially erroneous financial allocation for promoting "politicisation" of IMAUBAR projects instead of monitoring and economic support the educational school certification system. - Diversion of financial resources

5.2.2 Environmental aspects SWOT profile

Table 5-2 Environmental aspects SWOT profile

Environmental aspects matrix		
Internal characteristics	**Strengths** - Wide documentation of the environmental problem in urban and Pavia landfill - Partial characterization of waste composition documentation at Pavia landfill useful as a starting point for future data collection.	**Weaknesses** -Low level of compliance to environmental regulation at Pavia landfill. -No enforcement of sanctions for environmental law beaching in Iribarren Municipality .-Pavia Landfill soon to reach its maximum capacity approximately in 3 years -Scarce availability of space within the Iribarren Municipality circumscription for the location of a

		new FDS. -Lack of efforts from the environmental authorities to carry out the evaluation and assessment of potential locations for a new FDS. .- Atmospheric pollution due to high rate of GHG emissions at the Pavia landfill caused by the lack of gas control -Soil pollution by metals and non-biodegradable compounds -Surface water pollution due to the lack of leachate control -Group of grancheros in a constant and high exposure to toxic and hazardous waste. -Low investment in cleaner technology
External Factors	**Opportunities** -Reutilisation of the organic waste portion generated by households - Healthier environmental and sanitary conditions for communities at Northern sector of Iribarren by the implementation of the future transfer station. - Incorporation of material recovery facility parallel to the transfer station. - Technical assessment from the Ministry of environment Lara.	**Threats** - Reaching maximum capacity of Pavia landfill before expected (3-4 years) due to prohibition of recyclable extraction. -Danger of methane gas explosion due to lack of gas control at Pavia facilities. -Aggravation of environmental impacts on soil, water and air at Pavia landfill due to permanence of pollutant substances such as metal that were removed before the prohibition of extraction. - Reproduction of the similar sanitary problems at new transfer station as Pavia presents - Risk of the deterioration of recycling bins from the "Barquisimeto Recycle" project due to lack of maintenance

5.2.3 Socioeconomic aspects SWOT profile

Table 5-3 Socioeconomic aspects SWOT profile

Socioeconomic Organizational aspects matrix		
	Strengths	**Weaknesses**
Internal characteristics	**-** Potential high value of waste disposed at Pavia landfill according to the current waste composition and number of gancheros illegally working at Pavia. - Large number of registered businesses dedicated to collect recycled material Interest of certain collection companies to establish a recycling formal sector. - Advisory talks from MPPE propelling cooperatives dedicated to collect and recycle recyclable waste as well as organic matter (compost elaboration). - Existence of market forces for recyclable material due to the amount of waste collected at Pavia (Metals, Paper, cardboard, glass.	-Lack of governmental optimal allocation of financial resources for sanitation. -Very low tariff fees to extract residues and solid waste at Pavia Landfill. -Penalties imposed by IMAUBAR for violation of the municipal ordinance (1990) are not updated. - Deprived social sectors are unable to receive a proper waste collection service since the characteristics of the equipment use for private companies are not suitable. - Low commitment of employees at the private sector who do not get paid on time, due to the financial debs from IMAUBAR and the own's company cost inneficient management. - Poor investment from the private sector due to the political instability - Lack of market forces for organic waste - Current illegal status of extraction of recyclable material at Pavia directly affects all the stakeholders involved in waste recovery (gancheros, collectors, collection companies)
	Opportunities	**Threats**
External Factors	- Legal employment for the gancheros with the implementation of a collection routes program contemplated in LIMG - Social insertion of gancheros by elimination of sorting at Pavia landfill. - Creation of economic incentives for the active participation of the private sector not yet associated with the MSWS, in recycling programs, and environmental campaigns. - Creation of economic incentives for the general public to reduce the amount of waste generated at the household level	- Disagreements among private sector, small businesses (collection companies), and public authorities (IMAUBAR and MPPE) on measures to comply with the existing LIMG national regulation. -Vandal actions by individuals among the gancheros, interrupting future operations for adequation of Pavia landfill and elimination of sorting waste at the FDS. - Low motivation of Iribarren population to contribute to future waste sorting programs and future projects proposed by IMAUBAR - Resistance of small businesses to comply with the current legislation.

5.3 Elaboration of strategic actions to shape planning guidelines

Based on the principle previously explained in section 1.3.2.1, a list of strategic actions are proposed to shape planning guidelines, these were presented and divided by the 3 different action areas according to the criteria of action areas for the information clustering (institutional aspects, environmental aspects, socioeconomic aspects) and identified with a number in order to place them in the ranking criteria matrix in the subsequent table 5-4.

5.3.1 List of strategic actions in accordance to institutional aspects from the SWOT

SA1) Creation of a chronogram for information dissemination of new legal requirements of LIMG among IMAUBAR staff through the establishment of workshops, talks to initiate the process of legal compliance at the FDS (Pavia) as well as in all the stages of solid waste management. **H**

SA2)The implementation of financial and administrative accountability mechanisms to prevent financial resource diversion, and augment institutional transparency in order to effectively check compliance with the current law, and prohibiting current practices at Pavia landfill. **H**

SA3) The adjustment of the waste collection service tariff system by updating the municipal ordinance, assigning an adequate fee to improve the cost efficiency at IMAUBAR. Tariffs must be associated with waste generation besides residential location, providing incentives for generators to minimise quantity of MSW**. M**

SA4) Development of supervision and monitoring systems by IMAUBAR to report results of recycling and environmental education programs as well as any other future project. **M**

SA5) The development of a program for institutional integration and strengthen internal communication among departments of IMAUBAR. **M**

SA6) The Integration of the current international cooperation project "MSW Model for Iribarren" by IDB the component of technical assistance for improvement of the financial management of IMAUBAR as well as. **L**

SA7) Execution of capacity building activities and motivation talks for employees from SATECA and Urbaser to increment the quality of the waste collection service system, and improve the collection rate. **L**

SA8) Assessment of different plans for Integrated Municipal Solid Waste Management within the LAR to initiate the systematic evaluation of how to incorporate waste hierarchy as a principle in Iribarren also seeking inter. **L**

5.3.2 List of Strategic Actions in accordance to environmental aspects

SA9) Propel Environmental characterization of Pavia landfill and revise legal compliance of the facility according to the technical regulation on as part of the national diagnosis of all the FDSs. **H**

SA10) Inform and make pressure to local environmental authorities (MPPE) about the lifespan of Pavia, to initiate studies of the potential location of new sanitary landfill. **H**

SA11) Formulate and submit report of Pavia environmental and sanitary conditions to Municipal authorities to solicit budgetary aid to invest in environmental remediation technical method such as active gas collection system to lower the risk of methane gas explosion and atmospheric pollution. **H**

SA12) Formulate and submit report of Pavia environmental and sanitary conditions to Municipal authorities to solicit budgetary aid to invest in corrective method for minimization of heavy metal soil pollution; method such as cells for hazardous residues, and take into consideration closure measures. **H**

SA13) Characterization of solid waste at Pavia landfill with assistance of the MPPE of Lara State, academic, research institutions, NGOs, and other agencies within Iribarren. **M**

SA14) Establish an environmental supervision for the future transfer station in order to avoid the duplication of environmental impacts of Pavia in the new facility, adjustment of IMAUBAR transfer station project to incorporate compost facility at the future waste management facility. **L**

SA15) Solicit budgetary assistance to Municipality authorities to invest in the incorporation of a material recovery facility in the transfer station. **L**

5.3.3 List of Strategic Actions in accordance to socioeconomic aspects

SA16) Reincorporate local police to Pavia landfill facilities to regulate illegal activities currently occurring at Pavia**. H**

SA17) Implement effective channel of communication to publically inform the stakeholders involved in the MSWMS in Iribarren about the legal requirements in the LIMG, as well as workshops promoting the participation of these stakeholders to discuss possible solutions for the legal compliance. **H**

SA18) Implement environmental education programs for the community of Iribarren, addressing the environmental impact of the improper waste managent but also the potential economic value of waste generated in the Municipality. **H**

SA19) Creation of a robust plan of household selective sorting system, for waste diversion from Pavia landfill, in line with the collection routes stated in the LIMG. **L**

SA20) Promotion of partnership between private collection companies and *gancheros*, in cooperatives in order to initiate the implementation of the collection routes in Iribarren Municipality. **M**

SA21) Social reinsertion of "gancheros" by capacity building activities regarding new marketing channels for recyclable material, potential commercial value of the organic waste. **M**

SA22) Promote economic incentive mechanisms to involve the existing waste generators such as private industries in Iribarren, to financially contribute to projects related to recycling and energy recovery for MSW. Also the economic incentives should contemplate the general public, to promote the waste reduction and selective sorting at the household level. **L**

5.4 Ranking of strategic actions for the formulation of planning guidelines

In this section the descriptive criteria explained in section 1.3.2 were applied in order to rank the strategic actions (SA) from the SWOT matrix, based on the three attributes previously explained in the same mentioned section. The strategic actions themselves were replaced in the matrix by the number already assigned in the SWOT matrix. Afterwards the data resulting from the ranking process will be utilised to formulate and present the planning guidelines in accordance with the same criteria applied to create the SWOT analysis (institutional aspects, environmental aspects, socioeconomic aspects). The following table (5-4) illustrates the categorisation process.

Table 5-4 Ranking Criteria Matrix

Ranking Criteria matrix									
Maximization of strengths and opportunities and Minimization of threats and weaknesses									
# Strategies ID	**Urgency**			**Impact**			**Relevance**		
	H	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**L**
Institutional Aspects strategic actions									
SA1	X				X		X		
SA2			X		X		X		
SA3		X		X				X	
SA4			X		X			X	
SA5			X		X			X	
SA6			X	X					X
SA7			X		X				X
SA8			X		X				X
Envionmental Aspects strategic actions									
SA9	X			X				X	
SA10	X			X			X		
SA11	X			X			X		
SA12	X			X				X	
SA13		X			X				X
SA14			X	X					X
SA15			X	X					X
Socioeconomic Aspects strategic actions									
SA16			X	X			X		
SA17	X			X				X	
SA18	X			X			X		
SA19			X	X					X
SA20		X		X				X	
SA21		X		X				X	
SA22		X			X		X		

5.4.1 Formulation of planning guidelines

The formulation of planning guidelines resulted of the process of clustering and associating various strategic actions in one planning guideline according to each area of activity (organizational aspects, environmental aspects and socioeconomic aspects) and in accordance with the classification of high, medium or low priority.

5.4.1.1 Institutional Aspects Planning guidelines

High priority

- Establish an effective internal and external communication network among IMAUBAR authorities to inform to the institute staff the legal requirements and the implications of the LIMG affecting the current administration of the Institution, as well as communicate legal status to all the stakeholders involved in the MSWMS of Iribarren.
- Increase institutional transparency by implementing method of monitoring and supervision to assume institutional and administrative responsibilities.

Medium priority:

- Establishment of an effective management of existing projects in Iribarren by: introducing a monitoring system to report results of the current programs, and improve channels of communications to promote participation of the Iribarren community.
- Update tariff system to increment cost effectiveness of the IMAUBAR to solve debts with private collection companies and increment the efficiency of collection rate service.

Low priority:

- Enhance regional cooperation among Municipalities within the LAR and evaluate successful examples of Integrated MSWM in the region to assess feasibility of models from Municipalities with similar characteristics as Iribarren.

5.4.1.2 Environmental Aspects Planning guidelines

High priority:

- Creation of Municipal ordinance by IMAUBAR establishing sanctions for the non-compliance of the national regulation on sanitary measures at FDSs, as a mechanism to minimise soil and atmospheric pollution at Pavia landfill and regulate the future management of FDSs in Iribarren Municipality.

Medium priority:

- Propel inter-institutional efforts to update data regarding characterization of solid waste, at Pavia landfill as well as collect information about the waste generation points for further project and program development in cooperation with of local public and academic organisations.

Low priority:

- Revise and correct plan for the installation of the transfer station at the northern sector of Iribarren, considering the incorporation of a compost and material recovery facility and include the integrated MSWM approach to evade similar situation at Pavia landfill.

5.4.1.3 Socioeconomic Aspects Planning guidelines

High priority:

- Establish a security system by local police at Pavia facilities to regulate illegal activities at the landfill, such as those contemplated in the LIMG.
- Establish environmental campaign programs by IMAUBAR according to the role of stakeholders in the MSWM, covering topics such as the current legal regulation, selective sorting and recycling.

Medium priority:

- Promote partnerships among collection companies and gancheros to work in collaboration as well as the creation of cooperatives for the implementation of the "collection routes".

Low priority:

- Create municipal ordinances that will establish economic incentives such as tax alleviation for private industries to collaborate with programs and projects related to promote selective sorting at the household level, as a step towards the implementation of the waste hierarchy. The economic incentives should also be addressed to the general public to promote active participation in selective sorting, and in the reduction of generated municipal solid waste.

5.5 Analysis and Discussion

This section is meant to excel outcome of the research, and the most relevant aspects influencing the application and operation of the planning guideline as a starting point to improve the MSWMS in Iribarren.

Along the difficult road of creating an environmental conscious approach among citizens of Iribarren; where people are not familiarised not even with waste sorting (Gomez, 2008), there is another type of limitations which is related to the institutional commitment of public entities. This problematic issue is the discontinuation of programs, which is culturally related to the erroneous political tactics applied since the second half of last century in Venezuela (PAHO, 2003). At present, Venezuela is going through a critic process of intense institutional politicisation (see appendix XIII) followed by a significant absence of "check and balance" systems, and this affects the dynamics of institutional efficiency. Iribarren Municipality does not escape from that reality; nevertheless, the Municipal government authorities have committed to direct efforts towards sustainability as *"Iribarren, the environmental Municipality of Venezuela"* as the top project of the Major. This is a favorable factor for the Municipality since IMAUBAR has received the highest budgetary allocation from the present governmental administration (IMAUBAR, 2009). Parting from this fact it could be suggested that the financial support is not equal to strategic management; a proof of that, is the significant debts that the para-municipal entity is not capable of reimbursing to the private collection waste companies, as stated in the responses from the semi-structure questionnaire (See 5.1.6)

Analysis

One of the key elements for achieving goals associated with changing profoundly cultural behavior is the perseverance of institutions with solid propose and mission, accompanied by the state authorities' support (Mendoza, 2009) . This factor constantly affects the outcome of projects, which in the majority of the cases; they are meant to achieve a goal, followed by a subsequent phase that is supposed to lead to a successful final result; which in the reality

context, should be translated in the enhancement of the life quality of the citizens. In this order of ideas, the results of the present study aimed to address planning guidelines regarding three topic areas: institutional aspects (IA), environment environmental aspects (EA), and socioeconomic aspects (SEA), expressed in section 5.4.1.1, 5.4.1.2, and section 5.4.1.3.

The strategies to shape planning guidelines established in this study may be a subject of discussion to whether these contemplate a holistic and integrated approach for MSWMS. Nevertheless, as a finding of the study, it should be considered that in order to transform the current conception of solid waste in Iribarren, there should be corrective actions executed within the existing system that may correspond to conventional methods of solid waste management. Thus, these planning guidelines may be considered as previous steps in order to promote the transition and transformation of MSWMS in Iribarren, since the system at this particular Municipality as well as in the national context is already in a transition phase itself, due to the implementation of the LIMG.

Nonetheless, the national environmental authorities are at the present forming the NCW to create the National Plan for Integrated Solid Waste Management, therefore, it is unlikely that this plan will be ready before the first deadline which in the end of March 2012, because of the preceding experience with the expired law of Solid Waste (2004); in this legal document, it was also stipulated the creation of a National Plan, as well as a State Integrated Plan for Solid Residues, with less specific mandates. Nevertheless, six years have elapsed without achieving the elaboration of the National Plan, and not even one State plan for SWM. Taking this into consideration, the suggested planning guidelines could be viewed as part of the transition of a chaotic model of MSWMS at Iribarren Municipality to solve urgent problems of the IMAUBAR, or make corrections in the operational areas where not just there is a law breaching, but also severe environmental impacts are done.

The suggested planning guidelines (PG) are aimed to address the following issues: enhancement of public awareness regarding the new legal instrument and its implications, increase public perticipation by the improvement of existing projects by IMAUBAR creates effective solutions for the financial problematic imbalance of IMAUBAR as well as economic inefficiency of waste collection system. Secondly, the implementation of a local technical regulation (ordinance) to improve environmental management at Pavia landfill was suggested, along with the propelling of inter-institutional efforts to characterise MSW for further development of projects. In addition to this, in the arena of socioeconomic aspects, the PG suggested with the highest priority were: the establishment of security mechanisms to guard safety of current workers at the Pavia landfill was suggested as well as the establishment of an environmental education program involving all the stakeholders linked with the MSWMS of Iribarren.

Concerning institutional aspects, five planning guidelines were suggested (see 5.4.1.1). In first place, the establishment of an effective internal communication network was categorised as highly important, due to the alarming lack of information of among the IMAUBAR staff; the manager of the FDS was not aware of the existence, and the administrative assistant, who keeps accountability of the quantities of waste extracted was not aware either. The third representative of the IMAUBAR knew about the formulation of the law, nevertheless, the interviewee was doubtful about the content, the rest of the stakeholders from the private companies, collectors and gancheros did not know about the existence of the LIMG, this PG was formulated to establish informative systems for IMAUBAR staff as well as to inform the citizens of Iribarren about the legislation; it resulted from the SA1 created in section 5.3.

The second planning guideline is related to the increment of institutional transparency; it was categorised as highly important, since IMAUBAR presents problems such as diversion of money, the present administration does not comply with the institutional profile of the para-municipal entity, and most important, IMAUBAR is still illegally operating at Pavia landfill allowing extraction of material; practice banned by the legal instrument, furthermore, IMAUBAR is the responsible to properly manage Pavia landfill, therefore its employees should be aware of the current legal mandates; it resulted from the creation of SA2.

As medium priority planning guidelines, it is suggested the establishment of monitoring and report methods for existing and future programs at IMAUBAR, as well as the improvement of external channels of communication to promote participation in Iribarren, it resulted from the joint of SA4, SA5, the three of them categorized as medium priority strategic actions. This planning guideline is not contemplated in the LIMG, as it is directly related to the organizational profile of IMAUBAR, but it was classified as a medium priority for the interviewees, since some of the stakeholder representatives did not considered the monitoring and reporting as an important element for institutional development, but a part of the interviewees detected the lack of report and external communication as a challenge.

Besides this, according to the findings in the literature review, and the collected material regarding the ongoing IMAUBAR projects, there was no information on the results of the programs, and also scarce communication to the public. The second medium priority planning guideline resulted from the creation of SA3, since it was detected in the LIMG the adjustment of tariff for the waste collection service, but in the law it is not stipulated a timeframe to carry out the adjustments, but due to the information gathered in the literature review, and compared to other fee tariff in other Municipalities, as well as the viewpoints of stakeholders that constantly referred to the problems of the very low tariff fees and the debts derived from the financial management of IMAUBAR , this planning guideline was classified as medium priority.

The low priority planning guideline resulted from the union of SA6, SA7, and SA8. Since the inter-institutional and regional cooperation is not stipulated in the LIMG as a mandate and very few stakeholders mentioned the need of international collaboration as a way to improve the system. Nevertheless, the assessment and comparison of the existing MSWMS within the LAR could be an initial step to identify planning tendencies within the region. Also, in the literature review it was detected the presence of international organisation, cooperating and addressing efforts in the arena of waste management, that is why IMAUBAR is suggested to enhance opportunities for technical advisory from international organisation such as the IDB which is currently financing the installation of a transfer plant in the Northern part of Iribarren.

In the subject of suggested planning guidelines concerning environmental aspects, as a high priority it was suggested the creation of a legal mechanism at the municipal level (ordinance) to comply with the national sanitary regulation concerning FDSs; the PG resulted from the union of S9, SA10, SA11, and SA12. This PG also contemplates the mandate in the LIMG which stipulates implementing an inventory of current FDSs and corrective measures for closure or adequation of these. Besides this, it was found significantly relevant documentation on environmental impacts of the current MSWMS on the soils, air and impact in human health. On top of that, the majority of stakeholders were aware of the environmental problems at Pavia landfill, suggesting that authorities should create ways to remediate the current problems.

Secondly, as a medium priority planning resulted from SA13, it was suggested to propel inter-institutional efforts in cooperation with MPPE and other agencies to characterise municipal solid waste at Pavia landfill as well as at the generation points; this is not contemplated in the LIMG, but in order to apply the principle of waste valuation, differentiation of waste collection systems and subsequent waste utilization specified in the LIMG, the waste characterization is a fundamental step, therefore it was considered as a medium priority planning guideline. In accordance with the information found in the literature review, regarding the joint efforts from various institutions in Iribarren, and IMAUBAR authorities such as estimation of waste disposed at Pavia, and projects related to environmental characterization of the location, the PG was classified as having a medium impact to improve the situation at Pavia, since there is a tendency of the institutions to discontinue programs and currently there are no ongoing projects at the FDS. This PG was not relevant to any of the interviewees representing stakeholders.

As the last planning guideline concerning environmental aspects, resulting from SA14 and SA15, the revision and correction of the IMAUBAR plan for the installation of the transfer station at the northern sector of Iribarren, considering the integrated MSWM approach was suggested. The PG was considered to have a high impact for the future management of the transfer station, to revise this document, since currently the plan for the installation of this transfer station does not have another purpose but to increment the waste collection rate at the Northern part of Iribarren, which will represent a loss in valuable resources, and leaving out potential waste utilization. The incorporation of a compost facility for organic waste may be as alternative, as well as the installation of a material recovery center, parallel to the transfer station facility. On the other hand, this PG was categorised as low priority since stakeholders did not identify the issue and also there is no urgency on the legal mandate concerning the implementation of these type of facilities, or technical structure of the transfer plants/station in the LIMG, nonetheless, the transference of waste is considered as an essential phase of solid waste to improve its collection in this legislative instrument.

In reference to the socioeconomic aspects area, the first high priority planning guideline formulated resulted from SA16; it was categorised as highly important since all stakeholders interviewed within the circumscription of Iribarren Municipality referred to the serious safety problems at Pavia. Also in the literature review the lack of safety was found as a major barrier to regulate the illegal activities at Pavia; in the legal context it has a low urgency of implementation since it is not contemplated in the LIMG to augment safety at the FDSs.

The second planning guideline resulted from the union of SA17 and SA18, it encompasses the establishment of an environmental campaign programs by IMAUBAR according to the level of stakeholders involvement and their role in the MSWMS. It was categorized as having a high impact, according to the literature review, since it was detected the lack of knowledge of environmental impacts of improper MSWMS, also it was identified the lack of participation of the community in projects already implemented by IMAUBAR, and also lack of recycling culture among Iribarren community. In accordance to the majority of the interviewees, the PG was highly relevant since there is a lack of public awareness of the problem that represents the existing MSWM model in Iribarren, and there is no participation of the community. In addition, it was also detected that a just 3 of the interviewees knew about the existence of the LIMG, and the majority of the them were not aware of the future implications of the current LIMG concerning the changes that will have to be made in the current MSWMS of Iribarren, that is another reason why within each campaign from the different programs, it should be included the legislative aspects of LIMG.

The medium priority planning guideline resulted from SA20 and SA21; this is the promotion of partnerships among collection companies and the *gancheros*, to work in collaboration and implement the "collection routes" and the creation of cooperative with the same aim, as part of the social reinsertion strategy for the gancheros, contemplated in the LIMG as an strategy and alternative for minimising the social impact of eliminating waste extraction at the FDSs on groups that economically depend on this activity. This strategy would have a high impact if implemented; because it would be a solution for the seclusion that the *gancheros* undergo, and the health risks of gancheros and collections at the Pavia landfill, also it represents the formalisation of the current illegal market, as well as extending the life expand of Pavia. It was classified as a medium priority planning guideline since not all the stakeholders considered it as a solution, and the urgency to implement the "collection routes" is not established in the LIMG.

The low priority planning guideline resulted from the union of SA19 and SA22. This is the creation of economic mechanism for the incorporation of the general public and private sector to collaborate with projects related to selective sorting at the household level as an initial step towards the implementation of the waste hierarchy at Iribarren Municipality. It was classified as a medium priority PG since it is stated in the LIMG the creation of economic incentives for private sector, although there is no time framework established for its compliance. Also, the majority of the interviewees did not consider the involvement of the private sector as a solution, therefore, for it had a low relevance for stakeholders at Iribarren Municipality. Nonetheless, the implementation of this planning guideline was considered to have a high impact, because of the augment of community involvement, also it represents a positive manner to influence the household waste generators, as well as industries at the Iribarren Municipality that are not connected to the collection or recycling sector to collaborate with the improvement of the current MSWMS.

When assessing the new legislative instrument (LIMG), the following aspects were found as influencing factors that may be represent barriers to the implementation of the planning guidelines in Iribarren Municipality.

Influencing factors in the implementation of planning guidelines in accordance to LIMG

- There is a complex network behind the illegal market of municipal waste at the Pavia landfill; small, medium and large size recycling companies currently find the raw material for a very significant lower price, this sector may oppose to comply with the LIMG.
- In the same case, as above mentioned, the *gancheros* and collectors are other groups of people that depend on the market, it is more likely that they show resistance to comply with the LIMG if the mechanism such as "collection routes" are not created before, because then these group will be excluded from the MSWMS of Iribarren.
- Although the LIMG prohibits selective sorting and extraction of recyclables at the FDSs, it is necessary to reinforce the security mechanisms at these locations to assure that there is no ongoing commercial activity. Such as how it is happening now at Pavia, according to personal communications (Lopez and Rodriguez, May 16th 2011) the market of recyclable is still active in regular basis, although the LIMG entered into force two months ago.
- Elimination of extraction means less financial resources for IMAUBAR.

- The LIMG could bring unclear budgetary allocation for the proper management of FDSs, in the previous years the budget was designated by State Governmental Authorities according to the necessity reported by the MPPE local authorities; in the current legislation it is clearly stipulated that the SWM will be carried out in a centralised manner, thus the financial allocation for adequation of FDSs will also be carried out in a centralised manner.

Discussion

As is was stated at the PAHO Report (2003), the institutional scheme of solid waste management in Venezuela presents voids of responsibilities as well as the duplication of efforts and competencies. In the same document by PAHO (2003), it is reported that there is a lack of control, and enforcement of legislative norms. In the same order of ideas, it is stated that the waste management system is not run in a cost efficient manner, as well as there is a lack of investment from the public entities. These results are the similar in the detection of weaknesses implemented in this study; Iribarren Municipality presents the same problems, as detected at the national level by PAHO (2003).

At the local level, a research carried out by Mendoza (2009) was the Diagnosis Phase for the Implementation of an Integrated Management of Solid Waste and Residues for the Iribarren Municipality in Lara State, within the results of this research it was identified the lack of the Municipal Plan, as well as the inadequate planning, administration, imbalance in the financial status, lack of suitable technical operations at the collection and final disposition. In the same other of ideas, Mendoza (2009) also assessed the level of knowledge of employees at IMAUBAR; the results showed low level of institutional capacity at the technical level when activities such as collection, transport and the final disposition of waste is performed. Finally Mendoza detected budgetary deficit of IMAUBAR, affecting the performance of the private waste collection service companies SATECA and Urbaser.

With reference to similar researches concerning MSWMSs and based on the SWOT method, Srivastava et al. (2005) presented the following study: Stakeholder-based SWOT analysis for successful municipal solid waste management in Lucknow, India. These authors evaluated the viewpoints of the Lucknow community and governmental authorities from different public institutions and the creation of two SWOT profiles derived in the formulation of strategies according to both stakeholders, nevertheless, the outcome strategies were not ranked or categorised. The strategies that resulted from the research were centered in the subject of building partnerships with the community members and private sector, decentralisation of municipal solid waste management, amplify the decision-making process and formulate strategies based on local necessities, encourage the creation of microbusinesses for MSWM, augment government responsiveness, and find mutual consensus among stakeholders involved in the MSWM in Lucknow. The present study, presented similarities with the research of Srivastava et al., regarding the integration of the private sector in the MSWMS, as well as the promotion of the community involvement by the creation of small business and cooperatives for waste collection in the Municipality.

6 Conclusions and Recommendations

This study aimed to answer the following research question: What are the internal and external factors affecting the effectiveness of MSWMS of Iribarren Municipality and what actions should the Municipality take to comply with the new legislative framework on integrated management of residues and solid waste?. Likewise, the objective was: to suggest planning guidelines for the improvement of the MSWMS in Iribarren Municipality based on the assessment of the internal and external factors affecting the system, as a starting point to develop a full strategic framework to comply with the new legislative framework. Thus, in this chapter it is discussed the results of the most significant sections of the study that were utilised to respond the research question. In section 6.2 the proposed recommendations are presented to policy makers and individuals looking forward to do further research on the topic.

6.1 Conclusions

Assessment of the current situation of MSWMS

At the national level, the MSWMS in Venezuela is currently in a transition phase, due to the establishment of a new legislative instrument, the Law of Integrated Management of Garbage (LIMG) passed in 2010. In regards to the overview of the existing situation in the LAR, it was detected that the majority of the countries within this region are significantly ahead of Venezuela on the topic of SWM national planning, as it was assessed in section 2.1. The National plans of ten countries were assessed to identify the main tendencies of SWM in the region, and as the most relevant and common aspects amongst the documents were associated with the establishment of financially sustainable efficient waste collection services which comply with the sanitary and environmental regulation, adequation of FDSs, participation of all sectors of society in environmental campaigns related to selective sorting and recycling, and finally the application of the waste hierarchy. Thus, the evaluation of these plans might be an initial step towards the assessment of the current trends in the region, in addition, it is necessary the enhancement of the inter-institutional cooperation amongst Municipalities of the LAR that have implemented successful measures to tackle the waste management problems, to collaborate with the improvement of local initiatives.

In the case of Venezuela, there is an absence of a National Plan for Solid Waste Management, although, the formulation of this document was contemplated in the former Law for Solid Waste and Residues of 2004. Thus, there is an urgent necessity to implement the National Plan for SWM in order to coordinate the planning process amongst Municipalities. In the context the MSWMS assessment at Iribarren Municipality, it is essentially characterized by the generation, transport and final disposition of solid waste; nonetheless, there is a parallel illegal system that starts when the solid waste and residues are disposed at Pavia landfill. IMAUBAR was identified as the responsible para-municipal entity for waste management, presenting deficiencies such as the lack of institutional transparency; administratively and financially there is a high monetary deficit to cover operational costs of the two private companies which, at the moment are struggling to sustain their activities in spite of the financial debs of IMAUBAR. Additionally, in the operative level, the collection of MSW is not yet equal for all the sectors in Iribarren, translated in the accumulation of residues in the urban and suburban areas; these problems are derived partly because of the lack of planning. Along with this, it was noticed the current initiative of IMAUBAR concerning selective sorting and environmental education, nevertheless, it was detected the lack of monitoring and report of the programs' results, as well as the scarce public communication, and awareness raising campaigns.

In regards with the management of the final disposition sites (FDSs) such as Pavia Landfill, it does not entirely comply with the sanitary regulation (national decree 2216), and soil and air pollution are the main environmental impacts due to the lack of leachate and gas control measures. As previously commented, there is an existing illegal market of recyclable material at the FDSs, characterised by the presence of *gancheros* who work at Pavia in precarious sanitation conditions. This market is sustained by different stakeholders such as the *collectors*, who are the intermediaries between the *gancheros* and the collection waste companies in the Municipality, collecting a significant amount of metals and metal scraps (33.26%), paper and cardboard (49.87%) and glass (7.32%) (See table 4-2); meanwhile the collection of plastic is performed in a minor rate (5.27%).

Another relevant aspect detected in reference with the inconsistencies of the Law of Integrated Management of Garbage (LIMG) and current management of Pavia landfill, is the prohibition of extraction of recyclable material; this mandate will have negative environmental implications at Pavia due to the augment of waste accumulated, and also will be translated in a loss of valuable resources, due to the lack of an alternative system such as treatment or transfer station where the waste is sorted. In addition, an inconsistency of the LIMG, deeply linked to the planning process of municipal solid waste management, is the short time period given for the elaboration of the Municipal solid waste management plan, which will have to be created within 6 months after the publication of the National Plan for Integrated Management of Solid Waste and Residues.

Planning Guidelines for IMAUBAR

The suggested planning guidelines for IMAUBAR, aimed to address and correct the existing problems within the MSWMS in Iribarren. Among the relevant planning guidelines, there is the improvement of internal communication mechanisms within the para-municipal entity to inform the employees about the new legal instrument and its implications is one of the planning guidelines suggested, along with the augment of external communications concerning ongoing projects by IMAUBAR. Among another planning guideline; an increment of the tariff fees is proposed as a solution for the financial problematic imbalance of IMAUBAR, as well as to solve the economic inefficiency of waste collection companies. Secondly, the implementation of a local technical regulation (ordinance) to improve environmental management at Pavia landfill was suggested, along with the propelling the inter-institutional efforts to characterise MSW for further development of projects.

In addition to this, in the arena of socioeconomic aspects, the planning guidelines suggested were the establishment of security mechanisms to guard safety of current workers at the Pavia landfill, as well as the establishment of an environmental education program involving all the stakeholders linked with the MSWMS of Iribarren, and the promotion of active participation of the public in a proper waste management, such as selective sorting. Furthermore, another planning guideline suggested was the creation of cooperatives associating the *gancheros* and the collection waste companies, in order to comply with the LIMG mandate which promotes the creation of "collection routes" among the municipalities. As a final planning guideline related to the socioeconomic aspect action was the creation of a municipal ordinance that would contemplate economic incentive mechanisms to promote a more active participation and involvement of the private sector industries in Iribarren, along with economic incentive for the general public to actively participate in the selective sorting of solid waste as an initial phase in the waste generation.

The SWOT analysis in combination with the first criteria developed to group information according to the action area (institutional aspects, environmental aspects, socioeconomic aspects) proved to be effective tools to identify the internal characteristics and external factors of the municipal solid waste management system in Iribarren Municipality influencing IMAUBAR. The creation of a SWOT profile and the ranking criteria facilitated the information clustering, in order to formulate strategic actions derived from the overall SWOT profile (section 5.2). In addition, the second criteria developed (section 1.3.2.2) was proved to be useful to rank the outcome strategic actions for the creation of planning guidelines, which were subsequently categorised and grouped in the action areas above mentioned, in order to answer the research question. The outcome of this study is meant to correct the exiting issues; as the MSWMS is now in a transition phase while the national plan for integrated solid waste management is being elaborated, thus, a more integrated waste management approach is necessary after the national plan sets the future parameters, meanwhile, the application of the outcome planning guidelines in Iribarren is should be implemented to comply with the LIMG.

As a final outcome of this research, and connected to the last topic addressed in the last paragraph, it is important to stress that in order to create appropriate planning guidelines for IMAUBAR that will suit the integrated MSWMS approach, it is necessary to have a planning parameters at the national level that will serve as guidance. Thus, it is relevant to point out the urgency of a national plan with realistic goals and targets not only to deal with the operative and technical challenges ahead, but also to start the effective integration of the society as part of the strategies to minimise health, environmental and social impact that incorrect waste management bring along, and maximise economic benefits that have not been exploited by municipalities' entities. The elaboration and establishment of a national plan is an essential phase to initiate the regional and municipal coordination within Venezuela, since the national plan will be the baseline to start the transformation of the current solid waste management system.

6.2 Recommendations

Policy markers

The creation of a national plan for integrated management of solid waste and residues is an effort that will require the involvement of the national environmental authorities, State and municipal authorities. Since in the previous legislation on solid waste and residues from 2004, it was established the creation of a national plan, but it was never formulated. If the current environmental authorities keep acting as in previous years; with low institutional commitment to improve the waste management sector, the legislative instrument created in 2010 will not have any effect.

On the other side, it is suggested implementation of economic incentives to encourage the private sector to participate in the integrated SWM, and not just at the extraction from Pavia landfill, but also to play a role at the earlier stages of waste generation. Also, it is suggested the creation of economic incentives to companies of any kind, willing to contribute to the improvement of MSWMS in Iribarren by implementing public recycling campaigns, promoting the selective sorting, pilot projects related to energy recovery from waste and residues. Also, the intervention of public authorities is necessary for the implementation of concrete regulation for management of the portion of waste which does not have a strong market (organic waste and residues).

Further research

For the purpose of further research concerning the MSWM in Iribarren, detailed institutional analysis and diagnosis of the synergies among the stakeholders involved in the existing system is suggested. Also, assess the different phases of MSW in order to improve the management within each of the organisation from the technical and operational performance. In addition, the revision and evaluation of these planning guidelines by the IMAUBAR authorities and staff is suggested, to determine which areas need more strategic support (i.e. external communication, public awareness and promotion of their initiatives), as well as the optimisation of the waste management approach seeking to apply the waste hierarchy. The implementation of practical solutions appealing to the informal sector in the arena of solving the social issues at the FDSs are still needed, since this requires the constant work and educational efforts to insert the social group into a proper system where they will be able to safely work and contribute to the MSWMS.

On the other hand, the strategies formulated could be part of an action plan that IMAUBAR and all the stakeholders involved could implement to optimise the MSWMS, nevertheless, the cooperation of all the stakeholders is necessary as well as the participation of the Iribarren community, thus a further research including citizens of Iribarren as another stakeholder could be suggested. As a final aspect to underline there is the importance of developing a diagnosis of the existent market of recyclable material in Iribarren; this information will be essential to implement a more realist and robust municipal plan for integrated solid waste management. The diagnosis will be significantly beneficial at the time to put into practice the "collection routes" mentioned in the LIMG.

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Abbreviations

FDS: Final Disposition Sites

CBRV: Constitution of the Bolivarian Republic of Venezuela

GBRV: Government of the Bolivarian Republic of Venezuela

EASEWASTE: Environmental Assessment of Solid Waste Systems and Technologies

IMAUBAR: Municipal Institute for Urban Sanitation of Barquisimeto

ISWM: Integrated Solid Waste Management

LAR: Latin American Region

LIMG: Law of Integrated Management of Garbage

MSWM: Municipal Solid Waste Management

MSWMS: Municipal Solid Waste Management System

MPPE: Ministry of the People's Power for the Environment

MPPE: Ministry of the People's Power for the Environment

NCW: National Council of Integrated Management of Residues and Waste

NEUSWM: National Executing Unit of Solid Waste Management

NIMBY: "not in my back yard" syndrome

SWM: Solid Waste Management

List of Appendices

Appendix I: Definitions

Municipal solid waste: includes commercial and residential waste generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical waste (Mehra- & Khanna, 2010)

Integrated Management of Municipal solid waste: articulated group of actions addressing regulatory, operative, financial, administrative, education, planning, monitor, and evaluation of the waste management from the generation until final disposition.
Gancheros: common name for waste scavengers, or waste pickers in Lara State, Venezuela.

Recyclable material: already processed or raw material which could be reused and recuperated from a waste stream (Mehra & Khanna, 2010).

Sanitary landfill: location where different type of solid waste and residues (mainly municipal solid waste, commercial and industrial) are disposed with no further use. The facility should count with proper engineering measures which allow its adequate operative functioning in accordance with sanitary and environmental regulation (Paolini, 2007)

SWOT analysis: a method or tool for decision-making and planning which consists in the identification of internal factors (weaknesses, and strengths) and detection of external factors (opportunities and threats) to formulate strategies or actions plan according to the criteria applied (Karppi et al. 2001)

Waste Hierarchy: "The waste hierarchy generally lays down a priority order of what constitutes the best overall environmental option in waste legislation and policy" (Directive 2008/98(EC). Moreover in the Article 4 of Directive 2008/98(EC), it stipulates the succeeding: "The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy: prevention, preparing for re-use, recycling, other recovery e.g. energy recovery, and disposal".

Waste recovery: "Any waste management operation that diverts a waste material from the waste stream and which results in a certain product with a potential economic or ecological benefit. Recovery mainly refers to the following operations: material recovery, (i.e. recycling); energy recovery, (i.e. re-use a fuel); biological recovery, (e.g. composting); re-use. Direct recycling or reuse within industrial plants at the place of generation is excluded". The Environmental Heritage Service, 2003 Taken from *OECD-Eurostat Joint Questionnaire on waste*

Definitions according to the Law of Integrated Management of Garbage (2010)

Clean technology: that technology when applied it minimizes the secondary effects or harmful impacts on ecosystems.

Integrated Management of residues and solid waste: consists on the policies, resources, actions, processes, and operations applied in all the phases of waste management; from the generation to final disposition of all waste.

Leachate: highly pollutant products which result from the degradation of organic matter in the solid waste and residues, and subsequent incorporation of the liquid component to the environment.

Open-air dump: terrain where residues and solid waste are indiscriminately disposed and accumulated without any sanitary treatment and no technical controls are applied.

Recycling: the process where the segregated materials from waste are inserted in the production cycles as raw material.

Sanitary landfill: engineering infrastructure intended to the final disposition of waste that has to comply with the technical norms for its location, design and operation.

Solid residue: remnant material from human activities, that because of its physical, chemical, and biological characteristics it could be used in other processes.

Solid waste: all the material or mixed materials remnant from any activity, process or operation from which no other use is expected and must be eliminated, isolated o disposed in a permanent manner.

Appendix II: List of interviews and personal communications

Interviewees		
Name	**Institution**	**Date (mm/dd/yyyy)**
Academics and Experts		
Augusto Bastidas	Coordinator of Center for Environmental Studies - **Universidad Nacional Experimental del Yaracuy (UNEY)** , former General Director of MPPE Lara State, former Manager of "Pavia" Landfill	(02/02/2011)(07/02/2011)
Adriana Paolini	Coordinator of Community Service Center- **Universidad Centroodicental Lisandro Alvarado** (UCLA)	(01/13/2011)
Maria Lameda	Former Career Coordinator of Environmental Studies Department- **Universidad Nacional Yacambú** (UNY)	(01/07/2011)
Employees and Representatives	**IMAUBAR**	
Marisela López	Coordinator of Environmental Education Department	(01/04/2011) (01/20/2011)
Antonio Zambrano	Current Operative Manager of "Pavia" Landfill	(02/03/2011) (02/10/2011)
Yomar Rodriguez	Administrative Assistant of "Pavia" Landfill	(02/03/2011)
	Ministry of People's Power for the Environment (MPPE) Barquisimeto, Lara State	
Clareth Urdaneta	Coordinator of Environmental Quality MPPE Lara	(02/14/2011)
	National Operative Unit of Solid Waste Management(NEUSWM) Caracas- Associated with MPPE	
Douglas Rodriguez	Assesor of the Environmental Conservation Department - Caracas	(01/19/2011)
Bianca Guedez	Coordinator of Environmental Education Department- Caracas	(01/19/2011)
	Private Sector	
	Urbaser (waste collection service company)	
Luis Calderon	Operative Coordinator of Iribarren Northern Sector	(01/27/2011)

	SATECA (waste collection service company)	
Rossana Ferrer	Manager of Operation's Assistant	(02/11/2011)
	Repaca- Barquisimeto (Paper collection company)	
German Belisario	Owner of the company	(02/07/2011)
	Metalum- Barquisimeto (Metal collection company)	
Ignacio Lopez	Administrative assessor	(02/07/2011)
	Recuperadora Jose Amaro(Plastic collection company)	
Daniela Marchán	Employee	(02/08/2011)
	Informal Sector	
Deiny Escobar	Collector	(02/10/2011)
Gabriel Alvarado	Collector	(02/10/2011)
Luis Lana	Collector	(02/10/2011)
Leonardo Garcia	Ganchero	(02/10/2011)
Hector Torres	Ganchero	(02/10/2011)

Site visits during the initial research to Pavia landfill / Place of conducted semi-structure interviews and information gathering	
"Pavia" partially controlled landfill	(02/03/2011) (02/10/2011)
IMAUBAR, Urbaser, SATECA, Collection Companies, FUDECO, Ministry of Environment Lara, Ministry of Environment Caracas, UCLA University, Yacambú University, UNEY University	During the Month of January and February

Electronic Correspondence

Name	**Organisation**	**Date**
Edwads Castillo	Environmental Consultant and Assessor at the National Executing Unit of Solid Waste Management. Participant on the discussion sessions for the formulation of the Law of Integrated Management of Garbage (2010) <edwardscastillo@gmail.com>	(03/01/2011) (03/07/2011) (03/09/2011) (03/21/2011)
Pankaj Srivastava	Fellow Research at Council of Scientific & Industrial Research, India. pankajk@nbri.res.in	(03/12/2011) (03/21/2011) (04/01/2011)
Geovanna Polo	Specialist of Waste Management and Integrated Management of Solid Waste Master Plan at the Environmental Secretary of Quito, Ecuador <pologeovis@hotmail.com>	(03/23/2011)
Yomar Rodriguez	Administrative Assistant of "Pavia" Landfill yomarrodriguez26@hotmail.com	(05/16/2011)
Maricela López	IMAUBAR Coordinator of Environmental Education Department <eaimaubar@hotmail.com>	(05/16/2011)

Appendix III: Models of semi-structured questionnaires applied to different stakeholders

In the following text there will be found the different questionnaires applied during the research, highlighting the relevant questions for the identification of priorities areas within the MSWMS in Iribarren.

Questions to the experts
1) What has been your experience or link to the MSWMS in Iribarren?
2) Has there been any initiative or programs to improve the existence situation?
3) Is there an operative plan for the MSWM in Iribarren?
4) What are the most relevant problems that Pavia landfill faces?
5) Which are the present barriers and obstacles of the current MSWMS at the present?
6) What are the aspects that need to be improved concerning MSWMS in Iribarren?
7) What are the vulnerable aspects and dangers of the current management system?
8) What are the existent drivers to prompt a better management of solid waste?
9) What are the initial steps to solve the current management problems of solid waste?
10) Are you are you aware of the new legislative instrument for integrated solid waste management?
11) What are the positive and negative aspects of this new law?

Questions to IMAUBAR staff
Institutional aspects
1) Which is the role of IMAUBAR in the management of waste and residues?
2) Is there the existence of an operative plan for integrated management of MSW?
3) Which are the organisations/agencies which work in association with IMAUBAR?
4) Which have been the recent efforts and initiatives of IMAUBAR to improve the MSWMS?
5) Which have been the results of these initiatives?
6) Which are the phases that solid waste goes through after it is disposed at Pavia landfill?
7) What are the aspects to be improved in the administration of IMAUBAR?
8) What are the obstacles preventing process at IMAUBAR?
9) What are the challenges the institution presents?
10) Are you aware of the existence of a new legislation on solid waste management?
Management at Pavia landfill
11) What is the amount of waste disposed at Pavia landfill?
12) What is the classification of the solid waste?
13) How long is the lifespan of Pavia landfill?
14) What are the strengths of the existent management at Pavia landfill?
15) What are the negative aspects influencing the management of Pavia landfill?
16) What measures should be implemented to comply with the legislation?

Questionnaire applied to MPPE staff and participants of MPPE in the elabouration of LIMG

Questions for MPPE employees
1) Which is the responsibility of the MPPE in respect to the management of solid waste?

2) Is there an integrated plan for MSWM for Iribarren?
3) Which are the causes of the environmental at the FDSs (Pavia)?
4) Has the Ministry collabourated with the Iribarren Municipality to improve the management of solid waste?
5) As the entity to responsible for the sanction regarding MSWM, is there any enforcement of the legislation?
6) What have been the initiatives to modify the current system?
7) What are the aspects to be improved at the institutional level in the current system?
8) What could be improved in the technical and operative level?
9) What are the limitations of the current management system?
10) What are the potential solutions to change the existent situation of MSW in Iribarren?
11) Are you aware of the new legislative instrument on solid waste management?
Questions for MPPE employees involved in the elabouration of LIMG
12) What was your role as a participant on the creation of LIMG?
13) what were the weaknesses of the previous Law on Solid waste and residues
14) What are the advances of this new legislative instrument?
15) What are the actions already implemented by the Ministry?
16) Which is the entity responsible to start planning the integrated management of MSW?

Questions for the private sector
1) Since when has the company been operating in Iribarren?
2) What is the role of the company in the MSWMS in Iribarren?
3) What is the approximate amount of solid waste collected by the company in a daily basis?
4) Is there an operative plan for the integrated management of solid waste?
5) What is the connection of the company with the local authorities such as IMAUBAR and MPPE?
6) Has the company participated in any project related to selective sorting of waste/recycling
7) What are the advantages of the company in respect to the management of solid waste?
8) What are the barriers and limitations affecting the management of the company?
9) What are the opportunities for the company to improve its management?
10) Are you aware of the new legislative instrument on solid waste management?
11) Are you aware that the new law prohibits the extraction of recyclable material at Pavia?

Question for the informal sector
1) Since when have you worked in the Pavia landfill facilities?
2) Describe your daily activities at Pavia landfill relation with IMAUBAR
3) What type of waste do you collect?
4) Do you work in association with a collector/private business?
5) Do you use certain protection to work?
6) Have you suffered from any disease while working at Pavia landfill?
7) What is your perception about the management measures taken by IMAUBAR in previous years?
8) Which are the problems you face daily at Pavia landfill?
9) If you had the opportunity, what would you change at Pavia landfill to improve your activity?
10) Would you consider working with waste outside Pavia?
11) Do you know about the new law of solid waste management?
12) Are you aware that the new law prohibits the extraction of recyclable material at Pavia?

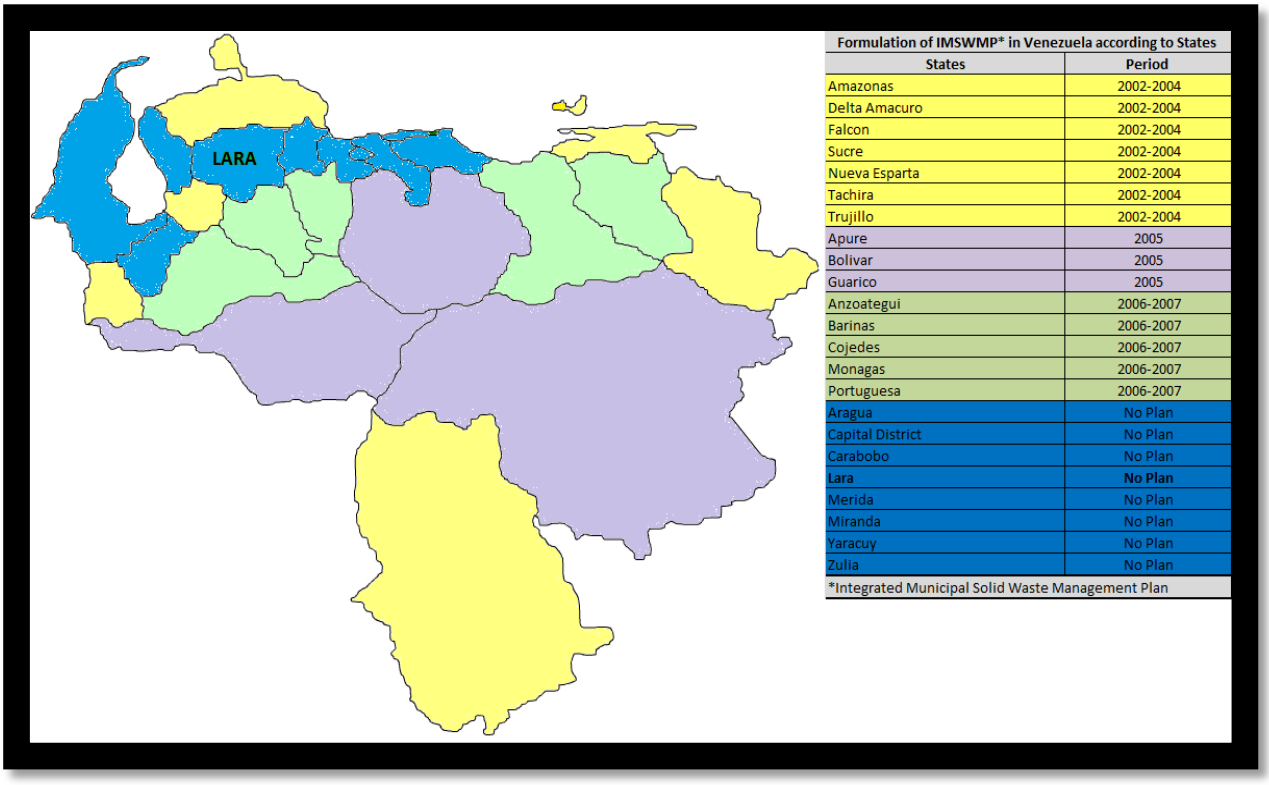
Appendix IV: List of National and Municipal Plans Reviewed

Title of the Document	Institution	Year	Country
National strategy for the integrated management of urban solid waste [*Estrategia nacional para la gestión de residuos sólidos urbanos ENGIRSU*]	Ministry of Health and Environment	2005	Argentina
Integrated Management of Solid Waste [*Gestão Integrada de Resíduos Sólidos]*	Brazilian Institute of Municipal Administration (IBAM)	2007	Brazil
Principal aspects of the national policy of solid waste in Brazil [*Destaques da política nacional de resíduos sólidos]*	Ministry of Environment	2010	Brazil
Policy on Integrated Managament of Solid Waste [*Política de gestión integral de residuos sólidos*]	National Environmental Commission	2005	Chile
Policy guidelines for solid waste management *[Lineamientos de política de resdiuos sólidos]*	Ministry of Environment, and Urban Development	2002	Colombia
Plan of solid waste of Costa Rica [*Plan de residuos sólidos Costa Rica*]	Ministry of Environment associated with GTZ	2008	Costa Rica
National Program for the Integrated Management of Solid Waste [*Programa nacional para el manejo integral de los desechos sólidos]*	Ministry of Environment	2010	El Salvador
National program for the prevention and integrated management of residues 2009-2012 [*Programa nacional para la prevención y gestión integrada de los residuos 2009-2012]*	Secretary of Environment	2009	Mexico
Nacional policy of Integrated Management of Solid Waste [*Política nacional sobre gestión integral de los residuos sólidos]*	Ministry of Environment	2004	Nicaragua
National plan for integrated management of solid waste [*plan nacional de gestión integral de residuos sólidos*]	National Environmental Council	2006	Peru
Strategic plan for the solid waste management in Puerto Rico *[Plan estratégico para el manejo de los residuos sólidos en Puerto Rico]*	Solid Waste Authority	2004	Puerto Rico
Plan for integrated management of urban solid waste of Quito Metropolitan District *[Plan de gestión integral de residuos sólidos urbanos (PGIRS) en el Distrito Metropolitano de Quito]*	Quito Municipal District Environmental Authority, Ministry of Environment	2005	Quito Municipality, Ecuador
Plan for integrated management of solid waste of Santiago de Cali Municipality [*Plan de gestión integral de residuos sólidos (PGIRS) del Minicipio Santiago de Cali]*	Santiago de Cali Municipality, Department of Administrative Planning, Ministry of Environment	2004	Santiago de Cali Municipality, Colombia
Directive plan of solid waste of Montevideo Metropolitan area *[Plan director de residuos sólidos (PDRS) de Montevideo y area Metropolitana]*	Montevideo Municipal District Planning Authority, Ministry of Environment	2005	Montevideo Municipality, Uruguay

Appedix V: Lara State Population

Lara State Population					
Year	1981	1990	2001	2005	2010
Total Population	945 064	1 193 161	1 556 415	1 751 625	1 896 420

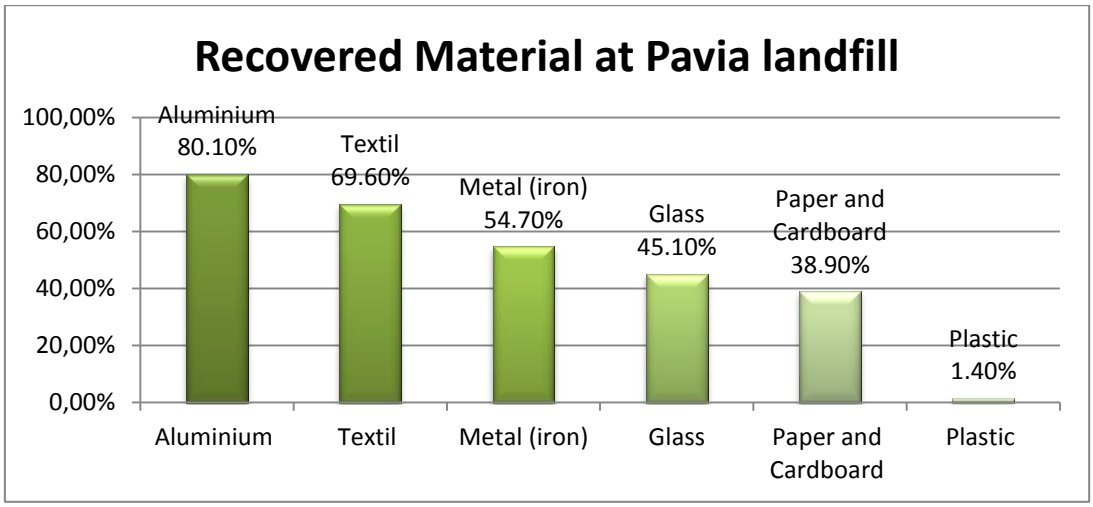
Appendix VI: Formulation of Integrated MSWM Plans in Venezuela According to States



Formulation of IMSWMP* in Venezuela according to States	
States	Period
Amazonas	2002-2004
Delta Amacuro	2002-2004
Falcon	2002-2004
Sucre	2002-2004
Nueva Esparta	2002-2004
Tachira	2002-2004
Trujillo	2002-2004
Apure	2005
Bolivar	2005
Guarico	2005
Anzoategui	2006-2007
Barinas	2006-2007
Cojedes	2006-2007
Monagas	2006-2007
Portuguesa	2006-2007
Aragua	No Plan
Capital District	No Plan
Carabobo	No Plan
Lara	**No Plan**
Merida	No Plan
Miranda	No Plan
Yaracuy	No Plan
Zulia	No Plan
*Integrated Municipal Solid Waste Management Plan	

This data was taken from Castillos (2010), it illustrates the period when the State Plans were formulated.

Appendix VII: Collection of recyclable material by informal sector in Pavia by Paolini (2007)



Appendix VIII: List of hazardous waste disposal tariff fees at the Pavia landfill (Resolution 2977, 2009)

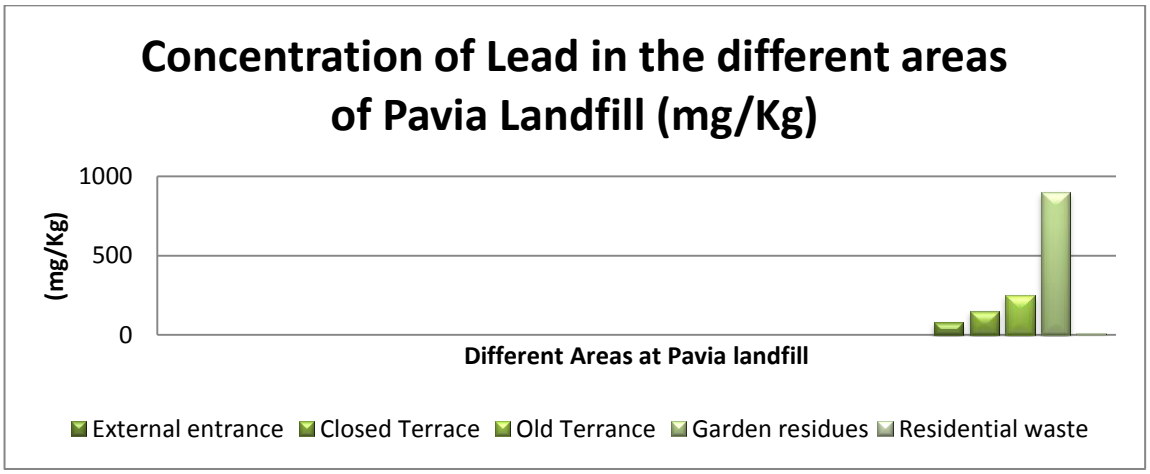
Restricted residues and waste (Hazardous waste)	
Type of waste	**Tariff fee per metric tons equivalent in EUR**
Hazadous and sewage sludge	1.94
Expired medicines	2.4
Incinerator Ashes	2.4
Organic residues (Hospital)	2.4
Medical infectiuos waste	2.4

Appendix IX: Estimation of waste generation in largest Municipalities in Venezuela

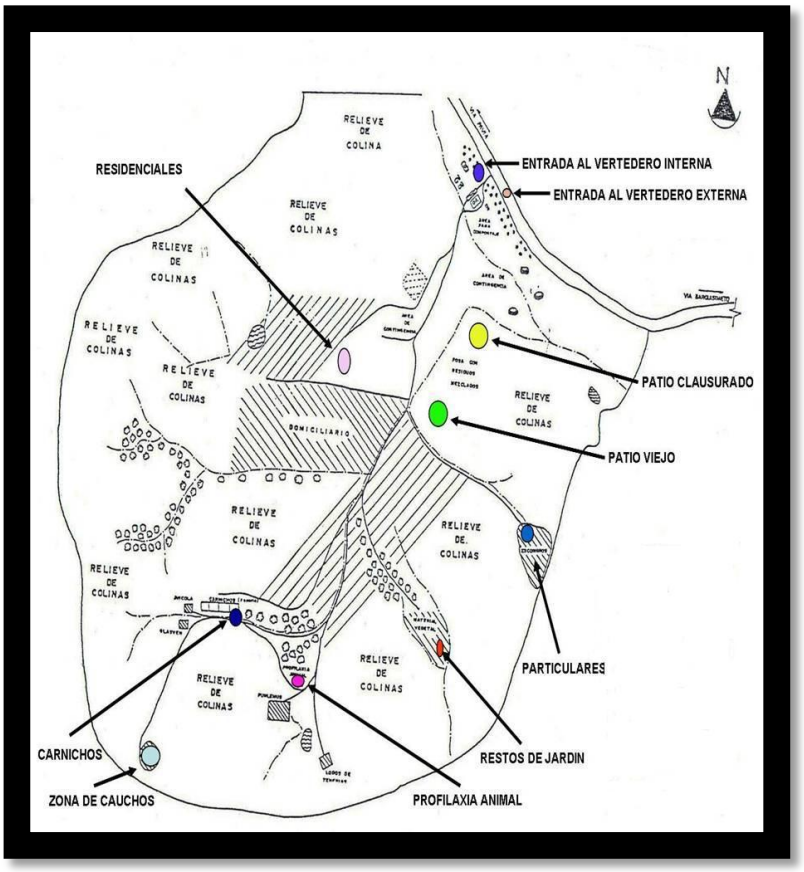
State	Municipality (Capital)	Estimation of Population 2010	Generation per Cápita(kg/inhab-day)*	Production (kg/day)	Production (t/year)
Miranda	Miranda (Miranda)	**3.212.875**	1.20	3 855 450	1 349 407
F.D	Metropolitan Area of Caracas	**1.983.434**	0.30	595 030	208 260
Zulia	Maracaibo (Maracaibo)	**1.701.949**	1.10	1 872 143	639 500
Carabobo	Valencia (Valencia)	**1.084.472**	1.50	1 626 708	569 347
Lara	**Iribarren**	**1 073 934****	**0.80**	**859 147**	**300 701**

Source: NIS 2009, ISER 2010, & PROINLARA 2010***

Appendix X: Concentration of lead in Pavia landfill (Gomez, 2008)



Appendix XI: Pavia Landfill sketch Map by IMAUBAR



Appendix XII: Photographic images

Image 1. Vehicle unit for urban waste collection with political publicity. (Rosell, February, 2011)

Image 2. "Pantallas ecológicas [environmental screens]" at "Parque del Este" Park from the program "Barquisimeto Recycles" recycling point frontside (Rosell, February 2011)

Image 3. Backside of the "Pantallas ecológicas" at City Center of Barquisimeto. Green; paper and cardboard, Red; organic waste, yellow; glass, blue colour; plastic and aluminium.. Right side: lack of monitoring and maintenance of the pantallas ecológicas and inappropriate sorting (Rosell, January, 2011)

Image 5. "Eco-rallies" organised by IMAUBAR promoting recycling at various highschools in Iribarren. Informational brochure of the eco-rally activities at the (IMAUBAR, 2007 and 2009)

Image 6. Environmental certification school program and educational campaign at primary school "El Manzano", Iribarren Municipality (IMAUBAR, 2008).

Image 7. Urbaser and SATECA facilities at Iribarren Munipality and Chacao Municipality (Caracas) (Rosell, January 2011)

Image 8. REPACA facility (paper and cardboard collection). Metalum Barquisimeto facilities (Metal collection). (Rosell, February 2011)

Image 8. Pictures of the Pavia landfill administrative facilities, and entrance of waste collection vehicle unit with mixed waste. (Rosell, February, 2011).

Image 9. Left:Gas emissions at Pavia Landfill (MPPE, 2008), right side: fire induced by the gancheros at Pavia landfill (From: El Informador http://www.elinformador.com.ve/noticias/sucesos/lara/cauchos-ardieron-pavia/31281 retrieved: May 21rst 2011)

Image 10. Existing conditions of a sector of Pavia landfill where individuals live, and child labor is predominant (Urdaneta, 2007)