

Steering Waste Management towards Sustainability in Senegal

The Role of Waste Valorization

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Executive Summary

Background and Relevance

With the current trends in population growth and increasing living standards, the amount of waste generated in the world is consequently in continual augmentation. Considering that the environmental, social and economic consequences of mismanaged waste can be disastrous, the need for sustainable Solid Waste Management (SWM) appears therefore as crucial. The concept and related processes of “Waste Valorization” have a central role in the dichotomy between economy and ecology since it can bring the two spheres closer. It consists in reusing and recycling waste in order to recover some value and enables thus its exchanges on markets. A shift can indeed be made from managing waste to avoid its harmful impacts, to managing it to enjoy its potentials. This alteration in perception and practices is enabled by waste valorization.

The general waste situation is concerning because of the increasing amount of waste that has to be handled. It is particularly alarming in many developing countries. Senegal does not make the exception and present accordingly a relatively mismanagement of a growing amount of generated waste. Disastrous consequences of disorganized and incomplete SWM can therefore be observed across the country. The discrepancy between the actual destructive practices and the numerous possibilities for improvement are factors raising interest. Waste valorization constitutes one of the solutions. Because the sector presents in Senegal only premises of development, starting planning and organizing it appear therefore as crucial. The conducted research finds therefore its relevance in investigating solutions for developing a sector beneficial and constructive for the entire society.

Research design

The research constitutes an attempt to find solutions for achieving sustainable SWM in Senegal. More generally, the requirements and possibilities to extend, in developing countries, a sector that has a sustainable dimension have been explored. Particular attention has been given to the waste valorization sector, its development perspectives and its participation in the sustainable development of Senegal.

Accordingly, the means to develop the sector have firstly been analyzed. In the current situation, the possibilities for development rely to a large extent in a better organization of its stakeholders and therefore, in the establishment of good governance. Therefore researches have been conducted to define good Senegalese valorization governance. Large attention has been given to local specificities for the realism of the hypothetical model expected to be designed, in order to increase its applicability. It is assumed that good governance would direct the sector towards a more advanced stage of development. Secondly, this research intends to explore the participation of an advanced valorization sector on the sustainable aspects of SWM in Senegal. Exploring these influences means identifying the participation of waste valorization on the SWM's improvements and exploring its parallel positive contributions in the economic, social and environmental spheres.

Thereby, the present research aspires to demonstrate that good governance in a strategic SWM stage enables a shift towards a more sustainable SWM, which would benefit the entire society. In order to achieve this goal, descriptive and explorative researches have been conducted. A relatively long-term immersion in the field has been necessary in order to engage in this reflexive process of data collection and analysis.

Summary of results

The situation in Senegal is particularly problematic and worrying due to the quasi-absence of a final goal to waste collection. Waste treatment for elimination is rarely implemented and valorization is only emerging, which leads to the current environmental and social crisis. But crises bring changes (UN-Habitat, 2009), and awareness is accordingly growing on waste related challenges. Valorization develops in the formal sector but presents still an unstructured aspect with isolated initiatives. The necessary organization of the sector requires the definition of good governance. Based on the features of the emerging governance, hypothetical good governance in Senegalese valorization sector has thus been designed. The public sector, the private sector and the civil society are involved and cooperate while adopting an approach based on inclusivity. Because of the extensity of the informal sector in Senegal, its integration is also crucial. The horizontal organization of the actors goes then through a network structure, promoting partnerships in detriment of competition. Thereby, the development perspectives of waste valorization sector in Senegal encompass the combination of a relatively decentralized repartition of valorization centers, with local organizers and a centralized assisting entity. This specific structure would therefore guide the valorization sector towards an advanced stage of development.

Besides, valorization participates in making SWM more sustainable by stimulating its performances, and by enabling the implementation of a waste cycle where waste flows are intelligibly directed. Closing the loop in SWM corresponds to rejecting the notion of waste and considering waste as a valuable resource. Senegal is facing serious problems from an economic, social and environmental point of view and the development of a new sector would be highly beneficial for the society. However, the role of valorization is not complete. It helps indeed in reducing the amount of waste ending in landfill but does not impact on the source of the problem which is the waste generation. Still, valorization's contribution in steering SWM towards sustainability is undeniable.

Conclusion

The purpose of the research has been to prove that governance in a strategic stage of SWM enables to manage waste in a sustainable way. As a conclusion, good governance would help the development of the valorization sector in Senegal. And since this process enables an upgrading of SWM and adopts a new approach on waste, it would steer the entire SWM sector towards sustainability. However reaching sustainability has other requirements that valorization does not enable to reach. Good valorization governance would therefore partly lead to sustainable SWM.

Some elements relying in the political, economic and social spheres participate in creating a deterring environment for the development of a sustainable SWM. Therefore, the changes required are as endogenous as they are exogenous.

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List of Abbreviations

ANSD – *Agence Nationale de la Statistique et de la démographie*

APROSEN - *Agence de la PROpreté au SENégal*

CBO – Community Based Organization

CODEKA – *COmité de DEvelopment de KAolack*

EIG – Economic Interest Group

GDP – Growth Domestic Product

GPF – *Groupement de Promotion Féminine*

HDI – Human Development Index

IAGU – *Institut Africain de Gestion Urbaine*

ISWM – Integrated Solid Waste Management

MDG – Millennium Development Goals

NGO – Non-Governmental Organization

NIMBY – Not In My BackYard

PEHD – *Polyéthylène Haute Densité* (type of plastic)

PNAE – *Plan National d'Action pour l'Environnement*

PNUD – *Programme de Nations Unies pour le développement*

PPP – Public-Private-Partnership

SARL – *Société à Responsabilité Limitée*

SD – Sustainable Development

SNDD – *Stratégie Nationale pour le Développement Durable*

SNU – *Système des Nations Unies au Sénégal*

SWM – Solid Waste Management

SWOT – Strength, Weakness, Opportunity, Threat

TEOM – *Taxe d'Enlèvement des Ordures Ménagères*

UN – United Nations

UNDP – United Nations Development Program

Glossary of terms

Bio-methanation, or pyrolysis, enables the transformation of organic waste into gas in order to create energy.

Civil society stands outside the State, the market and the family, and encompasses households, workers (formal and informal), grassroots organizations and NGOs. The actions driven are associated to common interests.

Community is heterogeneous and complex group of people, yet often considered and treated as a single, clearly identifiable and homogenous group (WELL, 1999).

Community participation is a responsible commitment, individual or collective, which refers to the idea that citizens can be part of cultural and socioeconomic structures and changes of the society. Application of this approach to SWM has shown satisfying results as regards to the efficiency of the system (UNEP [2], 2009).

Composting consists in valorizing organic waste by facilitating its decomposition. Thereby it can change into a new substance called compost.

Efficient running of the waste system is reached when the totality of waste generated is removed away from its generation source, waste is transported without any leakage to adequate places and finally, waste is treated and eliminated in the best environmentally-friendly and working conditions.

E-waste (or Waste Electrical and Electronic Equipment) are electrical or electronic devices discarded¹.

Formal sector is officially recognized by legal authorities. Formal economic activities' income is included within a country's gross national product (UN-Habitat, 2009). Practices such as tax payments, registration, trading license possession and regulations respect are imposed on formal activities in order to cover social welfare or government insurance schemes (Wilson et al., 2006).

Formal waste sector includes activities planned, sponsored, financed, carried out or regulated by the formal local authorities usually through contracts (UN-Habitat, 2009).

Governance is the manner in which power is exercised in the management of a country's economic and social resources for development (World Bank, 1991)¹. Actors taking part in it are from the public sector, the private one or the civil society.

Good governance is characterized by the presence of all stakeholders in the society working in cooperation while adopting an approach based on inclusivity. Therefore the cooperation and coordination are fruitful while the harmful competition is avoided (Dorier-Apprill & Meynet, 2005; UN-Habitat, 2009)

Hazardous waste is a material that poses substantial or potential threats to public health or the environment (UN-Habitat, 2009).

¹http://www.unep.org/PDF/PressReleases/E-Waste_publication_screen_FINALVERSION-sml.pdf
[Accessed on 8 August 2012]

Incineration with energy recovery consists in burning waste while recovering the heat released. Thereby it recovers resources from waste and restores hence value to waste. It is thus considered as waste valorization rather than waste treatment. It requires adequate infrastructures that are mandatory to install according to some countries' legislation.

Informal sector does not have any type of regulation by legitimized institutions and its activities are not accounted in a country's gross national product. It is non-permanence, casualness, carried on in small-scale by little capitalized establishments. It often relies on households or individual labor (Ahmed & Ali, 2004). The reason of the informal sector existence can be found in market forces or other socio-economic factors. Developing countries are characterized by relative poverty, unemployment and underemployment, which explain the predominance of the informal sector.

Informal waste sector is constituted of individuals or enterprises who are not officially recognized or allowed by the formal solid waste authorities, or who operate in violation of or in competition with formal authorities (UN-Habitat, 2009).

Municipal Solid Waste is domestic waste generated by households, and waste of a similar nature generated by commercial, industrialists, institutions and from public spaces (UN-Habitat, 2009).

Non-organic waste is material not derived from plant or animal sources and encounters thereby paper, plastic, metals, fabrics and glass (UN-Habitat, 2009).

Organic waste is material directly derived from plant or animal sources. It can generally be decomposed by micro-organisms (UN-Habitat, 2009).

Partnerships are the collaboration between two or more structures that promotes rather cooperation than substitution, subordination or competition. Thereby it is built upon negotiation between actors. Partnerships can be pro-poor arrangements or business opportunities (APROSEN & IAGU, 2009). Considering the dynamism that characterized partnerships, the concept is hence empirical. It indeed changes and evolves according to how the actors build it – based on their strategies -, experience it and perceive it (Handicap International, 2002).

Private sector is run by private individuals or groups not controlled by the State, usually as a mean of enterprise for profit (Ahmed & Ali, 2004).

Public sector covers public institutions which have specific limitations and rules. It encompasses generally municipalities and government corporations (Ahmed & Ali, 2004).

Recycling consists in extracting, processing and transforming materials contained in waste. It enables thereby their transfer to the industrial value chain through the reintegration into a new cycle of production. Recycling might be considered in some definitions to have occurred only when materials have been sold (UN-Habitat, 2009).

Residual waste is the discarded materials remaining in the waste stream or on the sorting line. They are either not recyclable or compostable, or perceived to have to little or no monetary value (UN-Habitat, 2009).

Resource recovery consists in extracting from waste, materials or energy that can be usable again. Diverse technics enable to recover value to specific waste types. It exist four principal processes for resource recovery: composting, bio-methanation, incineration with energy recovery and recycling (ENDA Tiers-Monde, 1990).

Reuse (Reclamation, Recovery) is the restitution of waste in a better state or with a better use by proceeding to relatively simple modifications and without significant transformations – cleaning i.e. - (APROSEN and WWF, 2009; UN-Habitat, 2009).

Solid waste is composed of solid matter from household, commercial, institutional and industrial sources. It is opposed to liquid waste.

Solid Waste Management (SWM) consists in collection solid waste and transporting it to places where it will be treated.

Sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”² (WCED, 1987).

Sustainable Solid Waste Management is characterized by the reduction of waste generated, the presence of a waste cycle for wastes that can be valorized and an efficient running of the waste system for residual waste (efficient collection, efficient transport and efficient treatment).

Waste cycle implies the diversion of waste for material and resource recovery through reusing and recycling. It enables to achieve a substantial reduction in final waste volume (UNEP, 2009).

Waste market is the platform on which valorized wastes are exchanged. It encompasses sub-markets for each waste type.

Waste treatment consists in eliminating waste while reducing the risk of exposure and the impacts on the environment of toxic or hazardous materials. For that it considers any method, technique, or process that is designed to remove solids and/or pollutants from solid waste streams (World Bank, 2011). It requires disposing waste within engineered landfill - where installations prevent pollutants’ infiltration or waste aerial dispersion –, and disposing waste by incineration - which consists in waste burning - (Hébet, 1996).

Waste valorization describes literally restoring value to rejected products in order to use it or its materials again. Methods for valorization encompass processes of reusing and recycling.

² Definition retrieved from the *Our Common Future*, also known as the Brundtand Report, which has marked the emergence of the concept of sustainable development

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Introduction

The world is currently facing an environmental crisis whose principal explanation relies in the initial sharp antinomy between economy and ecology. Perceived in a first period of time as a fatality, new approaches acknowledge nowadays the possibility of successful combination. Thereby ecology is progressively becoming an economic argument and hence an economic opportunity.

This shift is however a long term process and the economy-ecology dichotomy is still deeply implemented in many societies. Waste has a central place in it since its largest share is the outcome of the current economic system and it impacts directly the environment. UNEP has evaluated growth rate of generated solid waste³ at 8 per cent per year (2009, p.2), and with the current trends in the population growth and the increasing living standards, the tendency is not expected to reverse in the coming decade. These rejected materials, when mismanaged, have disastrous consequences on the environmental spheres but also on the economic and social ones. For these reasons it is crucial to overturn the current situation and adopt a sustainable approach. Accordingly, the needs of the present would be met without compromising the ability of future generations to meet their own needs⁴ (WCED, 1987).

From a technical point of view, managing solid waste consists in collecting and transporting it in order to remove it from its generation place, and treating it for its elimination. SWM is considered as efficient when the totality of waste generated is removed away from its generation source, waste is transported without any leakage to adequate places and finally, waste is treated and eliminated in the best environmentally-friendly and working conditions. Efficient running of the waste system is one component of Sustainable SWM. Besides, the amount of waste produced is expected to reduce and a waste cycle is supposed to be established. This last element implies the diversion of waste through waste valorization for material and resource recovery (UNEP, 2009). It diminishes hence the final waste volume supposed to be eliminated. Waste valorization consists in reusing or recycling so as to restore value to rejected products. It allows hence using the product or materials again. Therefore, waste has a central place in the economy-ecology dichotomy, and it has also a central role. It brings indeed the two spheres closer by generating exchanges and revenues⁵ while limiting environmental degradations.

However, as everybody produces waste the question of who is in charge of its management rises. Besides the State, responsibilities are progressively assigned to the market and the civil society. As a consequence, these new stakeholders gain lately a growing role in improving SWM, and their participation appear in this context as particularly relevant. The presence of a large array of stakeholders is beneficial for SWM, especially when embedded in a context of cooperation. It corresponds to good governance which is a requirement in SWM for reaching sustainability.

The general waste situation is concerning because of the increasing amount of waste that has to be handled. It is particularly worrying in developing countries where waste is often mismanaged. Senegal does not make the exception and present accordingly a relatively failing

³ Solid waste is composed of solid matter from household, commercial, institutional and industrial sources. It is opposed to liquid waste

⁴ Definition retrieved from the report *Our Common Future* - also known as the Brundtland Report - which has marked the emergence of the concept of Sustainable Development (SD).

⁵ UNEP has evaluated that approximately USD 150 billion are nowadays exchanged on formal waste market ([2], 2010, p.11).

management of growing amount of generated waste. Disastrous consequences of malfunctioning and disorganized SWM can therefore be observed across the country. Consequently adequate infrastructures and efficient management are highly needed. Priority in Senegal relies therefore in guiding SWM towards sustainability.

The present thesis aims at finding solutions for achieving sustainable SWM in Senegal. Particular attention is given to waste valorization and its development perspectives, which goes partly through the establishment of good governance. It is then intended to prove how and to what extent valorization would steer Senegalese SWM towards sustainability. Thereby, the present research aspires to demonstrate that good governance in a strategic SWM stage enables a shift towards a more sustainable SWM.

Chapter 1 introduces the research by providing an overview on the research design. The literature review in Chapter 2 and the regional context presentation in Chapter 3 help in getting a more accurate understanding on the research topic by giving a theoretical framework and a clear insight into Senegalese waste situation. In Chapter 4, particular attention is given to the valorization sector by describing its current state and opportunities for development. Local initiatives constitute the current strategy for valorization sector development and are presented in Chapter 5 through the analysis of selected case studies. It enables to understand the emerging local governance in valorization and therefore, explore the development possibilities. Chapter 6 describes hypothetical good governance that would enable the local and national development of the valorization sector. The light is then put in Chapter 7 on the influences of waste valorization on the sustainability of SWM in Senegal. Finally Chapter 8 concludes the present thesis with a general conclusion, encompassing recommendations for Senegalese stakeholders, and a discussion on the research scope.

Keywords: Efficient running of the waste system, Good governance, SWM, Sustainable SWM, Waste Valorization, Waste Cycle.

Chapter 1

Research Design

1.1. Research background and motivation of the topic choice

Solid waste is materials rejected when their owner considers them to be spent, useless, worthless or in excess (UN-Habitat, 2009). With the current trends in population growth and increasing living standards, the amount of waste generated in the world is consequently in continual augmentation. Solid waste generated by households and by the agricultural, industrial and mining sectors are expected to continue its boost from 2 billion tons per year (in 2006), to 2.4 billion in 20 years (UN-Habitat, 2009). Considering that the environmental, social and economic consequences of mismanaged waste can be disastrous, the need for sustainable Solid Waste Management (SWM) appears therefore as crucial. Meanwhile it helps in building the strength of an area by creating an enabling environment for development.

Interest has risen on this topic offering accordingly large literature on SWM. New concepts emerge such as the “3R” one, promoting sustainability through Reduce, Reuse, Recycle of waste. However, the availability of literature on some components of SWM and their applications differs strongly between regions. While concepts and practices in waste valorization are relatively advanced in developed countries, they are nearly nonexistent in developing ones. In African countries, only little attention has been given so far to waste reusing and recycling.

Senegal does not make the exception and receives moreover the degrading reputation of being unsanitary. The waste situation in Senegal is in fact particularly problematic. The related degradations, harmful for the entire society, are visible across the country. There exist yet numerous benefits in managing it well, which are made possible by valorizing waste. The discrepancy between the actual destructive practices and the numerous possibilities for improvement are factors raising interest.

Increasing the understanding on the actual place of waste valorization and its role in the societal progress appear thus as relevant for enlarging general knowledge and when exploring perspectives for developing countries.

1.2. Relevance of the study

From a general view, the present study explores how a sector which has a sustainable dimension can and should be developed. Understanding accurately how to mature and manage sectors that benefit to the society without degrading its environment is nowadays crucial. Then the necessity to apply it in developing countries with worrisome waste situation is high.

Like most of the countries in the world, Senegal is facing a growing amount of generated waste. This is combined with successive failures in managing it. For 20 years⁶, awareness from the Senegalese society on these issues has been growing. It can be observed through international commitments, formulation of national policies and multiplication of actors involved. But despite the growing consciousness on the importance and potentials of sustainable SWM, the different stages still meet numerous failures in all Senegalese municipalities. Disastrous consequences of malfunctioning and disorganized SWM can therefore be observed across the country. Consequently adequate infrastructure and efficient management are highly needed. However, a shift can also be made from managing waste to avoid its harmful impacts, to managing it to enjoy its potentials. Valorizing waste enables it. While its organization in Senegal is nearly nonexistent, it appears hence as crucial to start planning and ordering it. The present study finds therefore its relevance in bringing solutions for building and developing a sector highly beneficial and constructive for the society.

The recommendations that this present research has enabled to formulate focus on sector improvements. It could complete therefore other researches on this topic which aim at influencing public policy, private implications and people behavior upon SWM, and more specifically valorization. It is thereby intended to disseminate the present Master Thesis across the following stakeholders, involved directly or indirectly in waste related issues, in Senegal or international: the civil society; public authorities and academic structures; private or semi-private companies participating or willing to participate in waste valorization. This dissemination contributes to the development of the sector.

1.3. Aim of the research

With its holistic approach, the present research is expected to enlarge the literature and the understanding on SWM in developing countries. It intends especially to improve knowledge on its most underdeveloped component. Thereby, theoretical questions on valorization related are supposed to be resolved and theoretical models expected to be developed.

The case of Senegal has been chosen due to the particularly high need for improved SWM. The present research is an attempt to find solutions for reaching sustainability in Senegalese SWM. The aim is to demonstrate how developing waste valorization would participate to an overall up-grading of SWM and would direct it towards sustainability.

Accordingly, the means to develop the sector are firstly analyzed. It is considered that development possibilities of valorization sector rely to a large extent in a better organization of its stakeholders. The research aims therefore at building a hypothetical model for good governance in waste valorization. The expected actors, actions and partnerships are defined.

⁶ Senegal has participated to the Earth Summit in Rio de Janeiro in 1992 which symbolizes the starting point for environmental awareness.

Secondly, this research intends to explore the participation of valorization in SWM improvements. Exploring these influences means identifying the impacts of waste valorization on the efficiency of SWM and on its sustainable aspects.

Therefore the main purpose of the present research is to prove that governance in a strategic stage of SWM enables to manage waste in sustainable way. The factors needed in the governance of waste valorization sector in order to reach sustainable SWM in Senegal are accordingly identified. The outcome of the research is expected to be an advising guide for SWM development.

1.4. Problem statement

Answering the following question will enable to reach the aim of the research.

To what extent does good governance in waste valorization sector steer SWM in Senegal towards Sustainability?

Sub-questions have been formulated in order to dissociate the main components of this research.

- 1) What is the current state of SWM and more specifically waste valorization in Senegal?
- 2) What type of governance does enable to develop waste valorization sector?
 - a. Who are the actors required for reaching good governance and which relations should they maintain?
 - b. In what structure should the actors be set in to interact efficiently and how does this structure determine the accomplishments of the sector?
- 3) In how far does waste valorization steer SWM towards sustainability?
 - a. To what extent does waste valorization stimulate positively SWM and enable to reach sustainability?
 - b. How does governance in valorization influence SWM?

1.5. Methodology

In order to achieve the research aims and respond to the research questions, descriptive and explorative researches have been conducted. A relatively long-term immersion in the field was necessary in order to engage in this reflexive process of data collection and analysis. The time dimension to accomplish it has encompassed two periods: in a first period of time, secondary

researches have been realized by exploring existing literature; and secondly, primary researches have been conducted by the means of qualitative methods.

Literature on waste management related theories and researches have been reviewed. International organizations and international academics have constituted a large part of the sources used. A second review has been conducted more specifically on the local available literature. Particular importance has been given to locally produced researches, for scientific, ethical and moral reasons. It is acknowledged that local literature constitutes a basic step for understanding accurately the research context and enables therefore to uncover a more genuine form of local knowledge than the one provided by international literature (Desai & Potter, 2006). Using findings of local researchers whose access to dissemination channels is limited has also been motivated by a moral responsibility. Local literature has been accessed in the libraries of Dakar's university (UCAD), Senegalese public agencies (APROSEN), Senegalese NGOs and international NGOs implemented in Senegal (ENDA, IAGU, i.e.). Knowing the official academic language (French) has enabled to get into local literature. However, empirical knowledge on waste valorization in Senegal is lacking considering the embryonic stage of the sector. Increasing the understanding has been possible by conducting primary researches on the field.

Field researches have consisted in investigating SWM in Senegal, with a closer look at waste valorization. One part of the research is based on the analyses of two valorization centers as case studies. The investigation has been essentially based on qualitative methods. The choice for this type of methods has been guided by the holistic approach of the research, aiming accordingly at understanding complex realities and process (Desai & Potter, 2006). Furthermore it has been acknowledged that gathering the necessary information was only possible with this type of methods. Because of the limited development of valorization, sample was not large enough to apply quantitative methods for data collection. Although the qualitative data collected lack of precision, it has enabled in this research to capture different local perceptions and uncover process and causality. This has thereby helped for opposing the expected subjectivity of qualitative methods.

A combination of methods, presented below, has been the main channel for information-gathering during this research phase. These methods have also been applied when analyzing the case studies.

Observations have been made during the entire period of the field research and partly reported by the means of illustrative pictures. It has been integrated in the final Master Thesis in order to get insights into the local context and to show the realities of the area investigated. This tool enables to get information without risk of bias (Patton, 2002). Direct field observations were made while experiencing waste public and private spaces, following formal and informal waste workers in their activities and visiting formal valorization centers and informal valorization structures.

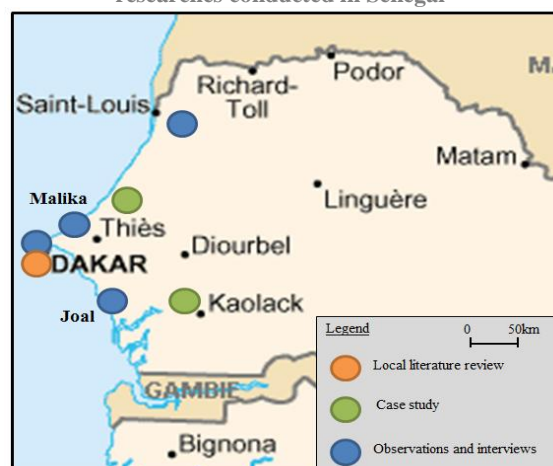
Local knowledge has then been accessed by open interviews with inhabitants and waste workers, and by organized interviews with key informants. A purposive sample for the interview has been defined for the relevance and reliability of the information. Persons who seemed to possess the particular knowledge sought or who had a professional position

interesting for the scope of the research were acknowledged as key informants and later interviewed. The “snowballing” technique has also been used to recruit interviewees (Desai & Potter, 2006, p.148), and has enabled to get into the network of workers directly or indirectly related to waste management. Accordingly representatives of NGOs, grassroots organizations, public authorities and valorization centers have been interviewed⁷. One part of the interviews was essentially conducted upon the actors in the two selected valorization centers. The multiplicity and diversity of the informants selected has enabled to cross check information and highlight similarities or differences in perspectives. Moreover the semi-structure nature of the interviews has enabled to gather precise information which could thus be comparable⁸. This type of interview has also been chosen because it enables to cover the main areas while providing the interviewees with opportunities to bring up their own ideas and thoughts, and helps thus in increasing the understanding. Furthermore, knowing the language has facilitated the use of open questions by avoiding the need for translator. The interviews took always place at the interviewees’ work-places so they could feel more at ease.

Finally the evaluative part of the research is based on both existing data and data collected from field researches. From this interpretivist perception a significant insight into the situation is expected to be provided. More specifically, the analyses on the two case studies have consisted in detailed comprehension and comparison of their patterns. Finally recommendations have been formulated, giving to the present thesis an advisory approach. Because of the limits presented in the following part, the representativeness of the empirical findings might be questioned. They should therefore be considered as hypotheses that need to be confirmed by their applications and further researches.

The following map presents the localization of the field researches conducted in Senegal.

Figure 1 : Localization for primary and secondary researches conducted in Senegal



(Based on a map retrieved from:
<http://www.senegal->

⁷ An exhaustive list of interviews conducted, including interviewees’ information, is available in Annex 1.

⁸ Sample of interviews upon the actors involved in valorization in Kaolack and Thiès are available in Annex 2.

1.6. Limits of the research

Difficulties met on the field have impeded data collection and has therefore constituted restrictions for the research. As a consequence the present thesis presents also some limitations.

Accessing the data has been sometimes problematic. Due to the limited amount of time for the field research, the scope of the primary research had to be strictly framed. Valorization centers are spatially dispersed and therefore hardly reachable. It appeared more feasible to limit the spatial scope by picking only two case studies. Yet, the representativeness of the chosen case studies appeared as sufficient for the investigation considering that the selected ones are the only two advanced centers in Senegal. Although reaching the targeted groups was in general relatively easy considering the helpful nature of most of the locals met, it has still presented some difficulties. When dealing with the informal part, contacts were more difficult to get and language barrier appeared. Although French is spread in Senegal, people who have not received education can barely talk it. Translation assistance was hence needed when explanations were given in Wolof.

On the other hand, the underlying competitiveness in waste market made some actors skeptical about the present research and its aim. It has been thus sometimes necessary to build trust over a period of time. First visit for presentation and explanation on the research's objectives have been helpful in such situation. Once they were convinced of the research's academic motivations, interviews could be conducted. However, some felt still obliged to filter their information and thus stood on purpose relatively vague on specific aspects of their activities or projects. Competitiveness might hinder total honesty.

Other limitations came from the intrinsic characteristics of the chosen methods. Qualitative methods are often criticized for the relative subjectivity of the collected data and the risk of biased analysis (Desai & Potter, 2006). The information gathered upon interviews does present subjectivity. However, conducting several interviews has enabled on one hand to cross check information. On the other hand, some part of the analysis were based on stakeholders' perceptions and therefore expected to be subjective. Also, using local literature has the disadvantages of being not accessible for other readers.

Finally, generalization of local scale findings at a national one might be questionable. For that, further researches enlarging the spatial scope of analyses would therefore be needed.

1.7. Outline of the research

Progression in the research to reach the research' aim is presented through the following chapters. After contextualizing the research, development perspectives are explored, build on existing strengths and directed towards sustainability.

The theoretical framework is presented in **Chapter 2**. Literature review on SWM and Sustainable SWM has been conducted in order to present theories and experiences in managing solid waste. It highlights the correspondent mechanisms, related issues and main challenges.

Reviewing literature enables thus to get a more accurate understanding on the research topic and provides a framework through which regional context can be better understood.

The regional context of the research is presented in **Chapter 3**. A clear insight into the Senegalese situation as regards to its waste is provided. It enables the comprehension on the driving forces behind the current waste state, the related socio-economic and environmental consequences and the country's main waste related challenges.

In **Chapter 4**, particular attention is given to the emerging sector of SWM: the valorization sector. This chapter reveals that despite constraints, waste valorization encompasses large potential for development.

Because of the urgent need to develop it and the related growing awareness, strategies currently develop. Understanding these emerging strategies and their applications is a prerequisite for exploring the possibilities for development.

Local initiatives constitute the current strategy for valorization sector development and are presented in **Chapter 5**. Two waste valorization centers recently created are analyzed as case studies for the investigation. The analyses are conducted on the organization of the valorization systems they are embedded in. It enables to understand their achievements, constraints and development strategies. Analyzing these centers contributes in increasing the understanding on emerging formal local governance in waste valorization.

Hypothetical governance that would enable valorization sector development in Senegal is described in **Chapter 6**. Based on the findings in Chapter five, the proposed local governance is firstly described. It is made through the identification of expected stakeholders, their actions and relations, and enables to explore the development perspectives of local centers. In a second part, scenario for the structure of the governance at the national level and its implications are described. The chapter aims at demonstrating that development perspectives for valorization sector rely in this hypothetical model of governance.

Chapter 7 finishes the investigation by putting the light on the influences of waste valorization on the sustainability of SWM. This chapter explains in details the role of valorization in the progressive shift of Senegalese SWM towards a sustainable management. Although the sector is at an embryonic stage in Senegal, positive stimulations are already observable in some aspects. And since governance in valorization influences the role of valorization, this chapter integrates also in the investigation the participation of governance in the shift towards sustainability.

Finally **Chapter 8** concludes the present thesis with general conclusion and discussion. Recommendations are made upon stakeholders for developing valorization and guiding SWM towards sustainability. The research constitutes on one hand an advisory report for Senegalese waste actors. On the other hand, the comparison of the empirical findings with the theoretical ones (presented in Chapter two) enables to highlight the convergences and divergences between theories and international experiences, and Senegalese situations. Thereby the development possibilities of valorization in developing countries are evaluated.

Chapter 2

Theoretical Background on Solid Waste Management and Sustainable Solid Waste Management

The literature review for the theoretical background has been conducted on existing global knowledge and is based thereby on reports written by international organizations (UN-Habitat, United Nations, UNEP), international NGOs (ENDA, Handicap International) and national NGOs and associations (IAGU, VIE, i.e.). Waste related problems are indeed universal and investigated already for decades. The current environmental crisis combined with the presence of a large informal sector in waste management – and especially valorization - catches nowadays more and more the attention of scientists, Medias and politics.

The following parts expose the existing knowledge on SWM in developed and developing countries. Managing waste is accomplished by using adequate technics and equipment, involving many different actors and implementing suitable organization (UN-Habitat, 2009). The first part of this chapter presents thereby the technical aspects of SWM through its main components and mechanisms. Secondly the different types of management are explored by presenting the shift from government to governance happening in the majority of the current societies. Thanks to the two presentations, the causes and implications of failing and successful management can be better understood. This is presented in the third part as well as the main challenges for future management. Perspectives towards sustainable management have been investigated by reviewing literature on Sustainable SWM, Sustainable Urban Development and Sustainable Development. It has helped to define precisely what sustainable SWM is and where further researches are nowadays needed. Defining precisely how it can be implemented in all societies represents the new challenge for academics.

2.1. Technical aspects

It exist several types of waste and each of them requires specific equipment and technics for its management. Box 1 provides the definitions of the three waste types. Waste management is therefore supposed to be differentiated according to the waste type.

Box 1 - Definitions of waste types

(Adapted by UN-Habitat for their glossary; UN-Habitat, 2009).

Municipal Solid Waste is domestic waste generated by households, and waste of a similar nature generated by commercial, industrialists, institutions and from public spaces.

Hazardous waste is a material that poses substantial or potential threats to public health or the environment.

Residual waste is the discarded materials remaining in the waste stream or on the sorting line. They are either not recyclable or compostable, or perceived to have little or no monetary value.

Organic waste is material directly derived from plant or animal sources. It can generally be decomposed by micro-organisms.

Non-organic waste is material not derived from plant or animal sources and encounter thereby paper, plastic, metals, fabrics and glass.

Complete consideration and management of solid waste takes place through 3 stages: collection, transport and treatment. The two first stages are often assimilated to one while the last one is composed of several methods.

2.1.1. Solid Waste collection and transport

2.1.1.1. Definition

Waste collection consists in removing waste from residential and commercial areas. According to the countries and associated practices waste is collected from containers or not and by formal or informal workers. It is then transported by the means of carts, trucks or packer trucks – waste compressor -. Waste is displaced from collecting points to transfer points, transfer stations and/or final disposal places (World Bank, 2011)⁹. Transfer point is designated places where small vehicles collecting waste dispose it in containers so waste can be transferred to larger vehicles. Transfer station can be either facility when the distance between collecting places and disposal ones is large, or it is adapted to serve as material recovery facility.

Often waste collection and transport are not differentiated. It is in fact assumed that collection is always followed by transport, or that the action of collecting is already a transport.

2.1.1.2. Practices

UN-Habitat (2009, p.16) claims that waste collection rates for cities in low- and middle- income countries between 10 and 90 per cent. A large portion of the population receives still nowadays no services at all. Consequences for human health and the environment are disastrous (further developed in part 2.3.1.2). The following Figure 2 reveals the gap existing between countries as regards to the access to waste collection service. While 97.2 per cent of Colombian had access to waste collection service in 2005, it concerned only 27.3 per cent of the inhabitants of Benin in 2001 (UN-Habitat, 2009, p.16).

Figure 2 : Waste collection rates in urban areas (in %) in selected African and Latin American countries

Region/ Country	Year	Average	Minimum	Maximum
Africa				
Benin	2001	27.3	12.4	47.4
Egypt	2005	86.6	40.8	96.4
Ethiopia	2005	39.0	19.6	69.6
Ghana	2003	39.6	30.1	64.4
Kenya	2003	28.5	5.6	57.7
Senegal	1997	62.6	34.3	85.9
Latin America				
Bolivia	2004	79.9	67.9	84.8
Colombia	2005	97.2	89.0	100.0
Dominica	2002	83.6	78.2	85.8
Guatemala	1998	56.2	42.9	89.5
Nicaragua	2001	64.7	56.1	80.8
Peru	1991	70.8	59.1	85.6

Source: UN-Habitat, 2009

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<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTURBANDEVELOPMENT/EXTUSWM/0,,contentMDK:20241717~menuPK:4153320~pagePK:210058~piPK:210062~theSitePK:463841,00.html>
[Accessed on 17th May, 2012]

2.1.1.3. Difficulties

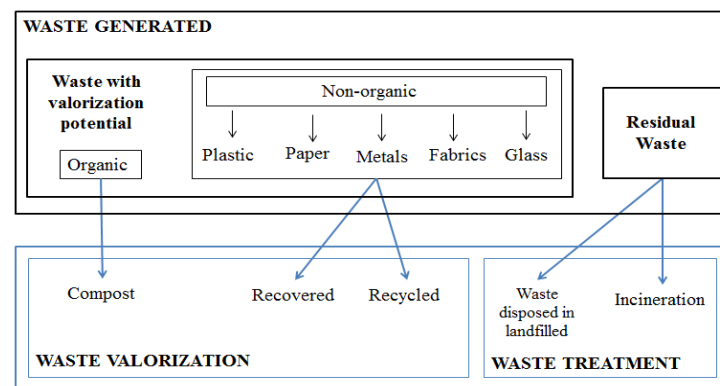
High financial costs represent the main difficulties in waste collection for people in charge of. The necessary equipment requires large investments whose profitability is indirect and on long-term. Many cities in developing words rely on foreign donors for collection vehicles (UN-Habitat, 2009). However these donations must be appropriate to the local waste and local conditions (small vehicles in narrow streets, avoiding packer trucks in sanded area, i.e.). In several experiences of north-south cooperation, inadequate equipment was provided to low-income countries. In Thiès (Senegal) for instance, trucks offered by Caen (France) were rapidly out of orders because inadequate to a highly sanded environment (LVIA, 2006). A second major difficulty relies in expanding the service coverage in hardly accessible neighborhoods and outside the city (LVIA, 2006). Expanding the service represent high costs which explains the possible reluctance of certain actors. Spatial inequalities in collection service coverage worsen however social inequalities.

2.1.2. Solid waste treatment and valorization

2.1.2.1. Definitions

There is no agreement around one single definition on waste treatment and valorization, and several sources have thus enabled to provide the general definitions and categorizations presented below. Firstly there exists confusion in distinguishing waste treatment and valorization because some authors consider as a treatment process (Diallo, 2007). In fact, some valorization methods do consist in treatment and distinction should therefore be done rather on the purpose of each process than its technics. Valorization uses waste, as opposed to treatment which aims at eliminating it. It has been thereby decided for this research to keep a clear distinction between the two processes. Furthermore, confusion exists also whether considering valorization as a stage within SWM or at a type of management of waste in itself. Considering that valorization methods can only be applied after collection, the first approach has been adopted in this research. Principal definitions on waste treatment and valorization, and the technics applied are presented in Figure 4 and provided in Box 2.

Figure 3: Practices of waste treatment and valorization according to the waste type



Box 2 - Definitions of waste treatment and valorization, and its components

Waste treatment consists in eliminating waste while reducing the risk of exposure and the impacts on the environment of toxic or hazardous materials. For that it considers any method, technique, or process that is designed to remove solids and/or pollutants from solid waste streams (World Bank, 2011). It requires disposing waste within engineered landfill - where installations prevent pollutants' infiltration or waste aerial dispersion –, and disposing waste by incineration - which consists in waste burning - (Hébert, 1996).

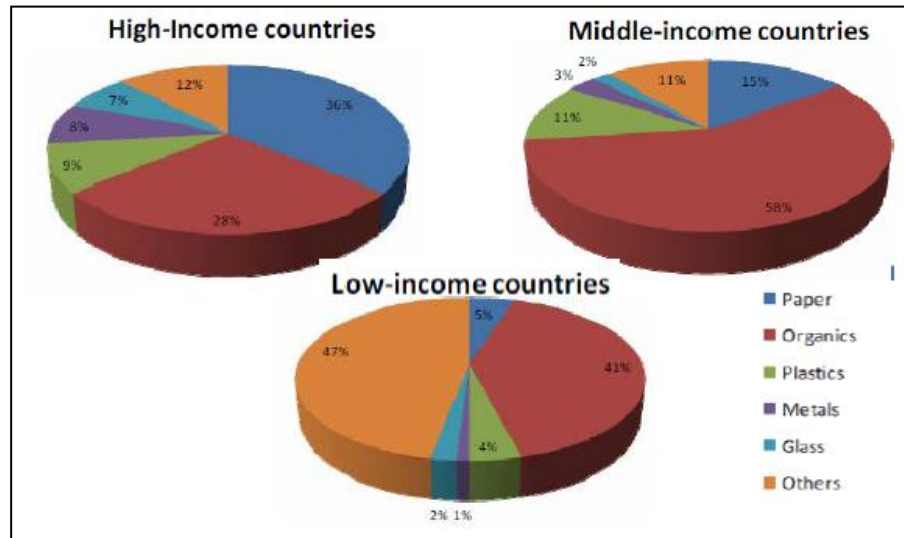
The process of **waste valorization** describes literally restoring value to rejected products in order to use it or its materials again. Methods for valorization are diverse and processed by recovers, recyclers or transformers. The methods for waste valorization are defined below.

- **Reuse** (Reclamation, Recovery) is the restitution of waste in a better state or with a better use by proceeding to relatively simple modifications and without significant transformations – cleaning i.e. - (APROSEN and WWF, 2009; UN-Habitat, 2009).
- **Resource recovery** consists in extracting from waste, materials or energy that can be usable again. Diverse technics enable to recover value to specific waste types (cf. Box 1). It exist four principal processes for resource recovery: composting, bio-methanation, incineration with energy recovery and recycling (ENDA Tiers-Monde, 1990).
 - **Composting** consists in valorizing organic waste by facilitating its decomposition so it can change into a new substance – called compost -. **Bio-methanation**, or pyrolysis, enables the transformation of organic waste into gas in order to create energy.
 - **Incineration with energy recovery** recovers resources from waste and restores value to waste, and can be therefore considered as waste valorization rather than waste treatment. It requires adequate infrastructures that are mandatory to install according to some countries' legislation - in France since 1994, i.e.-.
 - **Recycling** consists in extracting, processing and transforming materials contained in waste. It enables thereby their transfer to the industrial value chain through the reintegration into a new cycle of production. Recycling might be considered in some definitions to have occurred only when materials have been sold (UN-Habitat, 2009).

2.1.2.2. Practices in waste treatment and valorization

Composition of waste in high income countries and low incomes ones differ tremendously. This has high implication in the type of treatment and recycling process required. As the Figure 4 shows it, low-income countries' waste composition is characterized by a high share of organics. As opposed to high-income countries where plastic and paper are dominant. It corresponds to increase in relative standard living.

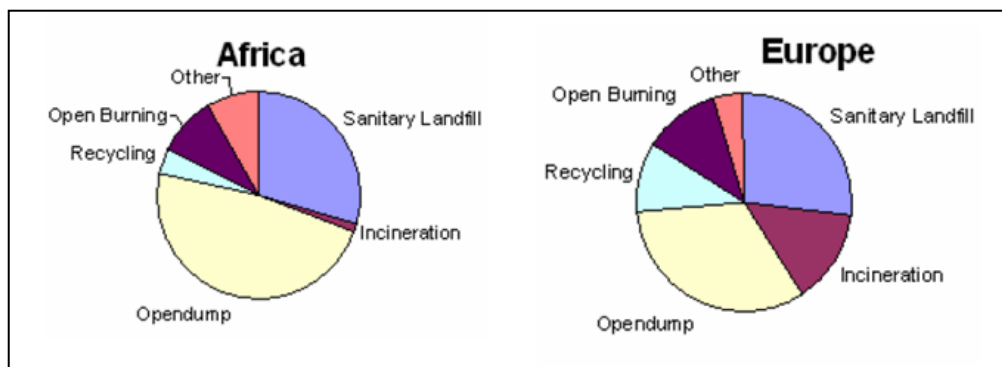
Figure 4: Trends in waste composition



Source: Arunprasad, 2009)

Choosing among treatment and valorization methods is supposed to be made according to waste composition. The practices used in reality do not respect this logic. As the Figure 5 shows it, open dump and landfill are dominating practices in Africa although compost would be the adequate technic considering the considerable amount of organic waste produced. On the other hand Europe should have a large recycling share and dispose yet mainly its waste in open dump and landfill as well.

Figure 5 Types of waste treatment and valorization applied in Africa and Europe

Source: http://80.33.141.76/pashmina/attachments/UNEP_Waste.pdf, UNEP, 2011

Practices differ also according to who is handling the task and if they have access to capital. Choice among treatment and valorization types depends therefore on who is taking care of the task. In developed countries waste recycling is mainly organized by the formal sector and more specifically by the industrial sector and/or valorization centers, due to their greater access to capital. Waste pickers in developed countries are most of the time individual acting for personal

motivations (homeless people seeking in bins). As waste pickers in developing countries are often informal workers working individually or gathered in groups. The largest the informal sector is, the largest the informal sector will be. The large scale of the informal sector in SWM and related market in India, Brazil or Senegal proves the high potential of waste valorization. A growing consideration is therefore given to the various practices of waste valorization and the possibilities to organize it in an efficient way.

2.1.2.3. Difficulties

The practices previously described face several difficulties in their implementation. This is mainly due to:

- Financial constraints since adequate equipment and infrastructures require large investments
- Technical constraints
- Knowledge limitations
- Economic constraints with the difficult integration of recycled product in the market due to the competition with the fresh products. This can be caused by the reticence of the industrialists and/or the population who are reluctant to recycled products.

Conclusion

Practices in collecting, treating and valorizing waste are numerous and developed with different strategies around the world. Implementing SWM requires taking all its aspect into account, which is a tricky task considering the transdisciplinarity of the issue (APROSEN & IAGU, 2009). SWM implies indeed several sciences: geographical with the space planning, social since the issue is linked to the behaviors, the perception and the organization of the actors, law as the tool of public policies are crucial to implement officially a system and economics. The choice in management technics depends not only on the willingness of the actors involved but also on the accesses to technology, knowledge and financial resources. Because it differs from among countries, there are therefore inequalities in the access to waste management service around the world. The frequency and efficiency of waste collection, treatment and valorization in low-income countries is fewer than in high-income countries. Developed countries present however still today failures in their SWM. Despite the growing awareness on waste implications and interests in waste potentials, focus stays limited to the collection stage and only little interest is given to waste treatment. In her book on waste management in Sub-Saharan Africa, Hébette has estimated the average costs shares of managing the waste for a municipality (1996). 75% of the total spending is destined to waste collection while treating waste receives between 10 and 25% (Hébette, 1996, p.21). It can be explained by the priority that is given to waste removal for human health protection. On long term human health is yet also concerned by non-treated waste. Collecting waste without treating or valorizing it consists merely in displacing the problem rather than tackling it.

2.2.Solid waste governance

The other variable behind SWM is governance encompassing the presence of various actors and the organization among them. Because everybody produces waste and managing it requires large investments, the question of who is in charge of rises. In order to develop and implement efficient SWM, the key actors must be therefore firstly identified. Actors potentially involved are classified in two groups and each has specific reasons to be integrated in SWM. The first group gathers the ones considered legitimately responsible of waste generation and/or waste management such as the public sector. The second group is composed of the ones who should take care of the SWM for the maximization of the system efficiency. Considering that certain actors are in better position to provide financial and technical resources, distribution of

Box 3 - Definitions of main actors and sphere of actions

Public sector covers public institutions which have specific limitations and rules. It encompasses generally municipalities and government corporations (Ahmed & Ali, 2004).

Private sector is run by private individuals or groups not controlled by the State, usually as a mean of enterprise for profit (Ahmed & Ali, 2004).

Civil society stands outside the family, the State and the market where actions driven are associated to common interests. It encompasses households, workers (formal and informal), grassroots organizations and NGOs.

Formal sector is officially recognized by legal authorities. Formal economic activities' income is included within a country's gross national product (UN-Habitat, 2009). Practices such as tax payments, registration, trading license possession and regulations respect are imposed on formal activities in order to cover social welfare or government insurance schemes (Wilson et al., 2006).

Formal waste sector includes activities planned, sponsored, financed, carried out or regulated by the formal local authorities usually through contracts (UN-Habitat, 2009).

Informal sector does not have any type of regulation by legitimized institutions and its activities are not accounted in a country's gross national product. It is non-permanence, casualness, carried on in small-scale by little capitalized establishments. It often relies on households or individual labor (Ahmed & Ali, 2004). The reason of the informal sector existence can be found in market forces or other socio-economic factors. Developing countries are characterized by poverty, unemployment and underemployment which explain the predominance of the informal sector.

Informal waste sector is constituted of individuals or enterprises who are not officially recognized or allowed by the formal solid waste authorities, or who operate in violation of or in competition with formal authorities (UN-Habitat, 2009).

Governance is the manner in which power is exercised in the management of a country's economic and social resources for development (World Bank, 1991). Actors taking part in it are from the public sector, the private one or the civil society.

Partnerships Partnership is collaboration between two or more structures that promotes rather cooperation than substitution, subordination or competition. Thereby it is built upon negotiation between actors. They can be pro-poor arrangements or business opportunities (APROSEN & IAGU, 2009). Considering the dynamism that characterized partnerships, the concept is hence empirical. It indeed changes and evolves according to how the actors build it – based on their strategies -, experience it and perceive it. The appearance of the concept can be traced during the late 1970s through the theory of co-production (Handicap International, 2002).

responsibilities is therefore not only determined by legitimacy but also by technical and financial features (Dorier-Apprill & Meynet, 2005). Because the private sector has a greater access to capital, it is consequently more and more asked to participate. On the other side the related benefits of civil society integration on SWM's performances have been proved by academics and experiences of participatory approach. As a consequence the public sector, the private sector and the civil society are nowadays all gaining simultaneously a growing role in SWM (TA Thu Thuy, 2001). Box 3 on the previous page provides definitions of the main actors and the spheres in which they are potentially acting.

A redistribution of responsibilities is in fact happening in most of the societies. SWM becomes thereby a shared management. A shift away from government and towards larger governance is a common global trend. Following this shift, several situations have emerged. The next sections present how the responsibilities are nowadays distributed among the increased number of actors. The analysis is based on theories on governance in SWM as well as reviews on case studies on the European, African and Asian continent.

2.2.1. Shift away from government

Solid Waste Management is a matter of public health, environmental protection and welfare. And since cleanliness and safe waste disposal are essential in these domains, exclusion from an efficient SWM should not be conceivable. From this perspective SWM appears therefore as non-exclusive and non-rivalled (Massoud & El-Fadel, 2002). It was accordingly considered in early stage as a typical public issue and the responsibility of SWM should remain squarely with government. However, the increasing number of tasks assigned to the State brings to a situation of overloading and thus inefficiency. As Dubbink exposed in his book (*Assisting the Invisible Hand*, 2003), the State is overloaded by increasing quantity and quality of tasks and responsibilities. Besides, the power of the State is not geared to the kind of management required today in the waste system.

A shift away from SWM bounded to the State is happening in most of the societies nowadays. In Africa, the Structural Adjustment Plans promoted by the World Bank have impulse a passing of responsibility already in the 1980s (Bulle, 1995). Decentralization has been the first phase of the process, followed later by the appearance of new key actors from the private sector and the civil society. According to authors Ali and Snel (1999, p.19), municipal governments which keep the hand on the entire SWM “fail to see the potential benefits which locally organized collection schemes can bring to their own operations”. As a common and global trend, the public sector steps back and let more space to other actors in order to get discharged of certain costs as well as maximizing SWM performances efficiency. The situation turns more extreme in some situation where the public sector retreats totally from the management of solid waste.

2.2.2. Towards privatization

SWM presents high costs in order to run efficiently and large infrastructures are needed for the three stages of collection, transport and treatment. Participation of the private sector is therefore firstly appealing for financial reasons. Financial capital can be easier mobilized for investments than in the public sector and the civil society. Plus it is recognized that private sector has also higher innovative performances with technical expertise and knowledge on technologies. Furthermore private sector is characterized by its managerial expertise and entrepreneurial

spirit. Finally according to basic economic theories, privatization in a competitive environment leads to cost decrease – under transparent conditions -.

Yet privatization is risky and unsatisfying from a sustainability point of view. It can lead to monopoly and social exclusion. The case of Egypt is presented in Box 4 and illustrates well this aspect. When dealing with waste collection and treatment, privatization is indeed likely to lead to

Box 4 - The privatization of SWM harming a part of the population in Egypt

The growth in solid waste production and the consequent increase in waste management costs explain the attempt made by the Egyptian government to reorganize SWM. In 2000 privatization became the new goal of the National Strategy. International SWM companies discovered a potentially profitable niche market and started hence to take over the waste collection route. (Bifa, 2009). However this change has threatened the interest of the local population among whom many depend on solid waste for survival – i.e., the traditional waste collectors in Cairo called “Zabbaleen” - . This strategy developed by the Egyptian government ignored therefore the possibility to alleviate poverty by restructuring the SWM (Fahmi, 2005).

inefficiency or even economically and socially harmful situations. In waste valorization however, this un-balanced governance is not damaging and participates even to the sector’s

success. Because the industries are the first buyers of valorization centers’ output, they are therefore essential to make the whole valorization system run. There would indeed be no sense in valorizing waste without commercial partnerships. Furthermore, the economic interest of waste that has recovered value catches the attention of a growing number of private enterprises, as the case presented in Box 5 illustrates it. The private sector is

Box 5 - Plastic recycling as a profitable activity for the private sector in Uttara (Bangladesh)

The profitability of the plastic recycling factory installed in Uttara has been proved for several years thanks to the costs of recycled plastic 2 or 3 times cheaper than the imported virgin resin. The factory owners are now willing to extend the volumes of plastic treated since the current demand on the industrial national and international market at the prices at which Uttara’s factory currently offer them is high (Matter et al., 2012).

accordingly likely to organize itself valorization schemes. In these schemes, collectors are required to be integrated and in developing countries they are often informal private workers. Therefore, the private sector has in waste valorization a major role to play.

2.2.3. Towards Public-Private Partnership (PPP)

The amount of waste and thus the cost of municipal solid waste management are intensively rising nowadays and have led local governments in numerous countries to examine whether the service would be best provided by the public or the private sector. While the opponents to partnerships argue that the focus should rather be done on the improvement of the public sector, some considers private sector as more innovative and efficient. SWM is indeed a basic service that must be provided to all citizens, where profit is not be the main motive and should therefore rely in the public sector sphere. On the other hand, private sector has the capacities to minimize the costs and maximize the resource utilization. Thereby hybrid or mixed organizations composed of both and organized through Public-private partnerships have emerged as a promising alternative to improve SWM performance by assuming the co-responsibility of

Box 6 - Successful Public-Private Partnership in Lebanon municipalities

Because Lebanon municipalities were facing a lack of financial resources and qualified human resources in SWM in the early 2000s, local governments started to signed contracts with private firms such as the capital Beirut which has signed a contract with the company SUKLEEN in charge of collecting waste (Massoud & El-Fadel, 2002). PPP in SWM appeared as appealing alternative in order to increase performance efficiency by delegating collection responsibility to private firms and by assigning authorities with the task of conducting environmental impact assessments regularly and developing different forms of treatment and valorization. Lebanese SWM has marked rapid improvements thanks to the participation of the public and private sector and their well-balance partnership.

service delivery (Massoud & El-Fadel, 2002; Ahmed & Ali, 2004). As the case of Lebanon illustrates it (cf. Box 6), it capitalizes on the strengths of each sector by “combining the efficiency and expertise from the business world with public interest, accountability and broader planning of government” (Ahmed & Ali, 2004, p.475).

According to APROSEN and IAGU (2009), and Ahmed and Ali (2004), developing countries present key elements for relevant

implementation of PPP in SWM. Firstly public sector has often less than satisfactory efficiency and capacity in managing waste. In many third world administrative systems, institutional-centralization is ineffective, or decentralization is not complete or has under-performances. Partnerships with private firms help in facing these difficulties. Secondly private sector in both formal and informal sector is willing to undertake some parts of the activity. It concerns waste collection, treatment, and more and more waste valorization. Also, the private sector has a growing interest on the outcomes of waste valorization since it represents cheaper input for their own productions. And thirdly, developing countries often present a vibrant informal sector. Sub-contracting waste collection for instance to informal waste pickers likely more experienced and competent for reaching and collecting waste, increases SWM performances. Cooperation with the informal sector in waste valorization sector participates in the sector’s dynamization and expands its market.

Partnerships with the formal and informal private sector is however not easy to achieve in reality. Enabling environment is necessary to foster trust and working relationship. APROSEN and IAGU (2009) find the explanation of failing PPP rather in communication and coordination problems than in the incapacity of local industries to satisfy the demand. Partnerships with the informal private sector are in reality relatively limited because informal workers are anonymous and there is therefore no representative during the meeting for state decisions. Finally risks in PPP rely in forgetting or giving only limited consideration to citizens and grassroots organizations. Yet integration of the civil society and community participation has proved its benefits in many cases.

2.2.4. Towards civil society integration

The shift to larger governance requires the integration of civil society through community participation and NGOs’ involvement. The absence, or semi absence, of the public service in SWM can be seen as an open space let to the civil society to develop itself. This is this opportunity to express, act and get recognition (Dorier-Apprill & Meynet, 2005). On the other side participation of NGOs and communities in SWM has proved to be beneficial for the system. For these reasons civil society started gaining public visibility in the late 1990s.

2.2.4.1. Community participation in SWM

Because households are also producer of waste, it should be integrated in the system and assigned with responsibilities. Besides the legitimacy participation, communities have also high potential for improving system efficiency. Growing disappointment over negative results of “top-down” strategies in development projects explains the appearance of concepts such as “empowerment of the poor” or “participatory development”. Several authors have explored the relevance of community participation giving particular attention to the potential management improvements. A review of the main theories is presented in the following part in order to provide a theoretical framework to community participation. The assessment of several community-based case studies within this framework helps in identifying the structures and practices of community participation and highlights its boundaries.

Definitions

“Community” is often treated as a single, clearly identifiable and homogenous group. In reality, it is far more heterogeneous and complex. Understanding the community composition and structure and avoiding as much as possible exclusion of poorer and weaker sections of the society is particularly important in community-based programs (Ali & Snel, 1999). By definition, community participation is a responsible commitment, individual or collective. It refers to the idea that citizens can be part of cultural and socioeconomic structures and changes of the society. Application of this approach to SWM has shown satisfying results as regards to the efficiency of the system. The malfunction of SWM is highly likely to happen when the population is being told how to manage their waste (UNEP [2], 2009). To truly take part in the system, communities ought to understand the whole process.

The nature of participation of an individual in a program corresponds to the degree of its involvement and hence its specific tasks and responsibilities. This is determined by personal motivations and the role assigned to communities in the project. A first distinction should be done between active participation and passive participation. In the first case the participant is an actor whereas in the second he is only an observer. Categorization of different types of participation has been done, corresponding to the degree of involvement. The ladder of participation of Arnstein (Figure 6) shows the gradation in participants involvement going from a manipulation state to a citizen control one. Methods used are specific for each steps and depend on the program’s objectives. Initiating participation among individuals or communities, maintaining participation or supporting already existing participatory initiatives require a large array of measures. The review is based on both theoretical framework and experiences from several case studies.

Figure 6: Ladder of participation elaborated by Arnstein, 1969



Source: Retrieved from Tritter and McCallum, 2006)

Schemes encouraging and maintaining community participation

Initiating Community Participation

Community-based programs start by bringing information to individuals or groups, and consulting them, which corresponds to the step 2 to the step 4 in the ladder of Arnstein (Figure 6). High consideration needs to be given to this phase by identifying the target population and its characteristics, and designing adequate awareness programs. According to UN-Habitat (2009), channels of communication determine the engagement of the users and the quality of waste disposal and/or collection in SWM programs. By highlighting in efficient awareness programs the causal-effects of degradations and people's responsibility in it, it motivates people to participate in the programs - including financially -, or even in the formulation of its guidelines. Particular attention is in fact given to financial contribution from participants since this contribution reflects a notion of symbolic ownership and leads to increased accountability. According to Ahmed and Ali (2004) the general public including in developing countries is willing to pay for waste management service. They are conscious that their financial participation contributes to the effectiveness of the service but their actual participation depends on the willingness to pay, the ability to pay and the performances of the tax recovery system. The consideration given to the residents' opinions and possibilities enhances the acceptance of the program among the population and therefore the system efficiency. Considering it and initiating participation is a pillar in a development project realization. Box 7 illustrates this aspect.

Box 7 - Community mobilization and financial accountability in managing waste, in Hyderabad (India)

A sanitation program developed in Hyderabad (India) considered community mobilization as an essential component of the project. Procurement assistance, formal and informal training were thus provided. The villages involved were also encouraged to create a collective saving account in order to overcome occasional technical problems and some inhabitants were responsible for the tax recovery (Ali & Snel, 1999).

Supporting existing activities

The United Nations claim that development should be based upon the strength of a city, meaning to identify, nurture and improve the processes that are already going well (2009). Consequently development programs initiators pay a growing attention to self-organization actions already implemented often for compensating failing and inexistent public services.

Box 8 - Supporting communities' initiatives in Mali

A program directed by UNESCO in Bamako (Mali) brought some financial and technical assistance to initiators of social projects -educational ones, i.e. - or economic activities that would potentially participate to living conditions enhancement. By doing so, it aimed at encouraging an "endogenous development" based on a bottom-up approach by the means of increasing communities' autonomy and supporting them in handling the area development. The overall area development relied hence on communities' self-government capacity (Muller et al., 2002).

Support initiatives programs takes part in the 6th and 7th step in the ladder of participation and it can potentially lead to the 8th final step (Figure 6). An instance is given in Box 8. However, these programs are not sufficient in themselves for empowering totally community in a participatory approach. The shift from local individual initiatives to collective participation and regional actions is necessary. Up-scaling is therefore a crucial element in

transforming community participation into a truly fruitful process and reaching hence the last step of citizen control over the development process.

Citizen Control

However, one can wonder about the real possibility to evolve from the basic participation in a program towards local initiatives which take a political dimension (Dorier-Apprill & Meynet, 2005). While donors and investors stay in the perspective of valorizing local initiatives, the accent is nowadays more and more put on the organizational support that these communities need for taking part in the system's control. It corresponds to the upper steps in the ladder of participation (Figure 6) where community participation reflects a high accountability in project management. It encounters moral and financial accountability, responsibility concerning the project management, communication and cooperation with the public and private sector. Partnership is indeed fundamental to reach the state of control. Dubbink (2003) promotes the citizens' self-organizing initiatives for a continuous research of efficiency. It is assumed that a participatory approach enhances the feeling of ownership and this in return facilitates the community to appropriate the system (Gaye & Diallo, 1997; Ali & Snel, 1999). According to UNEP ([2] 2009), the malfunction of SWM is highly likely to happen when the population is being told how to manage their waste. Community participation should therefore take place since the policies elaboration and process design, till the technical implementation and the management methods.

According to Bulle (1995) however, participants rarely manage to take the control of the entire program and system. In spite of the relevance of the participatory approach for SWM performances efficiency, community participation is not sufficient for the success of a SWM because of its limits. Including communities in a larger array of actors is therefore necessary.

Limits of Community Participation

Although the World Bank, the United Nations and most bilateral programs have made participatory approach as main criteria in development projects, the meaning of this concept in practice stays rather vague and its success not guaranteed. The misapplication of the participatory approach and the limitations of the concept in itself might prevent the development of a project or even initiates negative feedback loop.

Misapplication of the concept

A first step in program elaboration is to analyse the context of implementation. It enables to identify the capacity of communities to participate meaningfully and on long term in the project, in order to determine adequate methods and schemes (Botchway, 2001). Despite the determinant role of this process, it might be partly ignored in some cases, as the case study in Box 9 proves it.

Box 9 - Unsuitable participatory program in Northern Ghana

A rural development and sanitary project conducted in Northern Ghana failed to bring satisfactory results. The objectives of the project did not actually fit with the communities' priorities since their main concerns were to engage in more income-generating activities, what the SWM scheme, as it was designed, could not offer (Botchway, 2001). With low consideration paid to the context, the program has thus been implemented in spite of other regional difficulties rather than in combination with them and has consequently felt down.

A second limit finds its source in the reduced access of communities to decision-making, which questions the process of community empowerment. Participatory programs should go beyond asking for simple participation and basic solutions, but also encourage people to frame problems and develop their own initiatives (Tritter & McCallum, 2006).

Finally, community participation might be used as substitute for structural reforms and is in this situation counterproductive. The growing popularity of the participatory approach has led certain authorities legitimately responsible for service delivery, to take the opportunity of new actors' presence and shirk their responsibilities. According to Tritter and McCallum (2006), service's users involvement is often based in on "sub-contracting" tasks and thereby responsibilities. It corresponds to the stage of *Delegated Power* (Figure 6) which allows to a certain extent the legitimate service provider to disengage.

Limitation of the concept

In the ladder of Arnstein (Figure 6), the expected outcome of citizen engagement is to seize the service's control. There are however limits in this approach which question the extent till which community participation stays relevant. Firstly community may not always desire to increase their control over the service (CAG, undated). According to their means and willingness, members of community involves more or less in programs. However differences in the degree of involvement might lead to the "tyranny of the majority" where decisions are likely to satisfy the needs of some more than others (Tritter & McCallum, 2006, p.162). Because of potential reinforcing patterns of inequality, the sustainability of community participation might be questioned. There is consequently a dilemma, when designing a program, in choosing between involving some people intensively and involving many people in a limited way. Secondly the service is not automatically better provided by citizen since increased control without support may result in failure (CAG, undated). According to Wang and Van Loo (1998), citizen participation rarely reached a good quality level where citizens had some power to influence decision-making. It might be due to the inherent participants' limitations - financial, i.e. - likely to constrain project's development. Especially in SWM, community participation is not sufficient due to the high costs involved and large organization needed (Tritter & McCallum, 2006). To stay relevant, it should therefore be kept within a frame to avoid "cycle of disempowerment and disinterest" where communities are not efficient and loses recognition and power (CAG, undated, p.7). Instead, communities required to be integrated into larger governance where the public sector and the private one are also present. Furthermore, advocacy that state involvement means perpetuating the top-down approach to social development is ignoring the major role of the state as a provider of social development services. As a conclusion, it should not be forgotten that communities are just part of the governance and is irrelevant if not integrated in a broader picture.

2.2.4.2. NGOs' involvement

NGOs' capacity to adapt to unstable political context or changing funding possibilities proves their large potential for conducting programs in developing countries (Dorier-Apprill & Meynet, 2005). In many cases in fact, they have a major and central role by bringing financial, technical and/or organizational assistance. With their wide approach, NGOs are considered as able to put

in relation SWM with other problematic such as poverty reduction, environmental protection and/or access quality to waste collection service. And since NGOs is supposed to have a neutral position, it can therefore organize good governance supporting key actors and building bridges among them. Accordingly, NGOs have an intermediate position and are supposed to work in close cooperation with the governments, grassroots organizations and private structures, and facilitating cooperation (Bulle, 1995). Besides, NGOs are often the closest structures to communities in developing countries and are hence supposed to pave the way for greater communities' recognition (Dorier-Apprill & Meynet, 2005). Supporting local initiatives also takes place with concept such as the "5Ps" consisting in Pro-Poor Public-Private Partnerships. It aims at helping small enterprises to provide services to unserved, poor communities (UN-Habitat, 2009, p.45).

There are however also limits in NGOs' actions firstly because the recognition of their legitimacy is not automatic - and can even be challenging -. In areas where awareness on waste related problems are rather low, people are likely to be reluctant to change, keep thereby their habits - of dumping anarchically their waste and/or burning it - and consider NGOs' actions as interference (Deler et al., 1998). Secondly their activities do not systematically insure quality in the relations between actors despite their intermediate position (Dorier-Apprill & Meynet, 2005). Instead of acting to avoid conflicts as a facilitator, NGOs can in fact also be the source of it or reveal limits in the supposed democracy (cf. Box 10). The intense cooperation between NGOs and communities might exclude the public service, does not help its legitimate recognition and represents a direct concurrence. Consequently the State and municipalities may possibly feel being dispossessed from their initial role or that their chances for improvements are reduced or inexistent. Rochegude names it a "decrease in the institutional credibility" (2001)¹⁰. However responsibilities must be progressively transferred from the NGO to the local authorities (when there is no initial cooperation) to help the necessary public sector's recognition, legitimates its actions and thereby sustain the program on long term. The role of NGOs should consequently stay within a frame otherwise its actions' efficiency might be questioned. International development aid through NGOs can indeed prevent any local development from other sources (public sector or local civil society) and limit therefore decentralization process, democratization and population empowerment. Finally informal sector might also suffer from the competition prompted by NGOs. Often forgotten during the elaboration of SWM projects, the informal sector is yet in many cases pillar in SWM in many African societies.

Box 10 - Tense relations between NGOs and the State of Haiti

Since the 1980's to the present, the relations between the NGOs implemented on Haiti and the State are in a critical phase. By increasing people political awareness, NGOs might develop also critical opinions upon the government which explains the skepticism from the State on NGOs' actions. A control on these NGOs is supposed to be implemented with the means of decrees bearing regulations of NGOs' presence and actions. As a result, critics from the NGOs upon the government have risen. The actual limited and tense cooperation between the State of Haiti and the NGOs is counterproductive for the country development (Castor, 2008).

¹⁰ In Dorier-Apprill & Meynet, 2005, p.30

Conclusion

Reviewing literature on worldwide experiences in managing solid waste has revealed the need for multi-stakeholders participation with partnerships and interaction. SWM should stay a public service where the private sector and the civil society have a role to play. The relevance of NGOs involvement and community participation has been highlighted by the literature review, justifying thus its growing integration in SWM. The limits of participatory approach fixe yet the frame's boundaries within what the approach should be developed. Community participation in SWM ensures management efficiency and population empowerment when integrated in well-balanced governance. And NGOs have a large role to play in this process. Large consideration of actors combined with redistribution of the responsibilities in a contextual approach appears indeed as crucial. By redistributing responsibilities and powers however, the weight and influence of each actor are likely to become unclear. Large governance is therefore likely to create confusion. Besides tasks division, good governance requires also cooperation and coordination between the actors (Dorier-Apprill & Meynet, 2005). There is a visible shift from government to governance in SWM in the majority of societies. This observation needs however to be tempered for two reasons. Firstly governance in SWM differs from one-region to another since countries have their own economic, politic, social and environmental specificities which lead to specific types of SWM. It is therefore more appropriate to talk about a global trend including a large variety of SWM governance types. And it is consequently not possible to elaborate a pattern of sustainable SWM governance suitable for all societies. Secondly, it appeared in the literature review that differentiation needed to be done when talking about SWM governance between waste collection and treatment governance, and waste valorization governance. Actors involved in one group might be not involved in the other one. It appears that public authorities are less occupied by waste valorization than by waste collection and treatment, as opposed to the private sector which implicates more in waste valorization than in waste collection and treatment. While the public sector is guided by health and environmental motivations which can be accomplished by waste collection and transport, the private sector seeks for profit that especially valorization can satisfied. The incentives and necessary organization behind each sub-sector differ, and other actors and actions are therefore required. As a conclusion SWM governance encompasses in fact two types of governance.

2.3.Managing Municipal Solid Waste

The large number of studies conducted on all the continents for the last decades have enabled to understand better the two main components of SWM. Considering that SWM depends on technical aspects and type of governance, the characteristics of failing and successful management rely therefore in these constituents. The following part aims thereby at defining the technical elements and specificities in governance, which cause malfunctions or achievements in a system. Exploring the implications of failing and successful systems enables then to highlight the degradations caused by mismanaged waste and the numerous advantages of efficient SWM. Finally perspectives for the future of SWM are presented through the concept of sustainable SWM.

2.3.1. Failing system

2.3.1.1. Causes

The inefficiency of SWM is caused by the incapacity of the SWM to adapt to the current state and/or changes and/or an overloaded state of the SWM (United Nations, 1997). The first variable concerns directly the system of SWM while the second one encounters factors external to the system. The causality of these elements are described in the following section and presented in Figure 7 (p.41).

The incapacity to adapt is caused by nonexistent or ineffectual system management. There are two elements triggering failures in one of the stages of SWM or all of them. Inadequate or inefficient technics are explained by limited accessibility of certain areas (twisted, narrow or deteriorated roads) or technical problems (non-sufficient or limited maintenance of materials and infrastructures). Secondly poor governance might be characterized by defective coordination of the actors or monopoly state. The absence of collection is the starting point of mismanaged solid waste since it prevents the operation of the rest of the system. It results in waste accumulation at the source of waste generation. However, collecting waste without treating it corresponds to merely displacing the problem. Therefore all three stages of SWM are crucial pillars whose weights are equal.

Secondly an overloaded state can be reached because of the generated waste increase caused by population growth and rising living standards - which change consumption pattern -. Propensity to dump anarchically waste worsens then the situation. The reasons behind this behavior do not only rely in the disinterest of the population on this issue, but also in the limited knowledge on the linkages between waste and economy, living conditions and environment, and the lack of alternatives when no adequate receptacle are available.

The elements previously described affect negatively SWM which lead to the harmful consequences described in the following section.

2.3.1.2. Consequences

Mismanaged solid waste has catastrophic consequences simultaneously on the economy, the population and the ecological environment. Waste crises happen in places overloaded by mismanaged waste and results in disastrous situation.

Economic difficulties

Mismanaged solid waste affects negatively human activities and the economy in general, by limiting, preventing or damaging their development. Waste accumulation worsens indeed the access, the availability and the quality of the resources. Fishing deteriorates because of the limited amount of resources surviving to waste pollution or because of the bad quality of the resources living in polluted areas. Farming degrades because of soil, water and air pollution that affects production productivity and products quality. Tourism development is limited by waste accumulation mainly because of visual pollution and odorant smells. Finally anarchical dump sites occupy land in detriment of other activities or services and decrease in land availability might have negative consequences on the land market. Because of all these degradations, mismanaged waste is likely to prevent foreign investments.

Degraded social conditions

SWM has in fact emerged in Europe during the 19th century because of its harmfulness on human health (UN-Habitat, 2009). Waste disposal sites attract dogs, rats or pigs, which represent a mechanism for spreading disease and lead in extreme cases to epidemic - plague epidemic, i.e. -. Furthermore waste accumulation contributes to the formation of floods. It worsens diseases and infections spread and it has potential materials consequences. Accordingly living conditions are worsened. Finally it encourages the development of informal sector so as to compensate the failing service and enjoy the financial potential of waste. Although it might be an opportunity for the informal workers to improve their standards living, informal work often takes place in bad working conditions.

Environmental degradations

According to UN-Habitat (2009), waste treatment has its first implications in environmental protection. Waste impacts on the flora and the fauna because of chemical and physical pollution. Pollution resulting from waste decomposition affects chemically the air, the soil and the water. Surroundings ecosystems are directly or indirectly harmed by it. Despite the long-term process of certain waste types' degradation, exchanges between waste and the soil and the atmosphere do happen. The following Table 1 shows how long a waste dumped anarchically in the nature is expected to stay visible in the landscapes and to represent a threat for human and animal health and the ecological environment.

Table 1: Life expectancy of waste in the nature (Source: www.forumdechets.ch ; septembre 2005)

Waste type	Life expectancy in the nature
Paper tissu	3 months
Newspaper	3 to 12 months
Fruit peel	3 months to 2 years

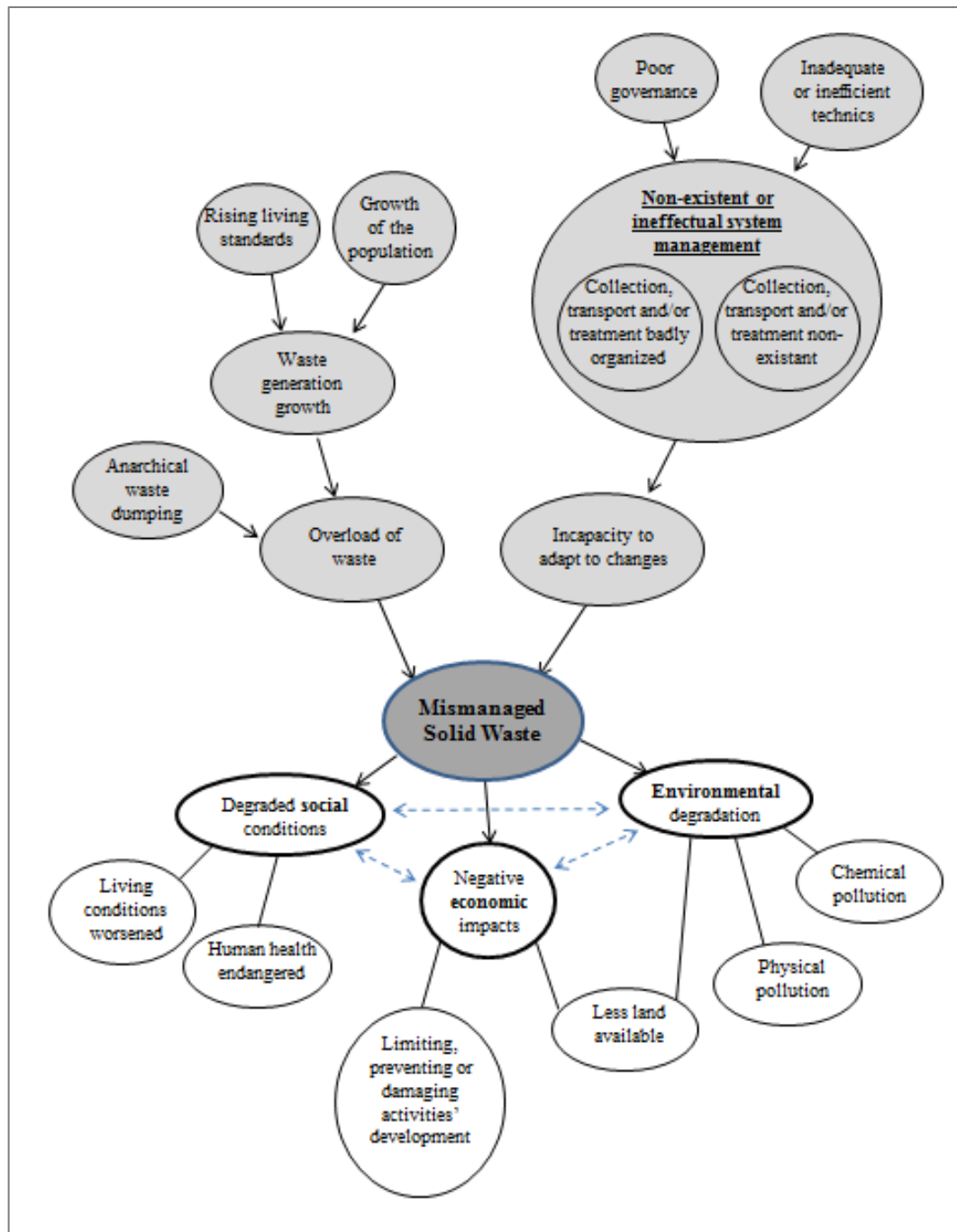
Chewing gum	5 years
Aluminium can	100 to 500 years
Plastic bags	100 to 1000 years
Glass	4000 years

Furthermore waste damages physically the environment with animals suffocating after ingurgitating plastic bags for instance. On the other hand it creates an upper layer that prevents to the fauna and the flora under to get sufficient oxygen and light to reach. This explains partly the disappearance of Senegalese mangroves for instance. Finally land utilized as dumpsites decrease the availability of green lands for fauna and flora.

Simple incineration in open spaces is the simplest and most used methods to eliminate rapidly waste when no other solution are available (UN-Habitat, 2009). It fills the urban air with ashes, particles and pollutants. Hazardous wastes from hospital and industry often become mixed with the municipal wastes because of a lack of infrastructures and control.

The following Figure 7 sums up the main causes and consequences of failing SWM described previously. Because the social, environmental and economic domains are interconnected – represented by the dotted arrows on Figure 7 -, a vicious circle (or negative loop) can then take place where one element affects negatively the other domains. Degraded environment prevents the enhancement of both economic activities and living conditions. Difficult economic situation might worsen living conditions and prevents the development of an efficient SWM.

Figure 7: Problem tree of mismanaged solid waste



2.3.2. Successful SWM

2.3.2.1. Good practices

There is no perfect pattern in SWM since local characteristics determine the technical specificities and the adequate governance. The following parts present thereby the general features.

Good technical practices

Good collection service is defined by UN-Habitat (2009) as a regular, reliable, user-friendly and affordable one. The service should have an improved cost-effectiveness and service coverage. It implies that the collection vehicles and transfer systems are appropriate to the local waste characteristics, street and traffic conditions. Avoiding multiple manual handling of the waste reduces the service costs. Finally implementing separated systems for each waste type reduces the deterioration of materials and facilitates thereby high-value recycling.

Rational management of solid waste must aim at promoting treatment and valorization before elimination. It includes efficient disposal methods for treatment and adequate infrastructures for waste valorization. While uncontrolled landfill must be totally avoided, the amount of waste ending in controlled landfill should be minimized and the valorization maximized. Infrastructures and technology are keys for the system development through specific installations. Technology and knowledge exchange is crucial for rapid improvements.

Good governance

The section 2.2. (p.28), has proved that SWM is better handled when shared among the public sector, the private one and the civil society. Strong linkages between them increase the chance for success. Redistributing responsibilities in SWM constitutes therefore the key for improvements and goes along with the concept of governance. UN-Habitat (2009) refers to effective SWM as a useful proxy indicator of good governance and in return good governance is essential for efficient SWM. UN-Habitat (2009) and Dubbink (2003) consider inclusivity as a main strategy for efficient SWM. It implies that all stakeholders are included in planning, implementation and monitoring changes.

As shown on Figure 9, satisfactory technics combined with good governance lead to efficient SWM.

2.3.2.2. Results

In some places solid waste is not stored and not treated because considered as not valuable. Yet, the outcomes of waste treated and valorized are not negligible from economic, social and environmental perspectives. Efficient SWM participates to the attainment of the Millennium Development goals. The Figure 8 below shows the different components of this contribution.

Figure 8: Relevance of improved solid waste management to the Millennium Development Goals

Millennium development goals (MDGs)	Achieving MDGs through Improved Solid Waste Management
1. Eradicate extreme poverty and hunger	Informal sector self-employment in waste collection and recycling currently provides sustainable livelihoods to millions of people who would otherwise have no stable source of income and would be most susceptible to extreme poverty and hunger. City authorities can both promote recycling and create more opportunities for the informal sector to provide waste collection services in unserved areas and thereby help eradicate extreme poverty and hunger.
2. Achieve universal primary education	Waste management activities contribute indirectly to education, through income generated by the parents. Many waste pickers earn sufficient income to send their children to school and do so with pride. The poorest waste pickers do engage their children for picking and sorting waste, but in instances where NGOs are involved, classes are organised for these children, after their working hours, and parents are informed about the need and the benefits of primary education.
3. Promote gender equality and empower women	A substantial percentage of informal sector waste collectors and waste pickers are women. Efforts to improve solid waste management services and enhanced recycling can include improvement and equal working conditions for men and women, by creating financial and other arrangements that build capacity and empower women.
4. Reduce child mortality	Effective solid waste collection and environmentally sound disposal practices are basic public health protection strategies. Children living in households without an effective waste collection service suffer significantly higher rates of for example diarrhoea and acute respiratory infections, which are among the main causes of childhood deaths. Co-operation with informal sector waste collectors and recyclers will improve their livelihoods, reduce child labour and hence direct contact of children with the wastes.
5. Improve maternal health	Almost all women waste pickers have no maternal healthcare available to them. Enhanced recycling may directly/indirectly improve maternal health through achieving improved living standards among households engaged in the sector.
6. Combat HIV/AIDS, malaria and other diseases	Originally, waste management activities started due to public health concerns. The reasons are almost self-evident: uncollected waste clogs drains, causes flooding and provides breeding and feeding grounds for mosquitoes, flies and rodents, which cause diarrhoea, malaria, and various infectious and parasitic diseases. Mixing healthcare wastes with municipal solid waste and its uncontrolled collection and disposal can result in various infections, including hepatitis and HIV. Reliable and regular waste collection will reduce access of animals to waste and potential for clogging of drains. Proper waste management measures can practically eliminate risks associated with healthcare waste.
7. Ensure environmental sustainability	Few activities confront people with their attitudes and practices regarding sustainability as waste management does. Reduce-reuse-recycle is yet to realise its full potential as a guiding principle for environmental sustainability through conservation of natural resources and energy savings, as well as through reduction of GHG and other emissions.
8. Develop a global partnership for development	Through co-operation and exchange, developed and developing countries can develop and implement strategies for municipal services and job creation where unemployed youth will find decent and productive work and lead a dignified and good life.

Source: UN-Habitat, 2009

Economic implications and advantages

The economic advantages in SWM rely to a large extent in waste treatment and valorization. Although it implies large initial costs, the outcomes of the investment are large financial benefits for the local authorities, the industrialists and the waste workers.

Waste treatment and valorization requires large investments

Waste generation rates in Africa are approximately 0.5 kilograms per person per day (UNEP [2], 2009, p.5). In countries where there are millions of inhabitants, shifting from uncontrolled landfill – which only occupies land – to controlled one and valorization installations represent therefore a consequent financial step for the ones in charge of. It is estimated that operating costs for (controlled) landfills range between 10€ and 50€ per ton, incineration between 80€ and 200€ per ton¹¹ (UN-Habitat, 2009, p.21). A large numbers of municipalities cannot handle these financial and technical issues. Yet these investments are likely to be profitable and even helped the stakeholders in saving money when looking on large time scale.

Waste treatment and valorization reduces costs

Waste treatment and valorization reduces costs for the people in charge of. Neglecting waste treatment and valorization increases on long term the level of investments in other sectors. Investing in waste treatment and valorization prevents indeed expenses in health or environmental sectors. The need for cleaning measures, human health protection and against environmental degradation increases with waste accumulation. Secondly waste segregation participates to cost reduction when done before transportation to landfill. Sorting waste and redirecting materials for recycling reduces the quantity of residual waste that has to be transported and eliminated in the landfill. Consequently costs for managing residual waste decrease.

Waste treatment and valorization reduces costs for the industrial. Some natural resources are expensive to include in the production cycle. The extraction of metals for instance can be extremely pricy and is conducted in only few places on earth. On the side process for recovering metals costs less than the extraction. Using recycled aluminum is 7 times cheaper than using the raw material (APROSEN & IAGU, 2009). Recycled metals can therefore be considered as the new profitable mineral deposit. Moreover using recycled products reduces raw material importation. Thereby dependence of countries on these importations decreases as well. Valorization is hence a good incentive toward a larger use of local products.

Waste valorization generates revenue

Waste valorization generates revenue by creating added-value and market development. Choosing to recycle raw materials at industrial scale is motivated by both ecological consideration and economic factors. As defined earlier, the process of valorizing consists in recovering value to waste which enables trade. Financial flows generated participate to the creation of revenue, but only if it exists some chains of operation that makes the products available to the consumers (APROSEN & IAGU, 2009). Developing and securing recycled products' markets insure the existence of economic outlets and hence business profitability

¹¹ Variations of costs depend on how modern and sophisticated the installations are

(ENDA Tiers-Monde, 1990). Business for secondary materials is dynamic. For instance the total world market for scrap metal is over 400 million tons and for recycled fiber is around 175 million tons (UN-Habitat, 2009, p.25). Admitting that recycled products are not merely environmental-friendly products but also economic resources enlarges considerably its potential and thus economic opportunities (ENDA Tiers-Monde, 1990).

Waste valorization generates revenue by creating jobs in the formal sector. Developing SWM in the formal sector means hiring waste collectors, waste transporters and opening treatment and valorization centers that need employees. Jobs thereby created are numerous and diverse. Since treatment and valorization is still at an embryonic stage in many countries, the potential for job creation is consequently high. The Vietnamese experience proves with a recycling center installed in Ho Chi Minh Ville employing more than 10 000 persons (APROSEN & WWF, 2010, p.24).

Waste valorization generates revenue by being a source of revenue in the informal sector. Since some methods in waste valorization do not require complex treatments or specific equipment, the informal sector see in it the opportunity to generate money. Informal markets develop where large amounts of money are exchanged. Where unemployment rates are high and uncontrolled waste accumulation large, informal valorization becomes attractive. It is estimated that about 13 million CFA (20 000€) circulated every day in the largest Senegalese uncontrolled landfill Mbeubeus (APROSEN & IAGU, 2009, p.30). In many developing countries unemployed people can thereby improve relatively their living conditions thanks to the money generated by valorizing activities

Social improvements

Removing waste is essential for human health by improving directly living conditions. SWM enables to live in clean places, avoid waste-related-smells and animals disturbance. “Diarrhea and acute respiratory infections are significantly higher for children living in households where solid waste is dumped, or burned, in the yard, compare to households in the same cities which receive a regular waste collection service” (UN-Habitat, 2009, p.2). It limits indeed sanitary risks such as disease proliferation and enables therefore better living conditions. Additionally to these enhanced sanitary conditions, a better management improves the social cohesion. By involving the inhabitants a renewal in the relationship is generated and benefit to the sense of community. Enhanced social cohesion helps in empowering communities.

Environmental conservation

Prevention of pollution related to inadequately treated waste

Infrastructures for waste treatment and valorization prevent the traditional practices harmful for the environment. The degradations described in the sub-section. 2.3.1.2. Consequences (p.39), would be avoided by installing efficient SWM.

Reduction of the natural resources (over)exploitation

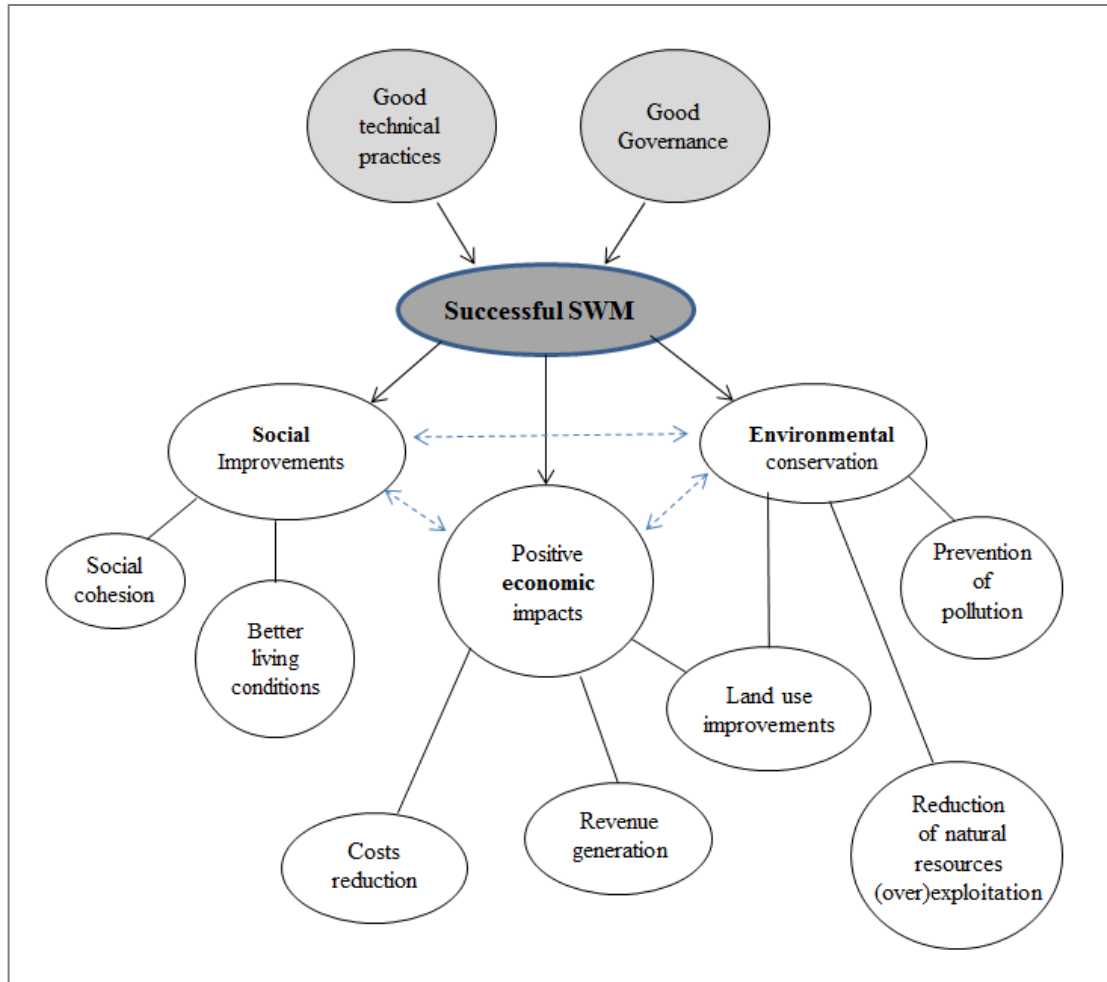
In the current world production, consumption of oil, metals or wood are very high, even though some are classified as non-renewable resources. Solutions rely in reducing the production and replacing the inputs during the production. Once a resource has been extracted, it should be used and reused as many times as possible in production cycles in order to limit the demand and therefore the extraction of natural resources. Consequently life expectancy of non-renewable resources would be lengthened. Thereby recycling centers take the role of raw materials deposit by transforming rejected elements of systems (ENDA Tiers-Monde, 1990). More than preventing environmental degradations, waste treatment and valorization protect therefore natural resources.

Land use improvements

Improved SWM goes together with improved land use. Rehabilitating unofficial dumped areas enables to transform them into official ones or to use the land for other purposes for the community – such as school or playground – and giving it back to the ecological environment. Furthermore social implications of improved land use rely in its impacts on the population's behavior. The establishment of areas specially destined for waste deposit help to change their propensity to dump anarchically their garbage. Finally this establishment facilitates the running and performance of the whole system.

Virtuous circles (positive feedback loops) can be observed between the waste situation and the economic, social and environmental states (represented by dotted arrows on Figure 9). An environment preserved from waste accumulation enables economic activities. The revenue generation helps in increasing the living standards. Enhanced living conditions lead to better access to services such as education. The propensity to dump anarchically waste is likely to decrease which limits waste accumulation in the environment. It exist other feedback loops that prove the broad influences of SWM on the entire society and its environment. All the elements previously explained are exposed in the Figure 9 below which sums up the main determinants and consequences of successful SWM.

Figure 9: Solution tree for efficient SWM



2.3.3. Sustainable SWM

In the 1960s attention given to ecological issues started to grow. The report “The Limits of Growth” published by the Club of Rome in 1972 concretized the awareness on the pressure put by the economic and social sphere on non-renewable resources. Series of meetings and reports followed since then have led to the emergence of the notion of Sustainability and Sustainable Development (SD). The UN-sponsored Brundland Commission that released “Our common Future” (1987), the Earth Summits in Rio in 1992, in Johannesburg in 2002 and in Rio again this year or the World Development Report (1992) are among the events that have marked turning points in the way the earth, its resources and the way human use it are perceived. The emergence of Sustainable Development was initially a reaction to the large environment degradations. It was enlarged progressively by considering the economic and social spheres. The scope of SD as known today aims at bringing together ecological, economic and social developments in order to insure the good development of future generations. Managing solid

waste in a sustainable way prevents by definition waste to cause harm to human health and the environment and promote resource use optimization (UN-habitat, 2009).

2.3.3.1. Approaches

Developing and implementing a sustainable SWM requires initially changing perceptions on waste. Waste should indeed not be considered as rejected element of a system but rather as part of it. During the 20th century SWM focuses on how to get rid of waste efficiently with minimum damage to public health and the environment. The 21st century observes a shift in the approach by considering waste management rather as a resource management. The issue relies thereby on how the discarded resources can be handled in ways that do not deprive future generations of some, if not all, of their value (Connett, in UNEP [1], 2009).

The concept of Integrated Solid Waste Management (ISWM) has been developed as a strategic planning for sustainable waste management. It gained in popularity for the last years and became lately a frame of reference for designing and implementing sustainable waste management systems or optimizing existing ones (UNEP [1], 2009). ISWM is on one side based on the “3R principle”: reduce, reuse and recycled – ranked according to the priority, starting for the highest -, and it considers on the other side the inclusion of all stakeholders.

The need for ISWM relies in the urgency in managing the large amount of waste generated causing numerous and serious socio-economic and environmental degradations and preventing therefore the good development of the new generation. Leaders in this field are in the Belgium region Flanders and California. Dublin in Ireland, Cape Town in South Africa or Pune in India, are cities undertaking nowadays the implementation of ISWM. And some local initiatives for the application of the 3R concept happen also in several developing countries around universities and NGOs¹².

2.3.3.2. Good practices solution

Reduce

Considering the current increase in waste generation all around the world, UN-Habitat (2009, p.26) estimates that the amount of waste produced will double around every 10 years. Consequently the time a city takes the decision of siting a new landfill and implementing it, the amount of waste that needs to be treated would have doubled (UN-Habitat, 2009). It appears therefore as essential to start reducing waste generation with prevention measures. Also called waste avoidance or waste minimization, this strategy aims at reduce the volume and toxicity of material discarded (Adapted from European Commission definition, in UN-Habitat, 2009). It consists in re-designing products and changing purchasing behavior (UNEP [1], 2009). Furthermore waste prevention helps in saving money.

European countries give nowadays growing political and regulatory attention to waste prevention. An EU Directive on Waste expects member states to establish national waste prevention programmes by December 2013 (UN-Habitat, 2009). Some initiatives in developed

¹² www.3rkh.net

countries aim at developing more sustainable practices by adopting the concept of sustainable consumption and production (SCP)¹³.

Reuse

According to UN-Habitat (2009), reusing is the method among the most suitable practices in our current society for reducing the amount of waste ending up in landfill. But for its implementation and development, the approach on reusing waste needs to change and especially in Western countries. For instance individual initiatives for repairing households' items seem to progressively disappear. Buying new items instead of repairing the old ones corresponds to over-consumption happening in numerous societies and especially the developed ones. Planned obsolescence partly explains this behavior. In some industrial design, the useful life of a product is planned or designed so it will become obsolete (unfashionable or no longer functional) after a certain period of time. The purpose of planned obsolescence is to put the consumer under pressure to purchase again. The consequent overconsumption is the source of large amount of waste. Refusing obsolescence is crucial by forbidding planned obsolescence practices.

In France a network for reused waste is developing throughout the country called “the resources network”¹⁴. Low- and middle-income countries “have a thriving reuse sector, built around small business” which develop numerous technics to reuse waste and thereby transform them back into products that can be sold (UN-Habitat, 2009, p.27).

Recycled

Recycling consists in closing the loop of material use. It does not only make sense from an environmental point of view but also economically (UN-Habitat, 2009). The market success of recycled products is determined by technical performance, appearance, consistency with specifications, transport logistics, institutional relations, prices and buyers perceptions. Sorting waste at its source represents advantages for recycling because it has impacts on its marketability. Sorting waste prevents in fact the material to be mixed with other waste, which deteriorate its quality. Recycled material quality influences the price and partly the marketability. Waste segregation before collection optimizes therefore recycling success.

In low- and middle-income countries, the informal sector undertakes most of the collection for recycling with the participation of waste pickers, itinerant waste buyers and informal recyclers and recovers (Wilson et al., 2006). The recovered materials are then sold and can thereby enter the value chain again. In developed countries emphasize is nowadays put on political incentives giving preference to materials with a high recycled content. By doing so the demand is expected to be simulated and the prices stabilized. The central government of the Netherlands encourages government at all levels through policies, to consider environmental and social aspects when purchasing products and services¹⁵.

¹³ www.scp-centre.org

¹⁴ *Le réseaux des ressourceries*, Official website : <http://www.ressourcerie.fr/reseau/> [Accessed on 10th March, 2012]

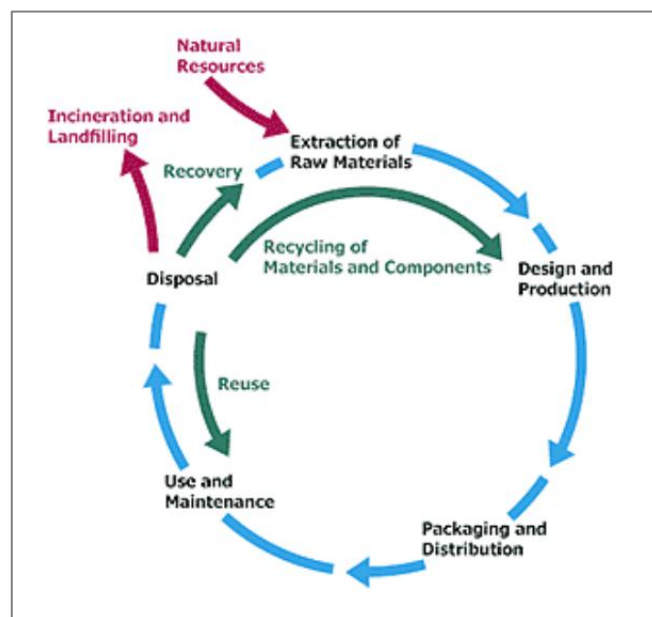
¹⁵ www.senternoven.nl/duurzaaminkopen/ [Accessed on 23th May, 2012]

Waste cycle

Diverting waste for material and resource recovery through reusing and recycling achieves a substantial reduction in final waste volume (UNEP [2], 2009) and on the other side it limits the exploitation of natural resources by assuring a loop in product utilization.

Reusing and recycling materials and components is a manner to consider waste as an element flowing into a cycle rather than a residual. Considering waste management as a loop corresponds to rejecting the notion of waste and especially the residual ones (cf. Figure 10). International organization such as UNEP and international NGOs such as ENDA encourage strongly the public sector, the private one and the civil society to approach waste management as a cycle rather than a linear process.

Figure 10: Waste cycle



Source: <http://www.unep.fr/scp/lifecycle/>

Although avoiding totally residual waste is in practice impossible, the aim is to get the closest to it. The concept of Zero Waste has been developed by Paul Connett who acknowledges the unfeasibility of erasing totally waste and highlights meanwhile the numerous possibilities to reduce it tremendously¹⁶.

Sustainable governance

Inclusivity is the integration of all stakeholders in the system without any dominance from one in planning, implementation and monitoring of changes. Although local authorities and the State are responsible for leading ISWM implementation, the success of it depends also largely on the actions of the entire society (UNEP [1], 2009). In the guide for implementing ISWM elaborated

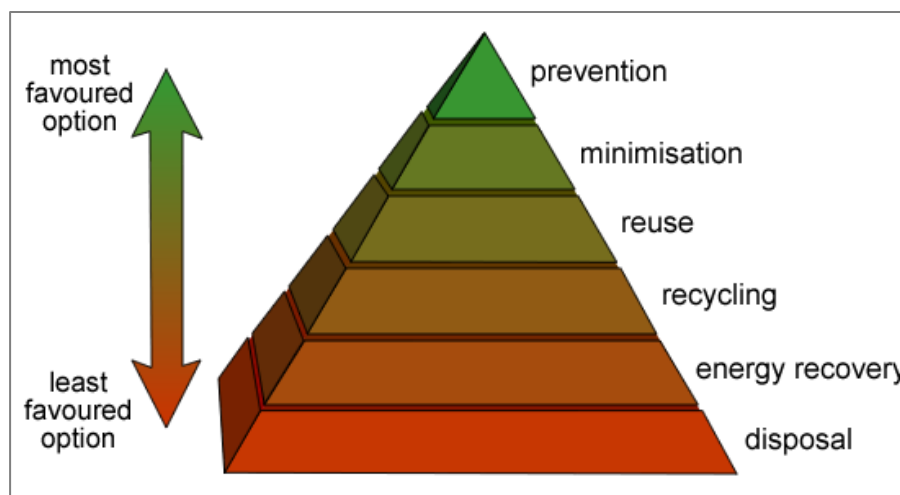
¹⁶ Official website : <http://myzerowaste.com/2010/02/dr-paul-connetts-zero-waste-and-sustainability/> [Accessed on 15th May, 2012]

by UNEP in 2009, tasks are assigned to each actor. The public sector is expected to prevent and minimize waste, to make available facilities for safe waste collection and disposal, and to participate in source separation and recycling services. They undertake the development of adequate legislative frame and enforce its regulation. Among the private sector, business and industrialists firstly are required to implement good practices in relation to waste prevention, minimization, recycling and disposal. They should implement on the other hand greener policies in-house. The packaging industry is responsible for improving packaging so their waste is reduced, reused and/or recycled. A shift towards more eco-design is expected to be made by these two last groups. The private sector active in SWM needs to continue their service expansion, provide innovative technologies and assist in the promotion of awareness on SWM and waste related issues. Together with the public sector, they are expected to develop infrastructures. Finally the civil society is encouraged to undertake waste projects at local level. Increased responsibility is taken as regards to disposal before collection and segregation. All the actors need to develop and conduct awareness programs on global waste related issues as well as their specific programs.

Conclusion

Characterizing failing and successful systems enables to get a clear understanding on the mechanisms behind SWM implementation. Avoiding degradations for the population today and for the future generations must be the aim of our current societies. Solutions rely in implementing efficient system while adopting a sustainable approach on waste management. What is considered as the last stage of waste management has a major role to play in this necessary evolution. Figure 11 below presents the options for treating and valorizing waste favored for the society. Entering in this pyramid is the first and main step that any country needs to do. Evolving in the pyramid is the next goal, until attaining the highest levels corresponding to a sustainable management. These last stages enable in fact to reduce the amount of waste flows and create loop with the flows. Thereby waste becomes just a temporary step in a product life.

Figure 11: The waste hierarchy



Source: Sligo County Council, 2008

General conclusion

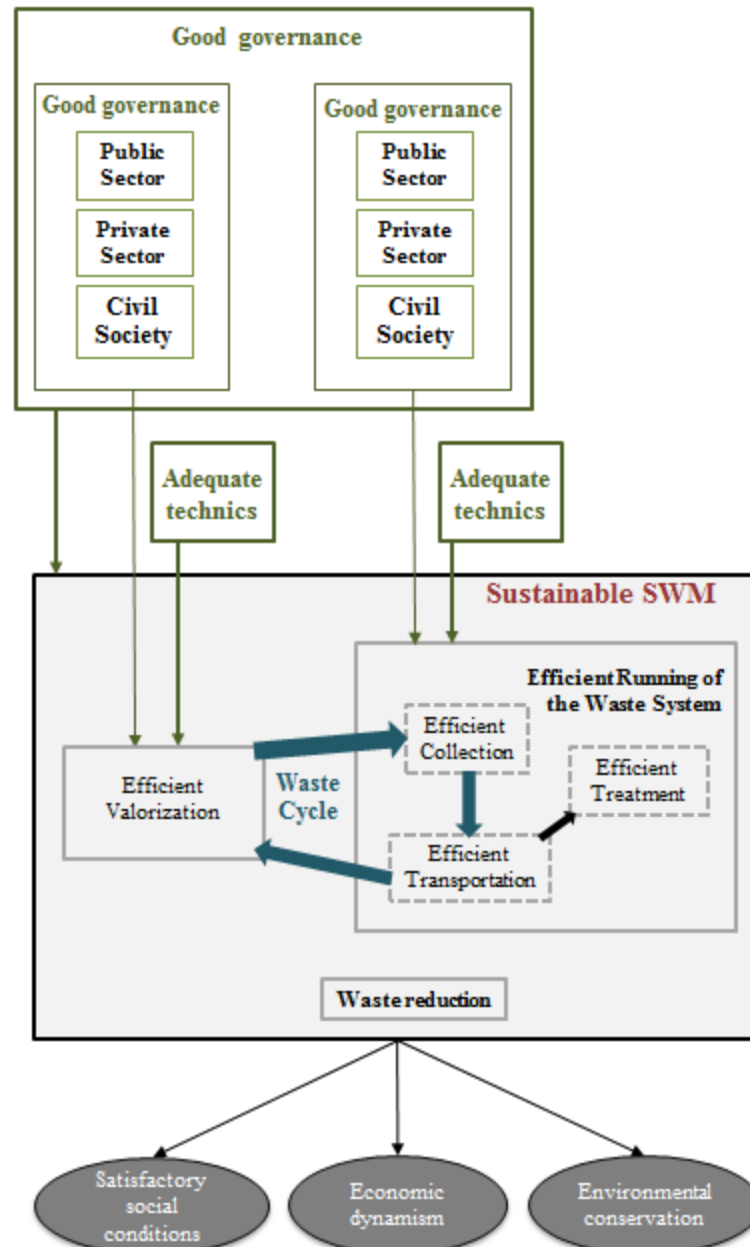
Literature on SWM and Sustainable SWM is large, and knowledge and awareness on the subject's challenges are advanced. Academics and international organizations provide accurate guides to understand waste management system, implement adequate technics and organization, or improve it. Finally numerous studies have been conducted on the consequences of mismanaged waste revealing the disastrous effects that it can have simultaneously on the population, the environment and the economy. The relevance of managing efficiently waste has been demonstrated also through the large potential that waste treatment and valorization have. Societies can indeed only gain from developing this sector. Furthermore the implications for the future generations' development show that SWM has definitely a role to play when talking about Sustainability. The approach on SWM must in fact go beyond the basic understanding on its mechanisms and implications. Sustainable SWM asks to change perceptions on waste by firstly avoiding its generation and then using the inevitably produced ones rather than rejecting it. To conclude SWM is a dynamic and well understood sector which has promising development perspectives.

But in spite of this, the review on SWM experiences is mitigated. While some systems are successful or showing promising evolutions, there are also some failing attempts or places where nothing is endeavored. Developed countries manage to remove efficiently their waste from the source of emission. Although waste treatment and valorization is meeting some great evolutions, it still needs some improvements - as shown on Figure 5 (p.26), open dump and sanitary landfill are still largely dominating the sector of waste treatment and valorization -. But it is in developing countries that the situation is the most worrying. Population is often exposed to waste accumulation and when collection is happening, it is rather to displace it further away from housing than treating or valorizing it. Disastrous situations such as in Brazil, India or Senegal have highlighted the urgency to react and it has caught thereby the attention of the whole society. It becomes urgent to give as much attention to waste collection as for waste treatment and valorization. The next chapter presents the situation in Senegal which is a developing country that does not make the exception of what has just been described.

2.4. Conceptual Framework

The literature review has enabled to build the following conceptual framework (Figure 12) which highlights the main components of sustainable SWM, its determinants and its impacts. The conceptual model helps in understanding the logical flow of the research in order to respond to the main research question: *“To what extent does governance in waste valorization sector lead to sustainable SWM in Senegal?”*

Figure 12: Conceptual Model



Sustainable SWM encompasses an efficient running of the waste system, a waste cycle and waste reduction. Accordingly, the totality of waste generated is removed from its generation

source and transported to adequate places. On one hand residual waste is disposed in controlled landfill and treated (represented by the black arrow). On the other hand, wastes that have potential in valorization are brought to valorization centers. The outputs are valorized products or valorized materials that can be integrated in industrialists' production processes. They produce thus "recycled products", which are then consumed and later changed into waste. Thereby a waste cycle is created where waste is as a resource that shifts from product to waste and from waste to product. In the conceptual model, the blue arrows represent the flows of wastes that can be valorized, forming the waste cycle.

There are two determinants for achieving SWM (presented in the green boxes): adequate technical aspects and good governance. On one hand technical aspects requires being adequate to local conditions. Besides, specific technics are applied to waste valorization, differentiated from the ones applied for the efficient running of the waste system. On the other hand, two types of governance are also distinguishable: one present in valorization sector and one in the other SWM stages. Good governance signifies the presence of all stakeholders working in cooperation while adopting an approach based on inclusivity. The public sector, private sector and civil society are therefore all involved in this management.

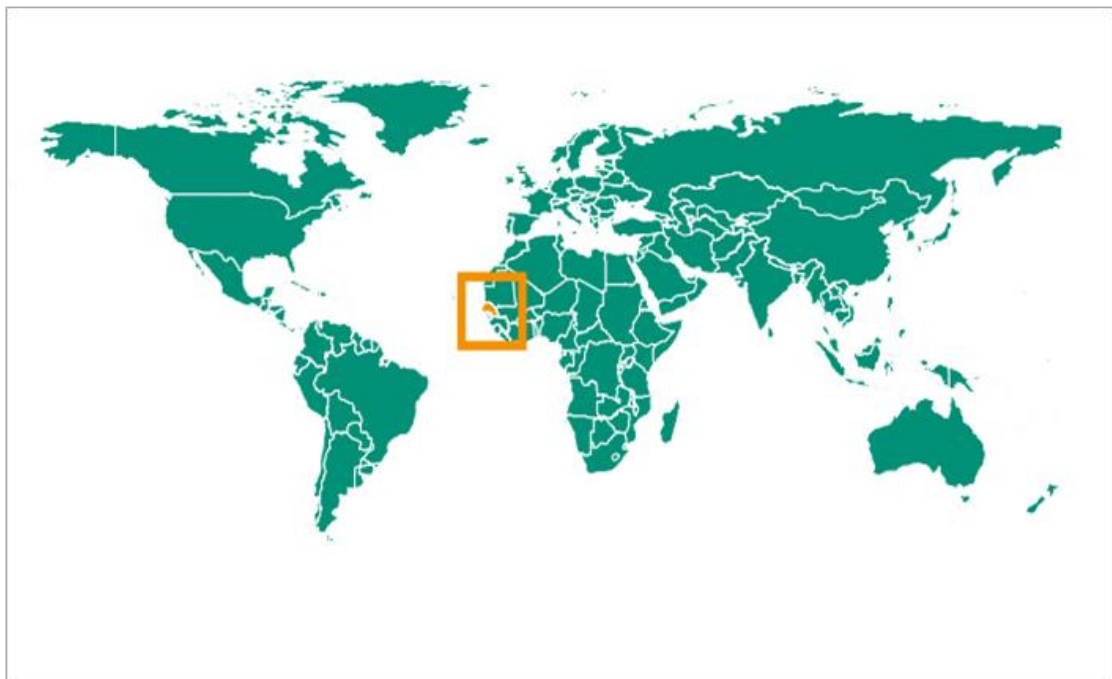
Finally, sustainable SWM benefits by definition to the entire society influencing positively the three principal spheres: economy, social and environment.

Chapter 3

Regional Context of the Research Area

Senegal is localized in West Africa with a coast along the Atlantic Ocean (cf. Figure 13). In 2011, the country was populated of approximately 12 850 000¹⁷ people among which 3 215 000 inhabit only in the region of the capital Dakar¹⁸ (in the center West as shown on **Erreur ! Source du renvoi introuvable.**). Demographic concentration around the capital is therefore relatively high with 24 per cent of the population on only 0.28 per cent of the national territory (UN-Habitat, 2009, p.6). The three largest cities have been encircled on Figure 14.

Figure 13 : Localization of Senegal on a world map



Source: UN-Habitat, 2008

¹⁷ Agence National de la Statistique et de la démographie (ANSD), http://www.ansd.sn/senegal_indicateurs.html [accessed on 13th June, 2012]

¹⁸ <http://www.populationdata.net/index2.php?option=palmares&rid=4&nom=grandes-villes>

Figure 14 : Map of Senegal



Source : Guide du routard, 2011

When looking at the main socio-economic indicators, Senegal presents yet some contradictions. On one hand the average economic growth is rather high with 4.3 per cent per year (World Bank, 2011)¹⁹. The evaluation of Ibrahim Index of African Governance (based on Safety and rule of law, participation and human rights, sustainable economic opportunity and human development) has ranked Senegal 15th among 52 countries in 2011²⁰. Despite these positive aspects the country faces still several social, political and environmental issues. HDI for Senegal is among the lowest (0.459) which ranks the country 155 among 187 (UN-Habitat, 2009). The corruption index is also relatively negative for Senegal positioned 112th among 183 countries²¹ in 2012. Finally it has been acknowledged that the environment state continues to degrade (SNU, 2006). As a consequence Senegal is considered as a developing country that has to face crucial challenges for its development. According to the United Nations in Senegal, priority has now to be put on wealth creation and fight against poverty and hunger, in parallel of the access to health services and the promotion of rights for an environment healthy and sustainable (SNU, 2006).

¹⁹ Data available on the website: http://www.diplomatie.gouv.fr/fr/pays-zones-geo_833/senegal_355/presentation-du-senegal_1293/index.html . [accessed on 17th May, 2012]

²⁰ http://www.moibrahimfoundation.org/en/media/get/20111003_ENG2011-IIAG-ScoresTable.pdf [accessed on 14th June, 2012]

²¹ <http://www.transparency.org/country#SEN> [accessed on 13th June, 2012]

This last issue is challenged by the waste crisis that can easily be observable in Senegal due to the high presence of waste in the landscapes. The country faces in fact many difficulties to manage it. As everybody generates waste, population growth leads directly to waste generation growth. With a population growth estimated in 2011 at 2.5 per cent²², the waste situation is therefore likely to get worst in the coming years.

In order to provide an accurate presentation on where Senegal stands as regards to its waste, literature review based on international organizations' reports and local literature has been conducted. The main characteristics of the current situation, the driving forces behind it, the related socio-economic and environmental consequences and the main challenges for the future of the country are presented in the following parts.

3.1. The facts

3.1.1. Significant waste generation increase

All countries around the world produce always more waste. This worldwide growth is caused by change in consumption due to increase in the living standards. This trend is easily observable in many African cities due to growing waste accumulation in public spaces and uncontrolled landfills. Solid waste generation is indeed one of the most apparent elements when looking at the environmental crisis that nearly all African cities are facing. And Senegal does not make the exception. Following the global trend, the country faces a growing amount of waste and especially in area where the concentration of the population and the economic activities are prominent such as Dakar where congestion is high. It is difficult to estimate waste generation in developing countries because of the absence of waste service in many places, especially in rural ones. The NGO LVIA (undated, p.6) estimated waste generation in large cities at 0.6kg/inhabitant/day in average. Waste generation of the capital and its region is the largest with 475 000 tons generated every year (Diallo, 2007). This number is expected to double in 10 years in certain cities such as Ziguinchor (LVIA, undated). A large part of waste accumulates without being treated or valorized since waste collection and elimination are weak in all Senegalese urban centers and especially in Dakar (United Nations, 1997).

3.1.2. Failing waste management

The growing amount of waste is easily observable because badly managed. Municipalities received the responsibility of the management but the lack of resources and willingness leads to failing system. Source of funding for the service is based on a tax called TEOM (tax for removing municipal solid waste)²³. Its recovery is very low in all Senegalese municipalities with rarely more than 30% of the population paying it (ONU-HABITAT [2], 2008; LVIA, undated, p.27). A vicious circle takes place where financial difficulties worsen technical aspects and the willingness to act for improvement. SWM stays therefore one of the biggest challenges for authorities.

Incomplete municipal waste collection

It exist two means to collect solid waste: directly at the source (at households, institutions or enterprises) and collection from small waste disposal centers (where waste have already been disposed). Although the door-to-door collection is preferred, the second technic is also often used, mainly in areas where access is limited. Official disposal places are firstly needed in order

²² http://www.indexmundi.com/senegal/population_growth_rate.html [accessed on 13th June, 2012]

²³ TEOM (*Taxe pour l'Enlèvement des ordures Ménagères*)

to receive the waste collected. In many places however, and especially in rural areas, official disposal places are not designated and collection system is inexistent or failing. The territory covered by efficient system of waste collection is therefore limited (ONU-HABITAT [1], 2008). In average, only 21.4 per cent of Senegalese households can enjoy waste collection service and it concerns one household out of two in urban areas (ONU-HABITAT [2], 2008, p.21). This numbers are close to African average – 50 per cent of urban waste is collected in the largest urban cities - (ENDA PRECEUP / ENDA RUP, 1998, p.43). With no adequate disposal places and inefficient or inexistent collection system, people have no other choice than dumping anarchically their waste in public spaces or uncontrolled dump sites. On the other hand avoiding totally waste accumulation does not only rely in waste collection. A collection without treatment or valorization is a collection without purpose which corresponds merely to displacing waste around the city. It is yet often the case in Senegalese municipalities.

Waste treatment and valorization informally developed and formally at an embryonic stage

Besides, efficient collection and efficient transport, SWM requires also efficient waste treatment. However, “removal of waste from houses and city streets was the main priority of cities’ waste management systems for nearly a century, with little or no attention to what was then done with it” (UN-Habitat, 2009, p.20). Senegal does not make the exception and ONU-Habitat accordingly observes that the system of transformation and recycling of the waste is nonexistent or weak ([1] 2008). If collected, waste ends up then either in public spaces or at the municipality boarder in uncontrolled landfills. When entering a municipality in Senegal the observer is nearly systematically confronted to anarchical waste accumulation. Even Dakar which produces the highest amount of waste does not have a controlled landfill. The totality of waste collected among waste generated ends up in the uncontrolled landfill called Mbeubeus which receives approximately 1 249 tons of waste every day (APROSEN & WWF, 2010, p.14). The daily amounts brought are higher that the receiving capacity and as a consequence Mbeubeus is overcrowded embodying an ecological disaster (ONU-HABITAT [1], 2008). Waste treatment is therefore nearly inexistent in Senegal while waste valorization is at an embryonic stage in the formal one and mainly happening in the informal sector. Considering the lack of resources and knowledge characterizing the informal sector, treatment and valorization stays rather underdeveloped and limited to basic reuse. The current economic difficulties that the country is facing explain also the actual large informal sector. In spite of the positive economic growth, job creation is not sufficient and unemployment stays high. 49 per cent of the active population were considered as unemployed in 2010 (Agence Nationale de la Statistique et de la démographie du Sénégal, 2010)²⁴. The half of this population is constituted of women and young people (SNU, 2006).

The underdevelopment of waste treatment and valorization in the Senegalese formal sector should not hide from view the large informal development of the sector. However it is far from being sufficient for efficient SWM. Failing collection combined with rare treatment and large informal valorization lead to the current worrying situation that Senegal is facing. Solutions rely partly in understanding the causes of the nuisances.

²⁴ Data available on the website: http://www.diplomatie.gouv.fr/fr/pays-zones-geo_833/senegal_355/presentation-du-senegal_1293/index.html . [accessed on 17th May, 2012]

3.2.The causes

Urbanization is a direct cause of the alarming waste situation in Senegal while the underlying cause comes from the political sphere.

3.2.1. Urbanization

As opposed to the rest of West African countries, Senegal had an urban sector at the embryonic stage at its independence. From this point in time, rural migration has become rapidly the new engine for urbanization. It was mainly motivated by the deterioration of the living conditions in the countryside, cross-border trade, tourism and fishing, and was principally directed towards the capital. Accordingly national urbanization rate is nowadays positive and relatively high by reaching 40.7 per cent per year in 2002 (SNU, 2006, p.4). At the regional level, Dakar's region has the highest rate with 96.6 per cent per year in 2004 corresponding to a relatively high population density of 5 328.4 hab./km² compare to the national one standing at 51 hab./km² in 2010²⁵. In parallel of population growth, urbanization is characterized by economic dynamism and has therefore led in Senegal to a concentration of the activities around Dakar. The region has become the economic core of the country by clustering 83 per cent of the modern enterprises and by generating 55 pour cent of the national GDP (UN-Habitat, 2009, p.6). Dakar has never been so attractive and it is not expected to change. The future creation of Exclusive Economic Zone (EEZ) and free-trade platforms will keep on stimulating these trends. The direct consequence is the high attractiveness of the region and a resultant polarization around Dakar. This centralization is deeply implemented in Senegalese urban pattern and continues to be stimulated by the increasing inter-cities migration mainly turned towards Dakar. However a progressive and more homogeneous redistribution of urban population across the country is nowadays happening. Although Dakar is the first and largest attractive pole, secondary cities grow as well despite lower urbanization rates. Among the total urban population, the share present in Dakar keeps in fact on decreasing, shifting from 80 per cent in 1988 to 53 per cent 2003 (ONU-Habitat [2], 2008, p.10). Natural population growth and constant rural migration has participated to the emergence of secondary urban centers. The second and third largest cities in Senegal are Kaolack and Thiès (cf. Figure 14) with respective population and population growth of 263 500 inhabitants with a growth of 3.5 per cent per year²⁶, and 260 000 inhabitants with a growth of 2.7 per cent per year (ONU-Habitat [1], 2008, p.10). These two cities have particular geographical positions which participate directly to their attractiveness. On one hand Kaolack is located at a cross road between the capital's region in the West-North, Mali in the East, the Gambia in the South and the Senegalese regions located in the South of the Gambia. On the other hand, Thiès is the largest city in the surroundings of Dakar and can thereby enjoy the proximity of the industrial clustering. Due to these advantageous localizations, opportunities are multiple and the United Nations have therefore judged that Kaolack and Thiès' attractiveness is not expected to decrease in the coming decades (ONU-Habitat [2], 2008).

The urbanization that Dakar and secondary urban centers are experiencing presents on one side advantages: economic activities concentration, economic dynamism, higher wedges, better service quality, higher alphabetization, better quality of life and access to information and innovation. On the other side however high urbanization rate is putting pressure on cities due to higher demand for housing and urban sprawl often happening in an anarchical way in developing countries (UN-Habitat, 2009). The main driving force behind urbanization is the

²⁵ Data available on the website: http://www.diplomatie.gouv.fr/fr/pays-zones-geo_833/senegal_355/presentation-du-senegal_1293/index.html . [accessed on 17th May, 2012]

²⁶ http://www.ceps.gouv.sn/doc_publication/planification/PRDI/prdi_thies.pdf [Accessed on 28th June]

migration of poor people from rural areas. As a consequence poverty increases as well within urban areas. Living conditions are likely to be unhealthy and the environment degraded. Environmental degradations can be differentiated between the ones caused by poverty and the ones associated with economic growth (Enda PRECEUP / ENDA RUP, 1998), but are interlinked in large cities partly because of urbanization. The SONESS (Senegalese public actor responsible for the water exploitation and distribution) has evaluated the water quality of the main groundwater in Dakar and found out a high pollution rate. They concluded that the sanitary state of Dakar's region was the most deplorable in Senegal (Bulle, 1995). The bridge between urbanization and pollution is to a large extent constituted by waste. Urbanization leads to pollution when town planning, including SWM, does not follow urbanization. Increase in the amount of waste generated following population growth, and new spatial population repartition require several adaptations in SWM. These tasks are yet highly challenging, especially in developing country where urbanization rate is high and slums spread. In such situation waste is therefore likely to proliferate and cause larger environmental degradations. Dakar, an old urban center from the colonialist time, gathers these characteristics for decades, while the emerging secondary cities get progressively closer to Dakar's situation. Human driven economic, social and environmental degradations can take large proportions with disastrous consequences as the current solid waste crises in every Senegalese urban center prove it. Beyond cultural, climatic or political specificities, the large difficulties faced by Senegalese municipalities are to a large extent caused the rhythm and type of urban development (Niang, 2005). The need to tackle urbanization negative implications is high and can be partly resolved by developing efficient SWM through firstly the formulation of legislative frame.

3.2.2. Institutional instability and incomplete decentralization

A legislative frame for SWM exists in Senegal and puts accordingly the basis of governance in SWM. It is characterized by public responsibility and decentralization, which are both considered as guidelines for the last decades but present yet limits and paradoxes.

The distribution of responsibility for SWM is embedded in a twenty-year old process of decentralization. The shift towards decentralization has been initiated by the government during the early 90s through the delegation of a growing number of tasks to local authorities. In 1996 the responsibilities for town planning, sanitation, health service, and environment protection have been officially transferred according to the laws n°36 (ONU-HABITAT [2], 2008). The formulation of a new constitution and the Environmental Code in 2001 have generally reinforced the process of decentralization and confirmed the major role of municipalities in preserving the environment by managing efficiently waste. SWM relies in fact in the four domains previously mentioned and municipalities are correspondingly expected to plan and manage SWM, by themselves or by sub-contracting (LVIA, undated). They are accordingly encouraged to find partners when it is judged necessary. The articles L32 and L36 - in the Environmental Code of Senegal²⁷ - precise these tasks by assigning responsibility from waste collection to waste elimination and valorization, and expecting therefore municipalities to prevent anarchical waste dump sites' creation. The aim is to promote a management close to local issues and strengthen thereby local management and local responsibility (Seye, 2009). But despite the apparent decentralization's integration into Senegalese system, it has yet some limits in the legislative frames. The transfer of responsibility has not been accompanied by the correspondent and necessary transfers of financial resources (LVIA, undated). The subsidies made available by the State have in fact not been augmented in spite of the increasing number of tasks assigned. Financial and technical difficulties have quickly been observed making in

²⁷ Environmental Code, 2001

many cases municipalities incapable of managing their waste. Yet, these difficulties have been foreseen by the government who has created already in 2000 public agencies to assist municipalities, among which some specialized in SWM. However, the responsibilities assigned to these agencies were controversial and the succession of new agencies for overcoming consecutive limits has prevented all of them to achieve their objectives. Moreover these successive changes have created more confusion than it has improved SWM's performances. The situation as regards to the agencies' creation is described more accurately in Box 11.

These successive changes characterized the institutional instability in Senegalese governance in SWM. A lack of transparency in the institutional arrangements was observable already in the 1970s according to Cissé (2007). Nowadays the distribution of responsibility is official but unstable which leads to confusion among actors and jeopardizes SWM performances (Seye, 2009). However, TA Thu Thuy claims that efficient control of solid waste goes systematically through a stable institutional frame and population awareness (2001). Institutional instability prevents indeed people to comprehend the issues and limit therefore their participation. On the other hand, it also proves that decentralization is not complete. The creation of agency is an unofficial but effective return of the responsibility to central structures in detriment of local authorities. Furthermore, the State keeps a hand on municipal management and allows therefore itself a certain form of interventionism. This trend common to many African societies according to TA Thu Thuy (2001) does not make the exception in Senegal where the State is for instance able to suspend or fire municipal council's presidents and mayors (ONU-HABITAT [2], 2008). Incomplete decentralization combined with institutional instability lead to institutional confusion and conflicts of jurisdiction (Enda-ecopop & UWEP, 1997). The concrete role of local authorities is unclear and so are consequently the governance and the organization of SWM. The growing participation of the private sector and the civil society in parallel has directly participated to the multiplication of stakeholders in SWM and worsened the already existing confusion. Finally the unclearness of responsibility distribution in SWM might be also explained by the transversal character of this specific management. SWM must be considered in the legal frames of sanitation, environment and local authorities. There is therefore a need for complementarity and a risk of inconsistencies between the sectors (VIE, 2008).

Box 11 - The successive creation of public assistant agencies in SWM

APRODAK (Agency for the cleanliness in Dakar) has been created in 2000, under the initiative of the Ministry of the Environment. This agency was in charge of the coordination, the monitoring and control of the actions application concerning the collection, transport and treatment in Dakar's region. The success of the agency comforted the Ministry of the Environment in its strategy and encouraged them to expand the agency's activities to the entire territory for supporting equally all municipalities. Therefore the spatial scope of the agency APRODAK was enlarged which marked the creation of APROSEN in 2006 (Agency for the Cleanliness in Senegal). Although the State realized the important to consider the entire territory, a particular and specific attention kept to be given to Dakar. In theory APROSEN was in charge of the entire territory but acted yet rather on the territory outside Dakar. The structure CADAQ-CAR has been in parallel created for the only city of Dakar. But despite the transfer of responsibility from the ministry of the environment to CADAQ-CAR, it did not have the full responsibility of SWM. In practice the State kept a hand on the management by choosing private partners (AMA, Veolia, i.e.). APROSEN in parallel has lived considerable changes in its status partly due to its financial limitation. It was supposed to be replaced by SOPROSEN, a national society partly owned by private investors, expected to fund SWM of municipalities – except Dakar -. This shift goes in the counter sense of decentralization and has been therefore criticized. Presently APROSEN does not exist anymore but SOPROSEN has not yet been created. And due to the recent presidential elections, the process has been suspended.

3.3.The consequences

The mismanagement of increasing waste amount in Senegal has negative repercussions on the economic, social and environmental spheres. There is yet a positive aspect in this situation in the sense that crisis stimulates changes. The waste situation became lately alarming enough to make people react. Awareness on waste and waste management related issues can nowadays be observed in Senegal.

3.3.1. Environmental, social and economic degradations

Senegal is facing two types of problems: the ones related to natural resources management and the ones related to management of the living.

Environmental degradations

The United Nations observe in their Common Country Assessment on Senegal (2006) that the natural resources are mismanaged and the environmental and ecological situation continues hence to degrade. Reaching the OMD 7 (Sustainable Environment) has consequently low probability to happen in the coming years (Bilan Commun de Pays (CCA) Sénégal, 2006). Loss of biodiversity or proliferation of exotic and invasive plants is among the main ecological problems that Senegal is currently facing (SNU & Gouvernement du Sénégal, 2006). Niang (2005) recognizes four main impacts of waste on the environment. Landscape deteriorations are caused by anarchical and spontaneous waste accumulations in public spaces or scattered dumping. The waste invasion in the environment is worsened by the volatility of certain waste type – especially light plastic stopped by any obstacle -. Animal health and life is put in danger because of injection of plastic. Because of the negative influence of the physic-chemical characteristics of plastic bags on animal organisms, plastic injection is the first mortality cause of Senegalese cattle.

Degraded social conditions

On the other hand Senegal is facing problems in managing the living. Living conditions are in general relatively poor and unhealthy as the low HDI reflects it (0.459) (PNUD, 2010). Limited access to services explains to a large extent this situation.

Negative economic impacts

Numerous practices in waste treatment and valorization in Senegal proved the dynamism of business for secondary materials. This is however made in the informal sector which does not guarantee healthy and secured working conditions. 300 persons gathered in 2 spontaneous villages live permanently in the landfill Mbeubeus (Niang, 2005, p.30). The proximity with waste is highly unhealthy and dangerous. The activities of the waste informal sector do not participate to the national economic growth, are not taxed and cannot therefore contribute to the development of public services.

These categories are actually interconnected and a negative feedback loop might happen under specific conditions as it has been described in part XX, Failing SWM. International organizations and national NGOs observe the negative feedback loop occurring in Senegal (ONU-Habitat [2], 2008; APROSEN & IAGU, 2009). In poor living conditions, access to services such as SWM is limited. It causes environmental degradations partly through pollution. Degraded environment affects negatively living conditions due to polluted water for instance. Viable economic activities can hardly develop in such situations. With a lack of income, living conditions can barely be enhanced. As a conclusion, the degraded environment is

interconnected with bad living conditions and lethargic economic activities. Waste has an intermediate position in it. Dakar is an illustration of that at a smaller scale.

3.3.2. Growing awareness on the need for sustainable SWM and local initiatives

Crisis – including waste ones- lead to changes. The one that Senegal is currently living obliges the country to react and become conscious of its responsibility and duties. A growing awareness on waste related issues can be observed through the commitments done on international scene, formulation of national legislations and financial investments.

International commitments

Attending the Earth Summit in Rio (1992) and Johannesburg (2002) was the opportunity for Senegal to commit on the international scene. Therefore nearly all the international conventions and protocols concerning the environment have been ratified. Senegal has also approved the convention of Bale -on the control of dangerous waste trans-frontier movements and dangerous waste rational elimination- and confirmed his willingness to apply

the recommendations formulated in the Agenda 21. According to it, production and consumption should be turned into a sustainable way and a ministry concentrating partly on the Senegalese economic system has been created (SNU, 2006). Reports are regularly published about the advancements in the implementation of the Agenda 21. Finally the Senegalese section of the United Nations in cooperation with the Senegalese government has highlighted domains on which the country should focus on in order to reach OMD. Although SWM is not clearly mentioned, it has an implicit major place (SNU, 2006) (cf. Box 12). However reports are not sufficient since they do not substitute policies, laws and decrees (SNDD, 2003). Accordingly the Senegalese State has to formulate policies which are based on the reports' outcomes and on the international conventions and protocols signed.

Box 12 - Priorities for reaching the OMD in Senegal

The four following points, formulated by the Senegalese section of the United Nations and the Senegalese government, are priorities for the country progress towards the OMDs (SNU, 2006).

1. Vanishing poverty and hunger
2. Guaranteeing the access to social services
3. Ensuring the healthy and sustainable environment
4. Implementing on the long term an efficient governance with cooperation for development

SWM has here a crucial role by helping in achieving priority one and having an important place for reaching

National Actions

Legislative frame

Besides international commitments, countries are also required to establish their own directives and monitor their running. For the last twenty years the Senegalese State is following this line and has therefore formulated legislative frames for environmental state improvement, which concerns both ecological and social environment.

In 1975, the Ministry of the Environment has been founded. A first strategy on natural resources management and environmental management has been

Box 13 - The Senegalese Code of the Environment

The article L 30 (chapter II) in the Code of the Environment stipulates that waste must be eliminated or recycled in an ecologic way in order to prevent harmful effects on human health, natural resources, fauna and flora or environment quality. The article L 31 (chapter II) specifies that any person generating waste is in charge of its elimination or recycling; or in charge of transferring the task to structures recognized by the Ministry of the Environment.

formulated 20 years later, monitored by the National Commission for Sustainable Development. The researches and evaluation driven during the two following years has enabled the formulation a National Action Plan for the Environment (PNAE)²⁸. An update has been formulated in 2003, called the National Strategy for Sustainable Development (SNDD)²⁹ which included a national strategy for integrated waste management. It distinguished clearly the roles and responsibilities of each stakeholder in a decentralized approach (United Nations, 2009). As explained in 3.2.2. Institutional instability and incomplete decentralization (p.60), local authorities are indeed expected to have a leading role in SWM. The Senegalese Code of the Environment formulated in 2001 became rapidly the reference in terms of rational urban management, including municipal SWM. The consumer's responsibility is recognized and SWM is acknowledged as a public service crucial for public health and ecological environment protection. However waste valorization does not make the object of specifications. APROSEN and IAGU (2009, p.13) designate it as a "legal emptiness around waste valorization subject". Despite the relative oldness of the Code of the Environment, Senegal is currently living a waste crisis. The explanations behind it rely in the non-respect of the articles due to a lack of control. The Code of the Environment has therefore not been concretely implemented so far (Niang, 2005).

Governmental investments

Besides formulating policies, the authorities are also expected to undertake financial expenses. The Senegalese State has proved its commitment by setting up an annual budget for SWM. The capital's region receives 7 692 000 € every year, among which two thirds are destined to waste collection and transport, and the third left to waste treatment and valorization (ONU-Habitat, 2008, p.23). There is however no official publications on subsidies for secondary urban centers, which reveals a lack of transparency and potentially a lower interest.

Progressive participation of the civil society

As a common global trend, communities and NGOs are participating more and more in SWM (cf. Chapter 2). The Senegalese population must deal with the disastrous consequences of mismanaged waste and understands therefore the urgency in reacting and changing it. NGOs see also a priority in this issue and develop consequently a growing number of related programs. Box X gives an illustration on NGOs' involvement in programs driven in Senegal.

According to UN-Habitat collection quality depends on the engagement of the users (2009). The civil society has actually realized it and the role that it could play in implementing efficient SWM and improving thereby the overall environment. In instances of SWM development in Yeumbeul and Rufisque, support from NGOs and creation of grassroots organizations have enabled the implementation and running of a system managing solid waste (Bulle, 1995; Gaye & Diallo, 1997. In these experiences (described in Box 14 and Box 15), the place of local authorities was relatively limited or inexistent, and the largest part of the program relied on the civil society participation. Initiated by NGOs or

Box 14 - The NGO ENDA actively supporting community participation in Senegal

Dakar's main landfilled, organizations of waste pickers were relatively weak. An existing grassroots organization called "Bokk" received support from the NGO ENDA which has helped in up-grading the organizations. It has changed into an Economic Interest Group, comparable to private enterprise of small-size. In a project developed for water treatment in Rufisque, the NGO ENDA was taking care of the procedures for inhabitant's enrolment into the system. By facilitating their participation, the NGO has also stimulated it.

²⁸ PNAE : Plan National d'Action pour l'Environnement.

²⁹ SNDD : Stratégie Nationale pour le développement Durable.

grassroots organizations, community participation has been highly promoted in these programs.

Box 15 - Initiating and maintaining community participation in the suburbs of Dakar

In programs developed in Yeumbeul (Senegal) and Rufisque (Senegal), large efforts have been put in encouraging community participation. Consultations of the population combined with awareness programs and campaigns have led to a consciousness rising among the populations (ENDA, 2011). By understanding the causal-effect between disease, waste water and solid waste, communities realized their responsibilities in it. The participation has been then reinforced by asking communities to participate in the formulation of the program's guidelines through the elections of representatives for each neighborhood (Gaye & Diallo, 1997).

Besides, the financial system of SWM influences strongly its efficiency and is determined by people's willingness to pay and ability to pay, and the performances of the tax recovery. Accordingly the programs in Rufisque and Yeumbeul have integrated financial supports for the poorest, creating thereby collective solidarity, and attempted to improve the TEOM recovery (Rufisque, ENDA, 2011; Yeumbeul, Bulle, 1995).

UNESCO took also part in these programs by supporting already existing official and unofficial grassroots organizations. Thereby an "endogenous development" based on a bottom-up approach has been promoted (Bulle, 1995, p.2; Muller et al., 2002).

Conclusion

There is nowadays an apparent awareness from the Senegalese government, the industrialists and the civil society, on the current worrying situation and the importance of enhancing SWM. On one side the State is willing and attempting for several years to implement efficient policies and directives as regards to SWM and massive investments are made to strengthen the sector. Also SWM is getting a growing interest among the private sector for mainly sub-contracting, and the civil society in the search of environmental improvements.

However Senegal is currently confronted to a waste crisis whose gravity has never been so high. There is an evident lack of control on the legislation application and the investments hardly reach regions outside Dakar and are most of the time destined to waste collection and transport. As a consequence of the remaining failures in SWM, the economic, social and especially environmental crisis related to mismanaged waste are still very present and damaging the country. Strategies are urgently needed and should be directed towards the improvement of waste collection and transport, and the development of waste treatment and valorization. The literature review revealed that the direct and underlying causes rely in institutional, technical, financial and socio-cultural difficulties and efforts should therefore be put on these identified elements with especially the enforcement of the legislation. However in order to improve profoundly and on long term the Senegalese situation it seems that attention should especially be given to waste treatment and waste valorization sectors. The legislative imprecision and the gap in the local literature on these sectors prove their limited advancements and the low interest for their development. It would yet enable to complete SWM and leads to further economic, social and environmental benefits through the valorization of waste.

Chapter 4

The Current Different Facets of Waste Valorization in Senegal

The Senegalese valorization sector is firstly characterized by its apparent limited development. Dynamism in the sector is yet slowly rising which enables to contemplate development process. Yet practices are still incomplete and the abundance of mixed wastes in disposal places – public spaces or uncontrolled landfills - proves it. The constraints causing this situation are numerous and diverse, and stand in the main societal spheres. Yet valorizing waste presents also large potential. It exists indeed numerous opportunities for the sector which make its development possible and even promising.

This chapter gives an overview on the current different facets of the Senegalese waste valorization sector. In a first part a description on its current development state and practices is provided. Then, the environment which the sector evolves is analyzed. Depending on restrictions and opportunities, the environment of the sector is either an enabling or a deterring one, which determines therefore its development possibilities. Accordingly, the difficulties met by the sector are presented in a second part and the third part puts in light the opportunities and possibilities that exists in Senegal for the development of the valorization sector.

4.1.Underdevelopment state of waste valorization sector

The underdevelopment of the valorization sector in Senegal is typified by rudimentary practices. Due to the slow expansion of the formal sector and the large dominance of the informal one, organization and technics for waste valorization are not advanced. Only few official treatment centers are nowadays running and each of them only treats specific waste types in relatively small amount compared to waste generated. Valorization activities and exchanges of valorized waste are mainly happening informally. Numerous disposal and transformation places have been informally created and they are nowadays deeply implemented into the urban system, especially in Dakar. The “Packs” are places known by many, where specific wastes are brought and then recovered (cf. Picture 1).

Several of them exist in nearly all the districts of the capital and they all have their specialization. In the district Gueule Tapée for instance, the “Pack” installed cope essentially with recovering metals from cars. Combined with the presence in the street of numerous waste pickers, the waste valorization informal sector is relatively noticeable. This situation has several consequences on the sector current state. APROSEN and IAGU has evaluated that all types of waste were valorized in the Senegalese informal sector (2009). However processes are not advanced ones due to the lack of resources and knowledge characterizing informal workers. By being deprived of adequate infrastructures and equipment, valorization is consequently often reduced to basic reuse. Also because of the informal nature, knowledge on the sector is vague. Outside information presented in few reports essentially written by APROSEN and NGOs on the topic, there is a lack of precise data. Consequently the real size of the sector is difficult to

evaluate as well as the numbers of workers, their features and the features of their work. Thereby, only generable descriptions on the development stages of the main waste types currently valorized in Senegal can be provided.

Picture 1 : The “Pack” in the district SICAP-Rue10 in Dakar (Senegal), as a disposal and recovering place for plastics and scraps,



Source : Author, 2012

Metal is mainly recovered from scrap and e-waste³⁰. No formal circuit valorizing metals is recognized in Senegal but there are dynamic and numerous activities in the informal sector (APROSEN & IAGU, 2009). Consequently metal valorization has kept a craft aspect. While the amount of e-waste received increases every year in Senegal, the adequate infrastructures and technology to treat and valorize it are lacking. According to Mame Fatou (2009), essentially improvised treatment develops and thus not advanced recovering processes. IAGU estimates that only 20 per cent of the materials contained in e-waste are recovered (2009, p.19). As a consequence this large informal sector does not participate to the development of a strong and sustainable sector. Furthermore it puts yet in danger population's health and degrades the environment. Craft foundries enable to extract aluminum and lead, which are then sold to blacksmiths and fishermen. E-waste contains also glass, plastic, iron and copper. Other elements such as cathode ray tube, mercury, battery and PCB (Polychlorinated biphenyl) are rarely extracted and valorized because of their dangerousness and the high technology required. E-waste pickers do not have the adequate instruments to recover high-quality products. Plus stocking e-waste has requirements to avoid rust and depreciation that the informal sector can hardly fulfill. At the moment enterprises acting in this field are for the majority foreign ones. Especially Indian business men are buying to waste pickers recovered metals. The following Table 2 sums up the practices of metal waste valorization happening nowadays in Senegal.

³⁰ E-waste (or Waste Electrical and Electronic Equipment) are electrical or electronic devices discarded (Retrieved from: http://www.unep.org/PDF/PressReleases/E-Waste_publication_screen_FINALVERSION-sml.pdf [Accessed on 8 August 2012])

Table 2 : Practices of metal waste valorization in Senegal (Source: IAGU & Sénéclic, 2009)

Recycled Materials	Recycling in Senegal	Commercial outlets (or potential ones in the absence of recycling)
Lead and iron	Yes	Metal industry / Exportations to Asia (China and India)
Aluminum	Yes	Local craft industries
Copper	Yes	India and Europe
Precious Metals	No	Asia
Cathode ray tube	No	Europe
PCB	No	Exportations to Europe for treatment

Composting and marketing the output are activities which stay relatively undersized in Senegal. Two official compost centers have been installed in Joal and in the landfill Mbeubeus and their outcomes are directly sold to the surroundings farmers. On a national scale the exchanges of compost stay yet limited and the motivation of collectors to exploit this potential is relatively low. Economic studies have revealed that externalities for compost are rather limited (Hébette, 1996). Only market gardeners, horticulturists or hotels are interested to buy it. And among these potential buyers a large part is suspicious on compost relevance and shows hence some reluctance to use it. The main problem relies therefore in compost's profitability hard to reach³¹.

Picture 2 : Waste picker collecting plastic from informal waste disposal, Dakar (Senegal)



Source : Author, 2012

Plastic waste is the only type of waste which sees its formal valorization really developing during the last years. Formal plastic collection and treatment can be observed in few places in Senegal. Official plastic treatment centers are localized in Thiès (PROPLAST), Kaolack, Diamnado (Sodiaplast), Joal, Tivouane Diacksao and soon in Malika (APROSEN & WWF, 2010). The large diversity of plastic types obliges investment in specific equipment which often require large amount of water and electricity to run. In spite of these difficulties and the limited number of official centers, the newspaper VIE specialized in environmental issues (2008) acknowledges a growing national interest on plastic recycling in Senegal. However it should not hide from the view that plastic valorization is also happening to a large extent in the informal sector. The collected plastics thanks to door-to-door collection and landfill picking are then transported to “packs” for recovery (ENDA Tiers-Monde, 1990). The picture on the left hand side shows informal plastic waste collection in Dakar. It is afterward sold again within the informal market. Despite the important supply of plastic, the lack of

³¹ Representative of the Rosalux Institute, 2012

adequate infrastructures to treat it obliges Senegal to continue importing. 2 000 tons of plastic granules are imported every year to satisfy industrialists' demand. It should yet be reduced and even avoided in the benefit of local treated materials.

Finally valorization of fabrics, glass, wood and papers are happening in Senegal to a smaller extent. They are usually only reused without receiving any treatment or transformation. The interest on these types of waste is lower than on the types previously presented, and the practices are therefore lesser known.

These situations described are caused and to a certain extent maintained by several difficulties. These constraints to development find their origin in the environment in which the sector is supposed to evolve (institutional and legal, geographical-economic, economic and social difficulties) and in the sector in itself (financial and technical difficulties).

4.2. Difficulties in waste valorization sector

The difficulties presented in the following part rely in different spheres of the society and affect it in return. It hinders the sector development and prevents therefore the population to enjoy waste valorization benefits. These barriers presented in the following parts must therefore to be removed.

4.2.1. Institutional and legal difficulties

Legal framework for waste valorization sector is nearly inexistent in Senegal (APROSEN & WWF, 2009). The article L 30³² (chapter II) in the Code of the Environment stipulating that waste must be eliminated or recycled in an ecologic way is the only official regulation concerning waste treatment and valorization. This directive is vague and not sufficient for municipalities who need more instructions considering the underdeveloped state. On the other hand local authorities hardly recognize their responsibility in treating and valorizing waste or might be confused regarding their position. According to the authors Ali and Ahmed, "it is difficult for public bodies such as municipalities to change their traditional role of service provider to a new role of service partner and regulator" (2004, p.417). Yet, the need for partnership in this sector is crucial. Official central structure that could organize and regulate the sector does not exist anymore since APROSEN have been closed down without replacement (cf. Chapter 3, p.55).

This confusion leads to the emergence of isolated initiatives which do not help an overall development of the sector. Collective actions to create and develop waste treating centers happen only at a local scale. In these few formal structures, processing capacities and productivity are limited which restrain the possibilities for expansion. There is therefore a lack of coherence in the activities of waste valorization. It leads to a lack of transparency and it adds constraints in the potential cooperation between the actors. According to APROSEN and WWF, such situation increases rivalry and competition between the actors (2009). Yet transparency,

³² Code of the Environment, 2001

fairness and accountability are crucial to not open up the sector for further corruption and inefficiency (Ali & Ahmed, 2004). A vicious circle exist thus, whose outcome is a growing informal sector. The absence of formal structure restrains indeed the possible cooperation with industries, cooperation with the municipalities and the integration into the formal sector. In this situation waste valorization can thus hardly move away from the informal sector toward the formal one.

The legislative framework appears on one hand unclear concerning the roles and place of the municipalities (APROSEN & IAGU, 2009). On the other hand no control is put on the responsibility assigned to industrialists to manage their waste. Also specific norms on products' manufacturing would enable valorization or increase its efficiency (cf. Box 16).

Box 16 - Regulation on plastic bags for improved valorization

The national agency APROSEN, the NGOs WWF (2010) and the author Niang (2005) advocate the establishment of norms on the chemical composition of plastic bags. In Senegal, they are often used but their quality is very low causing an early tearing. The lack of resistance is the result of a specific and cheaper chemical composition. Law forbidding such design would limit its overused and the related degradations.

4.2.2. Geographical-economic difficulties

Commercial outlets for treated waste encompass industrialists willing to integrate it in their production process. On the other side 83 per cent of industries, which could potentially buy valorized materials, are localized in Dakar's region (UN-Habitat, 2008, p.6). This geographical distribution corresponds thus to a high concentration of market development possibilities on restricted space. It constrains consequently homogeneous development of the sector throughout the country and limits it to only one region. The other regions meet therefore economic restrictions by having less externality. There are therefore spatial inequalities between urban and rural areas in general and between Dakar's region and the other ones more specifically.

However, when looking at plastic treatment for instance, the current distribution of treatment centers reveals that existing formal treatment centers are not concentrated in Dakar's region (cf. Figure 15, p.80). More specific economic difficulties might explain this spatial distribution.

4.2.3. Economic difficulties

The large informal sector has a symbiotic relationship with the formal sector. Sometimes however, this relation might hinder the development of the formal one because of the networks already deeply implement and hard to enter for an outsider. Especially in Dakar informal networks are dominating the market and make it therefore difficult for formal structures to integrate. The current installation of the pre-treatment center in Malika for instance would not have been possible without the cooperation with the already implemented informal workers. Such units cannot run if not integrated in the existing network³³.

³³ Director of the center in Thiès, 2012

Secondly the market of treated waste is still relatively underdeveloped and local commercial outlets are therefore lacking. As a consequence, large parts of treated waste are hence exported to the European and Asian markets. These exports prevent yet the development of local treatment centers and local markets.

4.2.4. Social difficulties

The poor perception of the society on waste is another constraint for the sector development. People reject waste rapidly after its generation. A clear distinction is made between private spaces and public spaces. Senegalese women are reputed to keep their house clean. Some even sweep the front pavements while merchants sweep their front shops. Besides many activities are happening in the streets such as eating, drinking, washing or working. Weavers, cabinetmakers or mechanics are often working on the pavements due to the relative high price for them of private local. Senegalese people enjoy spending time together in public spaces, and yet many degrade it by dumping anarchically their waste. The picture Picture 3 shows a waste pile located next to one of the markets in Dakar. This scene is relatively common in the capital. This particular approach on the public spaces might also found its explanation in the culture (cf. Box 17).

Picture 3 : Waste piles at a border market, Dakar (Sénégal)



Source : Author, 2012

Box 17 – Negligence in public spaces

Streets are “public goods” whose direct translation in Wolof “allalou buur” signifies “king’s property”. It refers to a space which is owned by nobody and whose cleanness is the province of the “king”, that is to say the State. As a consequence people throw their waste in public spaces and justify this behavior with the expected responsibility of

People live in the proximity of waste piles but they often refuse the official implementation of landfill when it is in their surroundings, although it would be healthier for them. But it also fixes definitely waste at one place. There are several instances where communities contested projects for landfill creation until its annulments. The

municipality of Thiès for instance had to withdraw its landfill plan under the pressure of the surroundings community³⁴. The municipality of Saint-Louis fails in installing transfer sites in districts due to the disagreement of surroundings inhabitants³⁵.

The low perception on waste hinders also the implementation of primary sorting schemes. It has been proven that households segregating their waste participates to a large extent to the sector’s performances (VIE, 2008). It necessitates adequate infrastructures (to collect the different waste

³⁴ Representative of LVIA, 2012

³⁵ Director of Saint-Louis’ urban development agency , 2012

types) and collaboration of the population. Bins of different types would help physical segregation in public spaces and at the households. However the largest difficulty in establishing waste sorting would come from the questionable population participation. People are reluctant to deal with their waste longer than the time needed for just gathering and disposing it outside the house. According to Zombé (1997, in APROSEN & WWF, 2009), around 30 per cent of the households in Dakar would refuse to sort their waste if asked. Therefore the behavior change for waste segregation appears as a long-term process. Finally the poor perception on waste has also influences on the way waste related works and waste workers are perceived. As a consequence little attention is given to their working conditions and waste pickers are considered as unclean or wrongdoer. Households for instance do not dispose their waste in closed bags which would help its removal by the collector, and prevent risks of spreading (cf. Picture 4 and Picture 5). Collectors have thus to collect by hand - not always covered - the unpacked waste. It is highly degrading for the workers and might jeopardize the workers' efficiency.

However recent positive changes prove that the situation evolves in the right direction. The Senegalese civil society especially (and especially NGOs) is acting in changing this image through education and presentation of successful practices. More adequate waste disposal can

**Picture 5 : Waste disposal in bins, Dakar
(Senegal)**



Source : Author, 2012

**Picture 4 : Waste disposal half anarchically
dumped and half properly disposed, Dakar
(Senegal)**



Source : Author, 2012

**Picture 6 : Official waste collectors
sorting waste while collecting, Dakar
(Senegal)**



Source : Author, 2012

be observed in certain districts and sorting is rising among waste workers. Picture 4 and Picture 5 show the progressive evolution with some inhabitants starting to dispose adequately their waste. On the Picture 6 sorting is observed among waste pickers at the waste generation source.

Industrialists have also a role to play in changing perceptions on waste. The commercialization of the products depends partly on its marketing. Efficient communication plan on recycled product showing its impacts on the environment and contribution to poverty reduction (by generating revenues) participates in changing perceptions. Consumers should understand the implications in buying recycled products. Furthermore it is in their interest to change mentalities since the success of their products depend on its acceptance on the market by the population.

Besides, the high vulnerability of waste workers participates also in deterring the sector environment. If waste valorization is done in the legal working conditions, the risks in manipulating it for the workers are low. However the sector of waste valorization is still today mainly an informal one in Senegal. Therefore the working conditions are often highly harmful for the workers' health. These risks can be mechanical during the physical manipulation of the waste, chemical when waste contains toxic products or when toxic products are used for in valorization processes, or biological with sanitary risk - waste being a vector of diseases. Furthermore, the main actors in waste valorization have only little information on the dangers that manipulating waste represents.

4.2.5. Financial difficulties

Recovering waste with basic reuse technics has the advantage to be an activity where no initial financial reserve is necessary to start the activity. Oppositely, waste treatment and transformation for valorization require large investments in order to buy waste from collectors, buy the machines and pay the workers. Costs for production factors concern especially water and electricity which are relatively high in Senegal^{36 37} (APROSEN & WWF, 2009). Access to financial resources is therefore essential to start valorization activities. These costs combined to limited benefit made on the treated waste sell limit investment capacities. Furthermore the culture and the possibilities to save money for investments in the dominating informal sector are rather low. There are only isolated examples of “mutualization”³⁸ throughout the country and the only known example is the workers in foundries in Reubeuss (APROSEN, 2009). Mechanisms for financing on long term initiatives – loan from banks, micro-credit from NGOs, i.e. – would be of great help but stay yet relatively rare in Senegal (APROSEN & WWF, 2010). Finally the prices are not stable and commercial outlets for treated waste have just started to increase. As a consequence the financial situation of the treatment and valorization sectors and its workers is uncertain.

³⁶ Manager of the center in Kaolack, 2012

³⁷ Commercial agent of the center in Thiès, 2012

³⁸ Mutualization is in this situation the process of setting up or reorganizing a corporation where financial resources are put in common in order to increase investments capacities.

4.2.6. Technical difficulties

Technical difficulties encompass lack of infrastructure and equipment, and/or inadequacy of it. They are caused by the financial difficulties exposed in the previous section and by the lack of education of the dominant informal workers.

Because savings are in general relatively low in informal sectors, capacities to invest in equipment are hence also limited. Formal treatment centers are also financially constrained, which limit their access to equipment and technology. Processing capacities and productivity of the few existing treatment centers stay rather low nowadays in Senegal (APROSEN & WWF, 2010). As a consequence, they can hardly process increasing amount of waste, generate more revenue and develop thus their activities. Furthermore lack of equipment and lack of education on waste valorization keep the treatment quality relatively low³⁹ (APROSEN, 2009). All these limitations hinder on one hand local initiatives to be stimulated and prevent on the other hand the existing initiatives to be up-graded. When it comes to metals valorization especially, technology and knowledge needed are particularly high. It explains to a large extent why only a very limited amount of e-waste is valorized in merely two places, Reubeuss and Colobane (IAGU & Sénécléc, 2009), and why there is no official foundry for metals.

Although the difficulties presented in the above sections are numerous and diverse, there are also means for overcoming them. Furthermore there are numerous possibilities in valorization proving that the sector can and must develop.

4.3.Opportunities and possibilities for the development of waste valorization

Because waste is initially opposed to a product of quality, finished, directly marketable and consumable, it is still perceived negatively in many societies. However a slow but progressive reconversion of opinions is currently happening worldwide, including in Senegal. Waste is accordingly less rejected than before. Possibilities for the valorization development rely in these changing perceptions.

There are two reasons for this progressive general shift: the growing concerns on social and environmental issues and the economic potential of valorization. Negative implications of unmanaged waste on the social and environmental spheres (cf. 2.3.1.2. Consequences, p.39) are nowadays acknowledged by a large part of the Senegalese population. People from urban as well as rural areas see in waste principally a source of diseases, threats for their domestic animals and cattle survival, and pollution. Social and environmental concerns are thus growing, but only to a certain extent. Because of the degraded economic situation, unemployment is high and poverty is spread. People are therefore primarily seeking for some financial opportunities. Sectors proposing some are accordingly particularly attractive to them. Waste valorization sector has consequently its highest potential in this aspect.

³⁹ Representative of the Rosalux Institute, 2012

4.3.1. General economic potential of waste valorization

Economic potential of a product/material is determined by its availability, its financial value and the possibilities for its commercial outlets. When the product/material has wide availability, high financial value and numerous commercial outlets, the possibilities to generate money are therefore large. This sector would become economically attractive and develops. In Senegal, waste is gathering progressively these three requirements thanks to valorization.

As explained in Chapter 3, waste generation is increasing which leads thus to a growth in the amount of the contained raw materials. Figure 4: Trends in waste composition (p.26) shows that the share of wastes that can potentially be valorized reaches 53 per cent (Arunprasad, 2009), meaning that half of the waste generated can potentially generate revenue if valorized. There exist a large variety of technics for reusing waste or extracting the contained raw material. These processes enable thus to make the valuable product/material available. But due to the lack of knowledge and equipment, simple waste recovery is relatively developed in Senegal while processes applied for material extraction stays relatively basic.

The financial value of valorized wastes is particularly interesting when comparing its prices to raw materials ones. By making material available again, the technics described above recover value to waste. The more elaborated these technics are, the highest the value recovered will be. The relatively simple technics applied in Senegal restrain the level of value recovery. It is yet high enough to add value and generate revenue. On the other side value recovery presents financial advantages compare to raw material extraction and/or importation. Prices of valorized waste are thus lower than product and raw materials.

Finally commercial outlets for valorized waste are found among industrialists. The industrialization well implemented in developed countries and growing in developing countries asks for a growing amount of raw materials but confront meanwhile their increasing prices. Oppositely, the low prices of valorized waste represent financial advantages for industrialists. It has convinced a growing number of industrialists to integrate it into their production processes in detriment of fresh raw materials. Due to increasing demand and increasing supply, waste market where waste is accordingly exchanged has tremendously developed internationally, including in Senegal. The different types of waste are exchanged among collectors, treatment centers, individual recovers, intermediaries and industrialists. Due to the large variety of wastes that can be valorized, potential suppliers and buyers are consequently numerous. Each type of waste is exchanged

Box 18 – The underestimated size of waste market

UNEP has evaluated that waste market in OECD represents USD 125 billion, in emerging economies (Brazil, China, India, i.e.) USD25 billion and the global market has increased by 37.3 per cent between 2007 and 2011(UNEP [2], 2009, p.11). These numbers prove the large size of the formal waste market. However informal exchanges are also largely spread across the world and UNEP's numbers underestimate therefore the market's real size by considering only one part of the sector.

on its corresponding sub-market⁴⁰ and all of them are currently growing in size (cf. Box 18). The combination of all of these sub-markets leads then to an up-grading of the entire waste valorization sector. Senegal follows this trend with an increase in the exchanges of all the types of valorized wastes and the consequent development of its waste market (APROSEN & WWF, 2009). It is visibly proved by the growing supply of and demand for valorized waste. On the other hand growing parts of valorized materials are integrated in Senegalese industries' production process (APROSEN & WWF, 2010) and exportations of valorized materials are augmenting (Mame Fatou, 2009). Commercial possibilities for valorized waste are also multiplying due to an increasing demand for recycled products among consumers. Replacing pricy imported raw materials by cheaper secondary raw materials stimulates indeed manufacture of low-cost where products are thus cheaper. Due to the dominant informal sector however, official numbers on the sector do not exist and estimations are challenging. APROSEN and IAGU have conducted researches in the largest Senegalese uncontrolled landfill Mbeubeus and have evaluated that 13 million FCFA (20 000€) were exchanged every day (2009, p.30).

The economic potentials in waste valorization are therefore appealing for the ones interested in enriching themselves but also for the ones funding SWM. Revenue generated from waste valorization can indeed participate in the funding of waste collection, transport and residual waste elimination. Such financial system is a good incentive for the participation of municipalities who justify its absence in SWM by its lack of financial resources. Finding economic advantages in an activity is often a driving force for its development⁴¹.

These generalities can be also observed when looking more closely the different waste types. Even though each type of waste has its own specificities regarding its availability and economic value, they all offer potentials.

4.3.2. Specific economic potentials of wastes

Every waste type has its own features, its own characteristic on the market and therefore its own potential. A study has been conducted on wastes potentials by APROSEN and IAGU (2009) in the uncontrolled landfill Mbeubeus. Survey has been made upon waste pickers asking them to rank waste types according to their perceived potentials. The following sections present, through this ranking, main characteristics of wastes and their correspondent sub-markets.

4.3.2.1. Metal valorization

Valorizing metals (copper, lead, bronze, nickel, zinc, brass and aluminum) has been recognized as the process with the highest potential. Supply of metals is growing in Senegal especially due to the continuous growth in the volume of electronic equipment (IAGU & Sénécléc, 2009). Developing countries have become dumpsites for Western e-waste for several years now, including in Senegal, and the metals contained in e-waste is high (Mame Fatou, 2009). Because metals are largely needed in industries, its demand in the national and international markets consequently grows. In Dakar this market is now dominated by the Indians who organized the

⁴⁰ Waste market is the platform on which valorized wastes are exchanged. It encompasses sub-markets for each waste type.

⁴¹ Director of Saint-Louis' urban development agency , 2012

exchanges (Mame Fatou, 2009; APROSEN & WWF, 2010). Growing demand has then repercussion on prices which explains the increases in metals' prices. The kilogram of iron was sold 15FCFA (0.02€) in 2002 in Dakar and reached the price of 150FCFA (0.2€) in 2008 (APROSEN & WWF, 2010, p.52). Extracting metals is highly pricy with increasing costs and can only be done in specific places. On the other side recovering metal necessitates 95 per cent less energy than extracting processes⁴² and these savings are directly reflected on final prices. Recovered aluminum for instance is seven times cheaper than extracted one. And copper can be infinitely reused. Buyers develop consequently a growing preference for recovered metals. The market of valorized e-waste has tremendously developed during the last years in Senegal, and is even recognized as the one developing the most. Due to the degraded socio-economic situation, many young men start collecting e-waste or scraps in order to sell it after to "packs". It is consequently common to see young men perambulating around the cities with carts transporting e-waste or scraps.

Considering the large informal sector, the Senegalese government has realized the urgency and potentials in developing it in a formal way and has thereby created the agency Sénécléc. The objectives of the agency are to create e-waste recovery and recycling centers, and developing North-South cooperation on these issues (Mame Fatou, 2009 ; IAGU & Sénécléc, 2009). These perspectives would help to overcome the lack of knowledge and technical constraints dominating metal valorization.

4.3.2.2. Organic waste valorization

Composting⁴³ is ranked at the second position in the survey. Although compost marketing stays rather restrained in Senegal, the second rank proves people's awareness on its potential. Supply of fermentable waste is largely assured considering that it represents 44 per cent of households' waste (Diallo, 2007). Then the transformation process of organic waste into compost is relatively simple and does not require large, pricy and numerous infrastructures and equipment. Finally the commercial outlets rely mainly on the agricultural sector which concerns still nowadays more than 50 per cent of the Senegalese population (ONU-Habitat, 2008, p.8). Urban agriculture and peri-urban agriculture develop and represent new outlets for compost. Furthermore the advantages of compost compared to chemical fertilizer have been proved by scientists - higher quality and lower cost - (Diallo, 2007) which should assure its evacuation. According to APROSEN & IAGU (2009), the profitability issue described earlier could be overcome with a better organization where actors coordinate better their activities and optimize their cost – by shifting from individual transport to collective one for instance -. Thereby the benefits made on compost sold would increase. Furthermore awareness programs exhibiting that chemical fertilizers do not provide all the necessary nutriments to the plant and its harmfulness would vanish farmers' reluctance.

⁴² http://www3.ac-nancy-metz.fr/clg-arboretum/images/pdf/diapo_recyclagemetaux_3e3.pdf [Accessed on 9th July 2012]

⁴³ Composting consists in valorizing organic waste by facilitating its decomposition so it can change into a new substance – called compost –.

4.3.2.3. Plastic valorization

Valorization of plastic obtained the third place. As the two previous waste types, supply of plastic is assured. This is due to the growth of plastic use in the industrial production and its consequent growth in the share of waste generation. The estimated supply represents approximately 20 per cent of the total waste generated (Diallo, 2007) and increases by 7 per cent per year (VIE, 2008, p.4). The largest part of plastic waste generated ends up in uncontrolled landfills. Among the 52 tons estimated plastic waste generated every day in Senegal, 20 tons are transported to the only landfill of Dakar's region (APROSEN & WWF, 2010, p.14). Only a small fraction is treated for valorization and yet it has many economic externalities. Processing plastic depends on the type of plastic used and is therefore diverse and delivers several outcomes. Furthermore plastic treatment is facilitated by the efficient collection of waste pickers. Plastic collection and transportation are indeed less constraining for waste pickers than other waste types because it is cleaner than organic waste, easier to find than metals and lighter than glasses. The demand from Senegalese industries for plastic is in constant augmentation. The creation of treatment units proves the extension of the national plastic market in Senegal.

Interest is therefore growing around plastic. But besides the economic potential, this particular attention comes from the large presence of plastic waste in landscapes, and especially the volatile plastic bags and plastic coffee cups. It reflects cultural trends of high consumption of these two products and their systematical and anarchical reject in the environment. The high visual pollution has caught the attention of many and stimulates initiatives for recycling.

4.3.2.4. Other waste types' valorization

The potential of fabrics, glass, wood and papers are less known. Waste pickers positioned it in the majority of the time in the last ranks. However the presence of these waste types and the existence of means to treat it is sufficient for recognizing potential.

Identifying the potentials of each waste type highlights the numerous possibilities for development that valorization in general encompasses. Ranking them has then helped to explore how waste market is likely to develop without intervention. Sub-markets where the economic interests are the highest are more likely to develop than others. Accordingly metal waste and plastic waste are expected to be increasingly exchanged as opposed to paper or fabrics. By highlighting the possible future trends it points where intervention is needed for a homogeneous development of the sector. Since damages caused by non-valorized waste come from every type of waste, consideration should still be given to every one of them.

Conclusion

As a conclusion, waste valorization sector in Senegal is relatively underdeveloped but it has meanwhile promising evolutions and large potential. Difficulties present in the sector and in its environment prevent still local treatment units' breakthrough. However the numerous possibilities offered by the sector help slowly to overcome some of the constraints and to enjoy waste potentials. Nowadays the economic potentials are largely recognized and it gathers the main interests. The development of the valorization sector is currently principally determined by the performances of the waste market. Economic advantages combined with social and

environmental gains help in shifting perceptions from landfill as disposal places to landfill as resources reserve. According to Cissé (2007), poverty plays a large role in changing views. With progressed opinions, initiatives are likely to multiply and institutionalization expected to happen. These successive changes would lead to a virtuous circle. The Senegalese situation presents the premises for this virtuous circle's establishment: wastes market is tremendously developing, opinions on waste visibly evolve, local structures open across the country and public authorities start to show interest in this sector. Accordingly strategies outside the informal sector are currently developing.

Chapter 5

Current strategy for valorization sector development

The distribution of responsibilities is not clear nowadays in Senegal and especially when dealing with waste valorization. Yet the need to develop this sector becomes urgent. Due to the growing awareness on the relevance of waste valorization, a strategy that takes place at a local level currently develops. Waste valorization centers specialized on one type of waste are created under local initiatives in order to face waste accumulation. Considering that a sector development should start from the existing strengths and build upon them (UN-Habitat, 2009), the Senegalese sector of waste valorization seems therefore to have its highest potential in the development of local centers. Analyzing them contributes in increasing the understanding on the emerging formal governance in waste valorization and its links with the rest of SWM. Therefore it has been decided for the research to focus on the two largest centers in order to understand better this strategy. The case studies selected are the plastic pre-treatment center in Kaolack and the plastic treatment center in Thiès, which are currently the most advanced ones in Senegal. The centers are geographically localized on the Figure 15 below.

Figure 15: Localization map of plastic valorization centers in Senegal



Based on a map retrieved from:
<http://www.senegal-online.com/francais/cartographie/senegal.htm>, 2012

The centers pre-treat and treat plastic waste in the perspective of valorizing it. Their activities are particularly relevant since plastic constitutes 18 per cent of the total amount of generated waste (Diallo, 2007). Removing it from waste piles and using it constitute hence waste

clearance. The analyses aim at understanding the organization of each system and compare them thereafter.

The analytical framework used for the case studies is firstly explained. It presents the elements analyzed, their implications and the methods applied. Thereafter the analyses on the centers in Kaolack and in Thiès are separately exposed. Having two case studies helps in getting an accurate and complete picture on waste valorization systems. Finally a comparative analysis is conducted and presented in the third sub-part. It helps to put in light their common opportunities and constraints for developing. Due to the high representativeness of the case studies selected, these findings can then be generalized to all valorization centers and show thereby what variables determine their development.

5.1. Analytical framework

A contextual presentation of each municipality as regard to their waste is firstly provided. It is based on evaluations of the waste nuisance they face, which is determined by the waste generation, its management and people's perceptions on it.

The aim of the analyses then is to understand accurately the organization of the plastic treatment centers. Thereby the centers' functioning is firstly presented. Then the analyses on the systems in which the centers are embedded are conducted. These systems are constituted of cores corresponding to the actors – valorization center, municipality, CBO, NGO, i.e. - and links between the cores corresponding to the relations between the actors. It is assumed that valorization system comprises an upstream part – where waste is produced and collected – and a downstream one – where waste is valorized and sold -. These two parts are interdependent. The governance in this system and its implications are thus explored.

5.1.1 Governance

The governance in the valorization system is firstly analyzed through its stakeholders and their relations.

After identifying the main actors, their roles are defined which enables to have a clear role demarcation. Depending on what they do, they have specific place in the system. It enables then to define the types of relation that exist between the actors. Analyzing these relations corresponds to a partnership analysis⁴⁴. It focuses on the partnerships of the center with the other actors and presents their types, purposes, implications and quality.

The four types of partnership are the following:

- Public-Private Partnership (PPP)
- Private-Private Partnership
- Civil Society and Private sector partnership

⁴⁴ The partnership analysis has been inspired by an analysis conducted by Handicap International (2002) on their partnerships in order to improve them, and by the program conducted by the French NGO "Coordination SUD" (undated) which aimed at analyzing partnerships of local NGOs in Benin and Togo.

- Civil Society, Private sector and Public sector partnership

Each of these partnerships has been established in the valorization system for a specific reason:

- Partnerships in SWM consist in organizing and coordinating the waste collection, transport and treatment among all the actors involved.
- Partnerships for support consist in maintaining or developing the center's activities. It encounters financial aid, technical support and management assistance.
- Partnerships in the commercial sphere represent the outlets of the center's activities.
- Finally the legitimate partnerships are the partnerships that are induced by law. Due to the decentralization process, the local authorities have the duty to manage solid waste.

All the partnerships have their implications and importance in the dynamics of the system. They provide the input, participate in managing it, recover the output or put the frame for this system. Therefore partnerships have either a direct impact on the center's capacity, are concerned by the centers activities, or have an impact on the center's general environment.

Finally the quality of partnerships influences directly and indirectly the system effectiveness. Relations' quality is evaluated according to the organization, practices and satisfaction of the partnerships. It is assumed that good quality partnership implies complementarity, comprehension, coordination and interdependency, which lead to partnerships' achievements and good system's performances. As opposed to bad quality partnership characterized by relations of domination, competitiveness, rivalry, incomprehension, dependency or independency (Handicap international, 2002). This type of analysis should by definition not stay restricted to merely one perspective, but considers instead the opinions of several partners so as to be relevant in its evaluation. The evaluation is based on the fulfillment or not of a certain number of criteria. A general analysis is firstly conducted on partnerships taking part in the plastic treatment sector of both municipalities. Then each partnership is evaluated. Thereby a global picture on the quality level of each partnership and in general is given. The partnership analysis evaluates thereby their use in the system and their potential to generate positive outcomes.

This first part presents the type of governance in each case study's system. Specific governance defines a specific organization of a system. This is presented in the second part of the analysis.

5.1.2. Organization and dynamics of the system

The structure of the system can be compared as chain encompassing three successive elements: the sources of plastic providing the inputs (households, commerce, institutions and public spaces), the processor transforming the input (the plastic treatment center) and the buyers purchasing the output (the industries). According to the governance type, specific organization is implemented in this structure and is described for each case study. The organizations are however not static but rather dynamic because subject to numerous influencing forces. Internal and external forces can be opportunities or difficulties for the centers. As a consequence they are likely to bring changes by influencing the centers' performances, the systems' organization and orientating thus the systems' development. These changes are the dynamics of the system. They are then explored through the descriptions of the actors' behaviors when confronted to

difficulties and opportunities. These dynamics are present in the systems' upstream and downstream parts which are then likely to influence each other. Finally feedback loops can also be observed.

5.1.3. Strengths, weaknesses, opportunities and threats of the plastic valorization system

The analyses on the governance, the organization and the dynamics in each system enable to understand their achievements, difficulties, opportunities and development strategies.

Based on these understandings, the development perspectives of the systems are explored through the SWOT analyses. This strategic analytical tool evaluates the Strengths, Weaknesses, Opportunities, and Threats, involved in a project or in an organization, in order to set achievable goals. Strengths are internal positive aspects of a system in that case, that give an advantage over others; Weaknesses are oppositely negative aspects that place the system at a disadvantage relative to others; Opportunities are external positive possibilities that could improve performances; and finally Threats are oppositely external negative elements in the environment that could limit or prevent the development of the business or project (EuropAid, 2005). Information collected during the interviews and from reports on the two case studies has enabled to generate meaningful material for each category. Since the analyses are to a large extent based on the interviewees' judgments and perceptions, it is by nature qualitative and subjective data.

The analysis aims at demonstrating that the more partnerships of good quality are established, the more interesting the dynamics of the system are and the more numerous the perspectives for development will be.

5.2. Case study of the plastic pre-treatment center in Kaolack

Kaolack is located in the center-West of Senegal at 192 km from Dakar and is populated by approximately 260 000 inhabitants (ONU-Habitat, 2009, p.10). The municipality has a strategic position between the South Senegalese regions, Mali in the East, the Gambia in the West and the capital's region in the North. Kaolack is therefore a node of the main communication axes. This characteristic is the main factor of rapid urbanization and the consequent social and environmental degradations.

5.2.1. Contextual presentation: the waste nuisance in Kaolack

Kaolack receives the degrading reputation of being one of the unhealthiest Senegalese municipalities and accumulation of waste can in fact often be observed within and at the borders of the municipality. Yet the inhabitants assure that the amount of waste accumulating in public spaces has tremendously been reduced during the last years. The waste nuisance is firstly analyzed based on the amount of waste produced, its management and people's perceptions on it.

Municipal waste production

The daily production of municipal waste is estimated at 199 tons. This number is expected to increase in the coming years because of the constant population growth - 3.5 per cent in 2009 (ONU-Habitat, 2009, p.10) - and the strategic geographical position.

Municipal waste management

Although the municipality of Kaolack has received the responsibility of managing the waste – due to the decentralization process, cf. Chapter 2, 3.2.2 (p. 60) -, its role in reality stays limited. Only 6.1 per cent of the municipality budget is destined to SWM in two central districts producing yet less than a third of the total amount of waste generated (ONU-Habitat, 2009, p.19). As consequence of the failing municipal SWM, an alternative system in the 15 other districts have been developed by a committee called CODEKA in cooperation with the civil society composed of neighborhood committees, EIG, individuals and NGOs. Box 19 describes the SWM governance in Kaolack in more detail. All these actors cooperate for organizing and implementing a waste collection system including in hardly accessible districts. They all recognized during the interviews their satisfaction as regards to the collection performances but also acknowledge the need for improvement. The main problem in Kaolack relies in its inexistent treatment and valorization infrastructure outside the plastic treatment center. When collected, waste is then disposed in uncontrolled landfills outside Kaolack and waste recovery happened therefore mainly in the informal sector⁴⁵. Financial constraints and the scarcity of available land constitute the main constraints for adequate waste treatment planning⁴⁶.

Box 19 - Governance in SWM in Kaolack

The CODEKA is a comity for the development of Kaolack that is constituted by the neighborhood committee's representatives and some technical services of the municipality. The civil society active in SWM is constituted by NGOs, neighborhood comities, EIG and individual. Neighborhood committees are committees present in each district aiming at representing the inhabitants and developing the district. They deal directly with local EIG (Economic Interest Groups) and individuals.

Perceptions on waste

From a general point of view, the awareness on waste related problems have risen during the last decade and the inhabitants of Kaolack are conscious that waste represent environmental and health threats⁴⁷. Consequent behavioral changes might be observed with financial participation for instance through the payment of a fee for waste removal. It proves their understanding on SWM's implications and on their responsibility in it.

However, the positive evolutions in waste perceptions have to be tempered. Waste piles are still present in public spaces mainly due to the propensity to throw anarchically waste. The “not in my backyard” (NIMBY) syndrome explains partly this behavior. Furthermore lack of education and scarcity of bins in public spaces worsen the situation. The need for evolution in waste perception can also be found when looking at the attention given to waste collection, and waste treatment and treatment. The representatives of APROSEN and CARITAS emphasized the

⁴⁵ Representative of APROSEN Kaolack, 2012

⁴⁶ Municipality councilor in Kaolack, 2012

⁴⁷ Assistance of the representative of Caritas Kaolack and representative of the neighborhood committee "Ndorong 1", 2012

importance in evacuating waste outside the city in order to preserve public health. Yet, this type of preservation only occurs on short term. Without efficient waste treatment, waste accumulation –even outside the city – constitutes indeed a source of environment and health degradations on long term. It shows that perceptions still need to evolve towards more long term thinking.

Waste nuisance has been identified in Kaolack because of failures remaining in waste collection and the lack of adequate treatment and valorization equipment. Waste nuisance is implemented for long time in the municipality and getting over it is consequently difficult and long lasting. The current system of SWM only makes “waste travel through the space” and do not fight unhealthiness as programs aims to do⁴⁸. Priority must now be put on the endpoint of SWM. A strategy has been developed in the last years to reduce waste nuisance and improve in a sustainable way the inhabitants living conditions. It has been done through the creation a pre-treatment plastic center.

5.2.2. Specific waste valorization sector in Kaolack

5.2.2.1. Functioning of the center

The motivation behind the center creation was firstly to clean up the city. Social and environmental concerns came therefore before economic motivations. But because of the expenses and salaries that the center has to pay, the activities of the center have to be also financially viable.

The municipality has launched the project and financed the construction of the center in cooperation with the NGO LVIA and the Japanese Embassy. Because of financial and managing difficulties, the management has been rapidly transferred from the municipality to CODEKA and later to an EIG.

Technical functioning

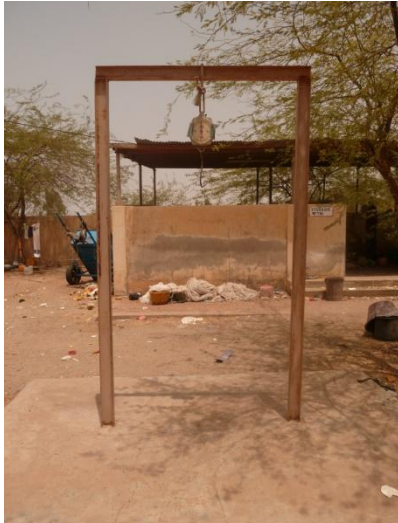
Plastic encompasses seven different plastic types which have their own characteristics and require thus specific treatment processes. The center in Kaolack accepts a type of plastic called PEHD⁴⁹ which is used for the production of buckets and plastic chairs for instance. The treatment process takes places through several successive stages presented below.

1. The center receives the plastic from the collectors. If the plastic is well sorted, the center does not need to proceed to a primary sorting. However it happens that collectors bring other types of plastic which obliges the center to keep on controlling the waste brought to them. The center weights the plastic.
2. A secondary sorting is processed to separate PEHD plastics according to their colors.

⁴⁸ Municipality councillor in Kaolack, 2012

⁴⁹ PEHD : « *Polyéthylène Haute Densité* » is a plastic type whose density is particularly high. It is used in plastic chair production for instance.

Picture 8 : Scale used to weight the plastic brought by the collectors (in the valorization center of Kaolack)



Source: Author

Picture 7 : Secondary sorting between the different types of PEHD according to the colors (in the valorization of Kaolack)



Source: Author

3. The plastic is manually cut in large pieces and the pieces judged as highly dirty are washed manually

Picture 10 : Plastic materials cut manually in large pieces (valorization center of Kaolack)



Source: Author

Picture 9 : Baths where plastic pieces are manually washed (valorization center of Kaolack)



Source: Author

4. The pieces are then put in a plastic pieces crusher that transforms them into chips that are 6 to 8 mm in diameter. The blades of the crusher need to be replaced every year in average, which represent consequent maintaining costs. Furthermore technical improvements would be required considering that the blades warm up rapidly because of the friction (shifting from iron to steel would limit this effect) and the machines do not have cooling systems. Consequently this plastic pieces crusher is not adapted to the Senegalese climate and must be stopped during the hottest hours of the day. Finally it processes only PEHD plastic and diversifying the activities of the

center, by accepting plastic bags for instance, would therefore require the acquisition of new machines.

5. A third sorting is processed to remove the pieces badly crushed and still too large, and to remove the sand.

**Picture 11 : Stocking area for yellow PEHD crushed pieces
(in the valorization center of Kaolack)**



Source: Author

**Picture 12 : Crushing machine
transforming large plastic pieces into
chips (in the valorization center of
Kaolack)**



Source: Author

6. The crushed pieces are then washed in an adequate washing machine. At the creation of the center this step was done manually in big baths by the employees. Only 1500 kg of plastic could be washed per month and the productivity of the center was therefore relatively low. The washing machine enabled to increase the productivity since it has a capacity of 6600 kg per month⁵⁰.
7. The outputs are valorized plastic that can be reintegrated into industrialists' production process. The plastic chips are put in bags and delivered to the buyers.

Control must be done at every stage to assure that different types of PEHD do not mix and guarantee therefore the high quality of the valorized material.

Financial functioning

The financial system relies on the revenue generated by the pre-valorized plastic sales which enable to buy the plastic upon the collectors and pay the center's employees. Besides the center receives indirectly financial allocations from the local authorities who pay the electricity bill. NGOs –such as LVIA - were supporting financially the center since its creation by subsidizing it with 500 000 FCFA (770€)⁵¹.

**Picture 13 : Washing machine
for plastic pieces (in the
valorization center of Kaolack)**



Source: Author

⁵⁰ Manager of the center in Kaolack, 2012

⁵¹ Manager of the center in Kaolack, 2012

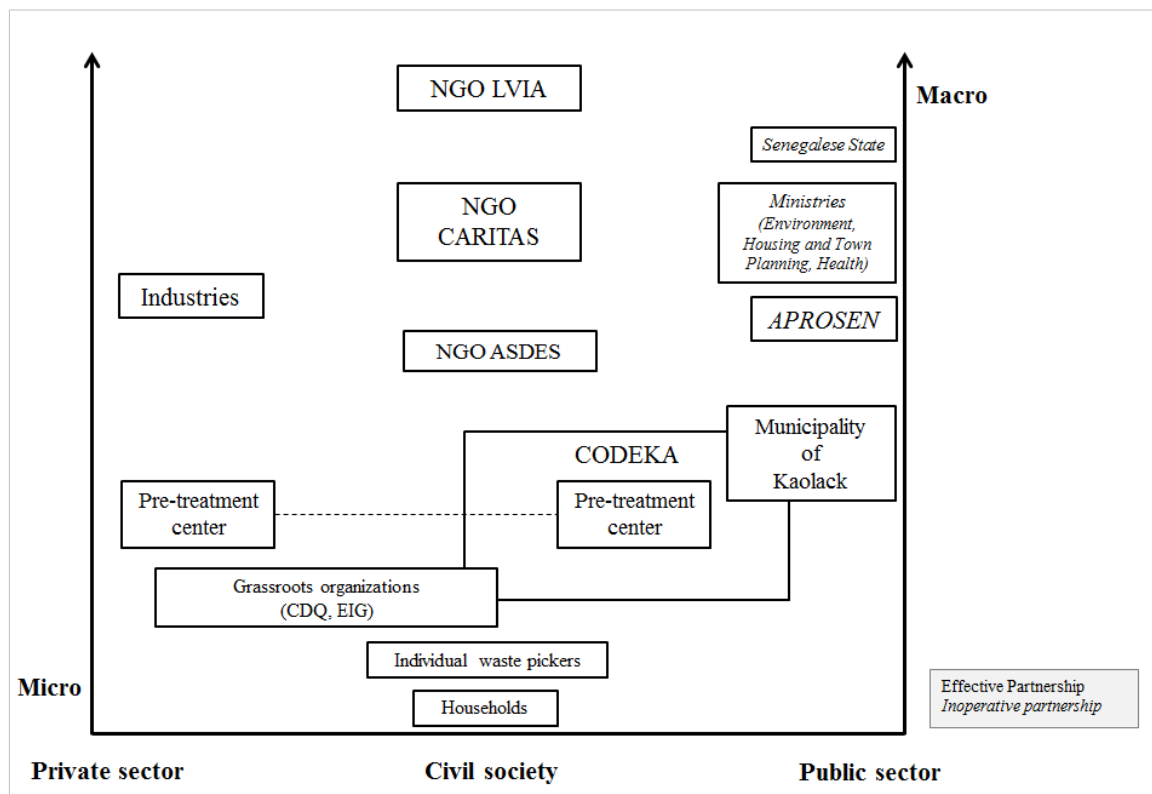
5.2.2.2. Analysis of the governance in the system

Plastic flows in a system where the treatment center is the main core. The other actors involved are the other cores of this system and interact with each other in different ways.

The actors

The Figure 16 below presents the stakeholders in plastic valorization system in Kaolack according to their type (public sector, private sector or civil society) and the scale of their actions.

Figure 16: Actors involved in the plastic valorization system of Kaolack



The pre-treatment center is the result of a Public-Private Partnership and depends therefore of both sectors.

APROSEN used to be the national agency for cleanness in Senegal⁵². Because of the institutional restructuration, the agency does not exist anymore but has participated in the development of the center.

All neighborhood committees are participating in plastic treatment management.

Industries – such as Simpa, Idraplast or SCD – are buying the plastic pre-valorized. They are Senegalese industries all based in Dakar.

Table 3 below exposes the roles of the actors.

⁵² Box 11, The successive creation of public assistant agencies in SWM, in 3.2.2 p.55

Table 3: Actors' role in the plastic valorization system of Kaolack

	Active Participation											Passive Participation
	Organization				Management				Mobilizing resources			
List of actors involved in the center’s activities	Who organizes the system?	Who identifies the problem?	Who proposes solution?	Who takes the final decision?	Who takes part in the system manage-ment?	Who takes care of the system integration and acceptance into the urban ones?	Who assures the relations between actors?	Who evaluates the results of the system?	Who brings financial resources ?	Who brings technical competences?	Who mobilizes human ressources?	Who participates passively in the system?
The Municipality of Kaolack			x	x			x		X			X
NGOs	X	X	X	X	X	X	X	X	X	X		
CODEKA	X	X	X	X	X	X	x					
Pre-treatment center	X	X	X	X	X	X		X	X	X	X	
Grassroots organizations	X	X	X	X	X	X				X	X	
Individual waste pickers											X	
Households												X
Industries									X			
x: limited role X: extensive role												

The above table reveals that the degree of involvement of each actor differs. The main actors taking part in the system are the pre-treatment center, the NGOs, the CODEKA and the grassroots organizations. They organize the system which requires important coordination among them. The large implication of the grassroots organizations in the organization proves the participatory approach of the project.

The outcome of this process is a shared management since each of the four main actors has specific tasks. The importance of integrating and assuring the acceptance of the system into the urban one⁵³ has been understood by the main actors. A responsible for monitoring the overall system's outcome is yet lacking, which might lead to lack of transparency. Furthermore insufficient meetings gathering the stakeholders are deplored but no one is officially in charge of organizing it^{54 55 56}.

Because mobilizing resources requires by definition several sources the array of people involved in this sector is therefore large and the actors are diverse.

Finally households in Kaolack and the municipality are passive participants in the sense that they are rather spectator than actors of the system and that they participate thus indirectly. The public sector has been active before and decided to get out of the system. And among the households, the indirect participation might differ according to their sorting habits (between plastic and residual). Awareness programs upon the households bringing the necessary information might influence it. From this perspective, passive participation is also necessary for the good performances of the system. As a conclusion, it seems that the distribution of tasks has some ambiguity and is therefore not at its optimum. The municipality could be a key actor and is yet only passive. Clarification would improve the performances of the system. The relations between the main actors are analyzed more accurately in the following section.

The relations

Table 4 below presents the four categories of partnerships in the plastic valorization system of Kaolack and the classification of the actors in the correspondent category.

⁵³ Urban systems refer to all the sub-systems implemented in an urban area. It can be for instance health system, educational system or public services system.

⁵⁴ Representative of CARITAS Kaolack, 2012

⁵⁵ Representative of the neighborhood committee "Gawane", 2012

⁵⁶ Manager of the center in Kaolack, 2012

Table 4: Features of the four categories of partnerships in the plastic valorization system of Kaolack and their associated actors

Partnerships' types	Partnerships' purposes	Partnerships' implications	The center's partners		
Civil Society - Private sector - Public sector	Partnerships in SWM	Partnerships that are concerned by the activities of the center	CODEKA	Grassroots Organizations	Individual waste pickers
Private sector - Civil Society Partnership	Partnerships for support	Partnerships that have a direct impact on the capacity of the center	NGOs	<i>The municipality of Kaolack</i>	<i>APROSE N</i>
Private-Private partnerships	Partnerships in the commercial sphere	Partnerships that are concerned by the activities of the center	Industries		
Public-Private Partnership	Legitimate partnerships	Partnerships that have an impact on the general environment of the center	The municipality of Kaolack		
Effective partnerships					
<i>Inoperative partnerships</i>					

Partnerships' quality

A general analysis is firstly conducted on the partnerships present in the system of Kaolack (presented in Table 5). Secondly partnerships of the center with other actors are individually evaluated. Thereby a global picture on the quality level of partnerships in general and on each partnership is given.

Table 5: General analysis of the partnerships' quality as regards to the project and its context⁵⁷

Criteria	Indicators	Evaluation
The program is in the line with global development policies	The program is based on partnerships	Positive
	Objectives of the partnership can be encompassed by national and/or international frame for development (MDGs, i.e.)	Positive

⁵⁷ The evaluation is essentially based on the data collected from the interviews and observations. The gradation explanation and the justification of the evaluation are available in Annex 3 and Annex 4

Preliminary agreements on the goals and outcomes of the program	All the partnerships agree on common goal and expected outcomes when launching the program	Positive
Dialogue about the program	Meetings are organized for discussion	Mitigated
	All the actors involved actively participate at the meetings	Mitigated
Shared organization and management of the program	Responsibilities in the program are shared in a legitimate way	Mitigated
Consideration of each other's constraints and difficulties	One's requirements are considered and integrated if necessary	Mitigated

The program promotes partnerships and its goals are clearly oriented towards sustainable development. Despite this satisfactory basis, the partnerships have in general a mitigated quality. On one hand the interdisciplinary of the program's tasks requires the active participation of all actors and this has been well understood since several actors are truly involved. There are also difficulties in the relation which prevent the optimization of the system's performances. While the relevance of organizing meetings is recognized among all actors, the absence of a responsible organizer and the unavailability of some limit gatherings. These failures in the organization explain partly the lack of communication and transparency on actors' activities. This worsens then the tasks distribution. Furthermore the limited participation of the municipality has negative impacts on the general analysis. The mitigated quality constrains consequently the running of the system.

Looking more specifically at each partnership provides an accurate understanding on the relations that the center entertains with its partners. The following Table 6 presents it and the Figure 17 (p. 95) illustrates it.

Table 6: Specific analysis on the relations' quality between the center and its partners⁵⁸

Criteria	Indicator	Evaluation			
		Partnership between the center and NGOs	Partnership between the center and the grassroots organizations	Partnership between the center and the municipality	Partnership between the center and industrialists
Reliability between the actors	The partnership was willing from both side and not imposed	Positive	Positive	Mitigated	Positive
	Partners know well each other's activities	Mitigated	Mitigated	Mitigated	Positive
	Wished relations became effective	Mitigated	Mitigated	Mitigated	Positive
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Positive	Positive	Mitigated	Mitigated
Respect of the procedures and agreements	Partners respect the procedures and agreement	Positive	Positive	Mitigated	Mitigated
Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Positive	Positive	Mitigated	Mitigated

⁵⁸ Partnerships' quality has been evaluated in the basis of the data collected from the interviews. The detailed evaluation on the gradation is available in in Annex 3 and Annex 4.

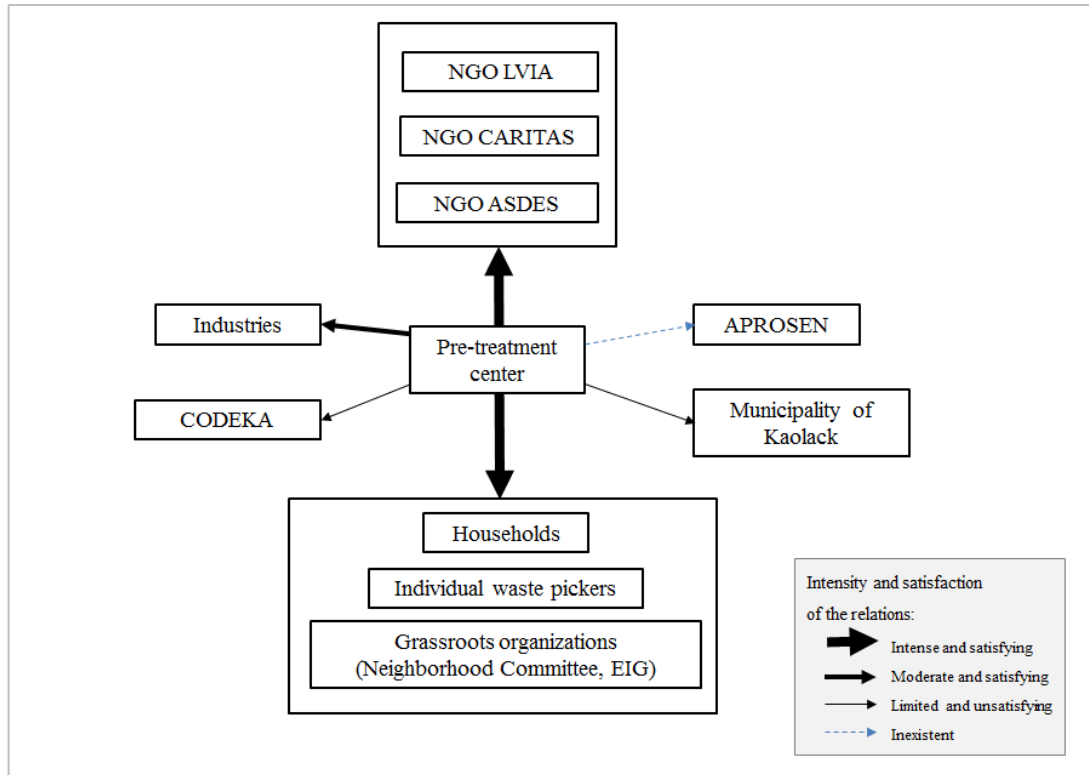
	New projects are developed	Positive	Positive	Negative	Mitigated
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Positive	Positive	Mitigated	Positive

The four partnerships presented above are of relatively satisfying quality. Especially when looking at the ones including the civil society, relations are particularly good. The exploration on the roles of each actor proved already the large presence of the civil society in the system. The civil society and the center comprehend well each other's constraints and opportunities. The center proves through this that the partnership with the communities is not based on their instrumentalization but rather on their strengthening. Negotiations are efficient and the outcomes are respected. The remaining difficulties find their origin in the promptly lack of transparency on their activities. The good quality of the relations between the center and the grassroots organization explains why they are currently the pillar of the system.

On the other hand, the limited relations with the municipality go in hand with its limited role in the system (cf. Table 3, p. 89). Because the relations between the center and the municipality are incomplete and degrading overtime, communication, comprehension and hence cooperation are nowadays very limited. Prompt meetings with CODEKA and agreements on the electricity bill are nowadays the only contacts of the center with the public sector. The responsibilities for this situation are shared.

Figure 17 below sums up each partnership's intensity and quality described in the previous parts through an illustration.

Figure 17: Relation intensity between the center of Kaolack and the other actors



According to ONU-Habitat (2009), Kaolack presents all the necessary requirements for an efficient shared management: the code of local collectivities, the existence of CODEKA as a superior entity, grassroots organizations and dynamic NGOs. Yet the presence of actors and the existence of partnerships are not sufficient in a system and partnerships of good quality are in fact crucial. The analysis on the actors' roles and relations has revealed that the center and the civil society are pillars of the system. The specific organization of the plastic valorization system in Kaolack have been determined by the good performances that came out of this local governance tackling problems in communications would enable progressiveness in the system's performances.

5.2.2.3. Organization and dynamics of the system

Plastic waste management integrated into SWM

Outside the treatment center, all the other actors involved in plastic waste management are also involved in SMW. The strong relations among the actors and especially between the center, the NGOs and the grassroots organization have steered to a specific organization for directing plastic waste flows.

Theoretically the source of waste is directly at the waste generators (residents, institutions such as schools and enterprises). There is however in Senegal - including in Kaolack - a part of the waste produced that is anarchically dumped before being collected. Thereby it exist two sources

of waste in Kaolack: at the waste generators and in the uncontrolled disposal places –public spaces and uncontrolled landfill -. The plastic flows need therefore to be directed from these two sources to the center and two schemes were accordingly developed.

On one hand, the center based its activity on schemes already organized by waste pickers. This scheme has been strengthened by bringing the necessary information on the activities of the center, the type of plastic that they use and the remuneration that they would get by bringing the adequate one to the center. On the other side a second plastic collection scheme has been organized by the cooperation between neighborhood communities and the center and takes directly place at the households. This scheme encompasses in fact two sub-schemes: one for the plastic collection and one for the residual waste collection. They are not running in parallel but are instead linked and complementing each other. Thereby, Kaolack presents a “double collection scheme”⁵⁹.

The revenues generated in the 8 districts and for the informal waste pickers caught the attention of the communities in other districts. A snow ball effect has happened and has therefore led to the spatial enlargement of the system. Despite remaining difficulties, these new organizations enable, according to the valorization center’s manager, to remove from the households and the landfills heavy plastic and direct nearly 100 per cent of it to the center, according to the treatment center. The integration of plastic management in the initial structure of SWM has therefore been successful. Furthermore organizing the two collections interrelated has boosted the sector of SWM by stimulating collection of residual households’ waste.

The organization described above is embedded in a system which is not static but rather dynamic because confronted to influencing forces. These dynamics are analyzed in the following part.

Dynamics of the plastic valorization system in Kaolack

The following part analyzes the internal and external forces that had and/or have currently an effect on the plastic valorization system in Kaolack, and the behavior that the system adopts as a respond to it.

Dynamics in the system’s upstream part influencing downstream performances

ONU-Habitat describes in their report on Kaolack (2009) a lack of cooperation from the communities. Their apparent reluctance has been tackled by the other actors of the civil society. Efforts have therefore been put on changing the perceptions, generating an interest among the communities on waste and sanitation topics by the means of awareness programs and technical support. Their integration has also been facilitated. Increasing understanding among communities has stimulated positively their participation. It has improved the performances of the collection and hence the upstream part of the system.

Other requirements for the center were to increase the quantity and improve the quality of collected plastic in order to enlarge and enhance the center’s activities and thus profitability. Firstly the coverage of plastic collection scheme has been enlarged to a growing number of

⁵⁹ Manager of the center in Kaolack, 2012

districts and also the surroundings municipalities⁶⁰. Collecting a large amount of plastic is however not sufficient, it should also be a good quality one in order to limit processing costs and to improve therefore center's profitability. This type of collection should therefore be primarily encouraged. Thereby improvements in plastic collection influence positively the performances of the center which will thereby be able to provide satisfactory amount of good quality plastic to the industrialists.

Dynamics in the system's downstream part influencing upstream performances

Difficulties in the downstream rely in the internal constraints of the center and the uncertainties for the valorized plastic outflow. Both question the center's profitability and performances, which indirectly influence the need for plastic and therefore the upstream system.

Financial difficulties

The insufficient financial resources have been recognized by the main actors and ONU-Habitat (2009) as the main limitation of plastic management system. The three strategies contemplated considered asking for external financial aid; adapting the system to the actors' financial constraints; and searching for more commercial outlets. Although European Commission (through Caritas) and the Japanese Embassy have given considerable amount of funds, it has not been sufficient to overcome durably financial limitations. Adaptations have therefore also been done by developing a new financial system for the collection according to the center's and collectors' constraints and obligations.

Technical difficulties

A cause and a consequence of the financial problems are the low processing capacities of the center. The actual equipment is too limited and intensively used for the last 7 years and the maintaining efforts have not prevented productivity to decrease. As a consequence, the amount of plastic that can be valorized might be inferior to the amount received⁶¹. And program encouraging in parallel plastic collection increases the pressure of the center's capacity. Getting equipment that incorporates technological improvements⁶² would also help in increasing the center's capacity. And increasing processing capacities is good incentives for collectors.

Commercial outlets difficulties

Since the input supply in Kaolack is insured, the outflow is crucial. In order to maximize the outflow of valorized plastic, the center has to work on satisfying the current partners and canvassing for new ones. Industrialists have the capital but invest when they are sure it is worth. Providing sample of recycled plastic to skeptical industrialists and let them test it helps in demonstrating the product good quality and convincing thereby the potential buyers. The center must then stay careful on the quality constancy since an occasional quality decrease could make the center lose some contracts and degrade its reputation. With the development of the recycling market, the opportunities for selling recycled plastic are nowadays more numerous and the

⁶⁰ Manager of the center in Kaolack, 2012

⁶¹ Manager of the center in Kaolack, 2012

⁶² Machines with a cooling system for instance would enable the center to not stop its activity during the hottest hours of the day.

center canvass therefore more commercial outlets. Increasing the outflow increases the demand for waste plastic and stimulates therefore plastic collection.

The system of plastic management is autonomous and well integrated in the SWM system. Its relevance is then proved through its positive effects on the economic, social and environmental spheres.

Economic, social and environmental implications

Economic implications

Waste valorization creates an activity and therefore revenues. The creation of the center has enabled the creation of 12 jobs in the center and has indirectly stimulated the multiplication of collectors. The market of recycled plastic is then positively stimulated by the participation of the center, which helps the market development.

Social implications

The plastic treatment center has on one hand participated in living standards elevation of the center's employees. The jobs that have been created within the center are occupied mostly by women who used to be cleaning lady (average monthly salary in Kaolack is between 15 000 à 20 000 FCFA - between 23 and 30€ -, for a 7 days working week). Today they earn about 40 000 FCFA (61€) and have the advantages of a formal job (two days-off every week, retirement subscription, i.e.)⁶³. The development of plastic treatment sector has also positive impacts on the inhabitants' living conditions. Removing heavy plastic from public spaces has positive impacts on the inhabitants' health. Since heavy plastic prevents water flow, stagnant water attracts mosquitos among which some have the Malaria virus. Evacuating heavy plastic helps thus to reduce the contamination rate of Malaria⁶⁴.

Environmental implications

Managing the heavy plastic flows has helped in reducing the amount of waste unvalorized that normally ends in uncontrolled landfill and accumulates in public spaces. The associated environmental degradations have accordingly been reduced. Furthermore the implementation of the center has put the light on the negative impacts of uncontrolled waste and it has thereby increase environmental awareness among the population⁶⁵.

Understanding the functioning of the center, the governance in the system and the dynamics of the system enables to explore where the perspectives for the system's development.

⁶³ Manager of the center in Kaolack, 2012

⁶⁴ Representative of the neighborhood committee "Gawane", 2012

⁶⁵ Representative of the neighborhood committee "Gawane", 2012

5.2.3. Strengths, weaknesses, opportunities and threats of the plastic valorization system in Kaolack

The perspectives of development are explored by highlighting the strengths, weaknesses, opportunities and threats of the system. It has been enabled by conducting a SWOT analysis presented in Table 7.

Table 7: SWOT for the treatment plastic system in Kaolack

<p style="text-align: center;"><u>Strengths</u></p> <p>System's governance</p> <ul style="list-style-type: none"> Governance is large with intense participation of NGOs, grassroots organizations and communities. The participation of the municipality is limited but exists. Participatory approach is successful General quality of the partnerships is good <p>System's functioning</p> <ul style="list-style-type: none"> Supply is assured thanks to the expected growing waste generation The spatial influence of plastic collection is large Plastic management well integrated in SWM <p>Others</p> <ul style="list-style-type: none"> Economic, social and environmental benefits have been proven 	<p style="text-align: center;"><u>Weaknesses</u></p> <p>System's governance</p> <ul style="list-style-type: none"> There are some communication problems Actions of the official central institution CODEKA is limited Lack of transparency on the center's activities perceived by the other actors Responsibility distribution is not at its optimum <p>System's functioning</p> <ul style="list-style-type: none"> Plastic quality is not high enough Quality of valorized plastic can easily degrade which is risky in commercial partnerships Processing capacities of the center are limited The financial difficulties limit the possibilities to invest in processing capacities <p>Others</p> <ul style="list-style-type: none"> The center is not economically viable (balance between expenses and benefit not reached so far) There are some difficulties to find commercial outlets
<p style="text-align: center;"><u>Opportunities</u></p> <p>System's governance</p> <ul style="list-style-type: none"> Most of the partnerships are of good quality and are therefore likely to influence positively the center's performances There is a demand from representatives of other municipalities to exchange knowledge and experiences concerning plastic treatment. <p>System's functioning</p> <ul style="list-style-type: none"> Some sorting initiatives have been notices <p>Dynamics of the system</p> <ul style="list-style-type: none"> Dynamics in the system's upstream part influence efficiently the downstream part Dynamics in the system's downstream part influence efficiently the upstream part <p>Others</p> <ul style="list-style-type: none"> Enabling environment where ecological environmental awareness is growing Awareness programs keeps on being conducted upon the large public and schools 	<p style="text-align: center;"><u>Threats</u></p> <p>System's governance</p> <ul style="list-style-type: none"> Involvement of the municipality is too limited <p>System's functioning</p> <ul style="list-style-type: none"> Sorting initiatives stay isolated ones Competitiveness of the center is questioned because of the transportation costs implied by the geographical isolation <p>Others</p> <ul style="list-style-type: none"> Deterring environment where waste nuisance is high and SWM requires still numerous improvements Negative perceptions on waste are still spread Profitability of the center's activities is hard to reach

Considering the strengths and weaknesses of the center, and the opportunities and threats in its environment, the perspectives for the center rely therefore in developing and strengthening the elements helpful to achieve the center's development, and limiting and overcoming the elements constraining the achievement of the system's development.

Conclusion

The valorization system is well accepted and integrated in Kaolack. However there are still improvements necessary to maximize the system's performances. The stakeholders have decided to focus on the upstream part of the system and strengthen the collection schemes. The center is nowadays the second most advanced one in Senegal and the high involvement of the stakeholders enables the system to have promising development perspectives.

5.3. Case study of the plastic treatment center in Thiès

Thiès is located 70km in the East of Dakar in the region of the same name. The municipality is the third largest one in Senegal with 263 500 inhabitants in 2007⁶⁶. The region of Thiès is the second most visited region by tourist and the second most industrial region (INEP, 2006). The economic dynamism is correlated with demographic dynamism and urbanization.

5.3.1. Contextual presentation: the waste nuisance in Thiès

Municipal waste production

With the large population and high economic dynamism, waste generation in the municipality of Thiès is consequently large. IPEN estimated it at 110 000m³ per year (2006, p.15). Such as the majority of Senegalese municipalities, the positive population growth rate - 2.7 per cent per year⁶⁷ - is expected to keep on stimulating waste generation.

Municipal waste management

The waste management in Thiès consists in collecting waste and transporting it to uncontrolled but official landfill located at the municipal borders. The actors involved in waste collection and transport differ according to the districts: the municipality is taking care of the central one, while the civil society – mainly based on neighborhood committees - takes care of the other districts. This last scheme meets some leakages since collectors do not always respect the official disposal areas and dumped waste anywhere. In that case waste is not managed but just displaced further away from its source but stay within the municipality.

Box 20 - Financial and technical difficulties in the SWM of Thiès

The first difficulty in SWM in Thiès relies in the failing waste collection with a heterogeneous organization across the urban area. The limited spatial coverage of public collection service is mainly explained by financial difficulties. Governmental allocations are too few and tax (TEOM) recovery is low - 15 per cent of the inhabitants are paying it -. Besides, SWM faces technical difficulties that partnerships with northern cities – such as Caen, France – has not enabled to overcome on long term. The equipment promptly donated is in fact rapidly out of order due to an inadequacy with the local environment, and lack of knowledge and resources for maintaining the equipment.

⁶⁶ National Agency for Statistics and Demography, Senegal (*Agence Nationale de la Statistique et de la Démographie, Sénégal*). <http://www.ansd.sn/> [Accessed on 22th June]

⁶⁷ http://www.ceps.gouv.sn/doc_publication/planification/PRDI/prdi_thies.pdf [Accessed on 28th June]

Besides the difficulties presented in Box 20 ⁶⁸, the principal failure in Thiès' SWM is its incompleteness caused by the absence of appropriate equipment and infrastructure for waste valorization. Collected waste is then dumped in uncontrolled landfill devoid of adequate installation⁶⁹. The absence of fence enables waste pickers to work actively and animals to search food in the piles. Furthermore all types of waste including toxic ones – from hospitals, industries, i.e. – end up mixed in the open dump. Incinerations are promptly organized to reduce the accumulation size, which are highly harmful for the environment and the population (IPEN, 2006). Because of the overloaded state of the uncontrolled landfills, a project has been elaborated 5 years ago which consisted in creating a controlled landfill (IPEN, 2006). However land pressure faced by the municipality and the disagreement of surroundings communities because of their future proximity with the landfill and related disturbance⁷⁰ made the project stop⁷¹.

Perceptions on waste

There are contradictory trends among the population in their waste perception. On one hand awareness on the negative implications of waste is growing and an increasing number of people attempt to resolve waste related issues. On the other side harmful behaviors remain among the population. People reject waste and want to get rid of it as fast as possible. This behavior in a context of failing collection leads to a constant presence of waste in the surroundings environment. Consequently the proximity of the population with their waste is very high.

Waste nuisance is nowadays relatively high in Thiès. Failures in managing large generation of waste lead to high waste accumulation. However growing participation of the civil society and private sector in SWM in Thiès proves that this high nuisance is perceived at the present time by larger part of the population and actions start to be taken⁷². The creation of the plastic treatment center proves the progressive change.

5.3.2. Specific waste valorization sector in Thiès

The creation of a plastic treatment center in Thiès has been an innovative step in SWM at the local and national scales since it has been the first one implemented in Senegal.

5.3.2.1. Functioning of the center

The NGO LVIA motivated by insalubrity reduction has assisted in 1997 a grassroots organization. The Japanese Embassy, the Italian regions Lombardie and Piemont, and the European Commission have also encouraged by financial means the development of a structure (APROSEN & WWF, 2010). The “GPF”⁷³ LAAK DIOM created was constituted by 15 women

⁶⁸ Representative of LVIA, 2012

⁶⁹ There exists a large array of installations reducing the harmfulness of landfilled. The basic ones consist in waterproofing the soil (and avoiding pollution infiltration) and covering waste to prevent its dispersion.

⁷⁰ This problem rose also in the case of controlled landfill creation for Dakar's region in replacement of the actual uncontrolled one called Mbeubeus.

⁷¹ Representative of LVIA, 2012

⁷² Representative of LVIA, 2012

⁷³ “GPF” (*Groupe de Promotion Féminine*) are groups constituted essentially by women aiming at developing an activity and promoting female representation. There is no official English translation.

willing to improve their surrounding environment. A center for treating plastic waste has been build and the members of the GPF became the employees. During the following years of the center's creation and the NGO was organizing, managing and funding the entire system. They were organizing the cooperation with the neighborhood committees that take care of plastic waste collection. It was judged in 2007 that the GPF was able to change status and insures its own management. Thereby the SARL⁷⁴ "PROPLAST Industrie SARL" has been created.

Technical functioning

The functioning of Thiès' plastic treatment center is similar to Kaolack's one (cf. 5.2.2.1. Functioning of the center, p.85). The main difference between the two centers relies in the additional process that PROPLAST Thiès is executing. It consists in transforming the plastic chips into granules. The process of extrusion is applied once the chips have been washed and dried. A machine melts the plastic pieces while keeping the intrinsic characteristics. It is then cooled down and shaped into granules or powder. However extruding includes large financial costs and only few industrialists are in fact interested by this form of valorized plastic. Numerous industrialists consider plastic chips even more convenient than granules since the chips can be integrated in their production process and are cheaper. The pursuit of this process is currently questioned by the center's managers⁷⁵.

According to some data collected by APROSEN and WWF in 2010, the volume valorized during the 10 last years has tremendously increased. The plastic bought to the collectors has risen from 22 604kg in 1999 to 156 000 kg in 2008 (2010, p.21). The processing capacities of the center are nowadays 12 tons per month⁷⁶.

Financial functioning

The financial system of the center has evolved during the last 10 years shifting from a dependent one to an autonomous system. When the center was created, it depended totally on the funding of the NGO LVIA and of other donators. LVIA was paying for all expenses (salaries, technical maintenance, i.e.) until the center became profitable. The change in status to an SARL marked a turning point. The financial system is now based on the enterprise's expenses and benefits made on the plastic sell. Plastic is weight and bought to collectors at a fix price per kilo and valorized plastic is then sold to industrialists based essentially in Dakar's region. Profitability of the center's activities is reached when at least 15 tons of plastic is transformed per month⁷⁷ (APROSEN & WWF, 2010, p.23). They still receive some external funds which are considered as additional ones. The financial participation of ESPERE has enabled the change in status from GPF to SARL.

⁷⁴ "SARL" (*Société à Responsabilité Limitée*) is a is a private limited liability corporate entity that exist for instance in France or Senegal

⁷⁵ Representative of LVIA, 2012

⁷⁶ Representative of LVIA, 2012

⁷⁷ Representative of LVIA, 2012

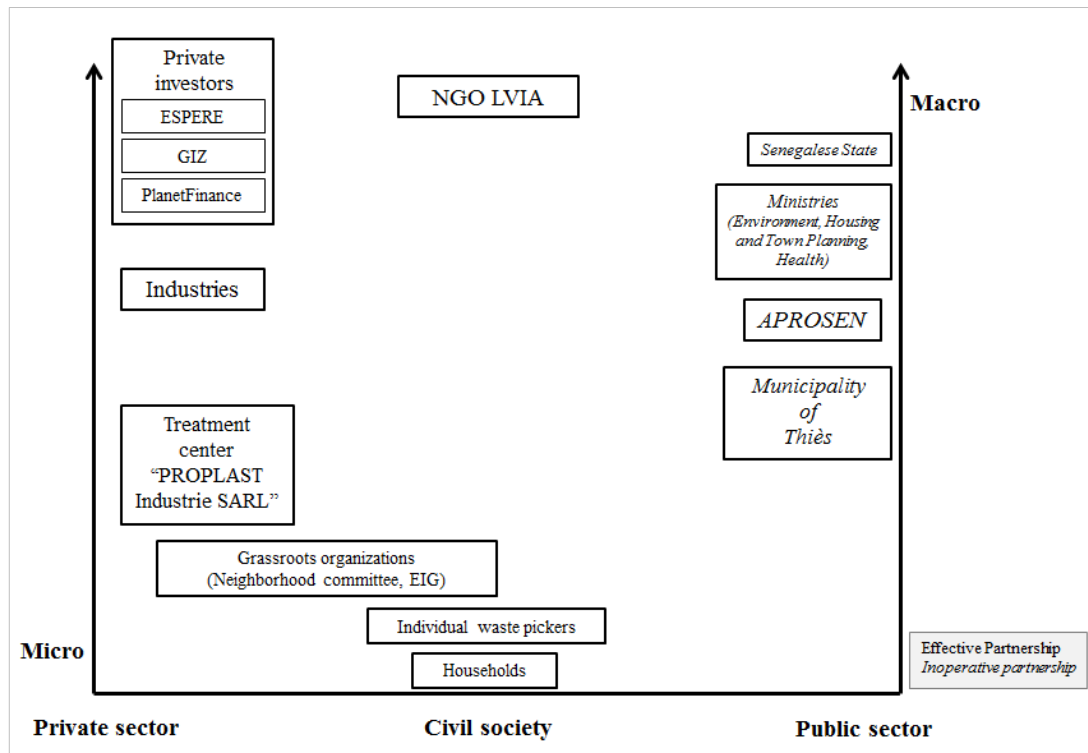
5.3.2.2. Analysis of the governance in the system in Thiès

The center PROPLAST is the main core of a system where plastics flow. Other cores and links are embedded in the system corresponding to other actors and their interactions.

The actors

The identified actors involved in plastic valorization system are presented on Figure 18 according to their type and the scale of their actions.

Figure 18: Actors involved in plastic valorization system of Thiès



The center "PROPLAST Industrie SARL" is a private enterprise since its status change from GPF to SARL in 2007.

The municipality of Thiès does not participate directly in the system but stays in the system as a potential actor due to the legislative frame.

Because of institutional change APROSEN does not exist anymore but was supposed to participate in the creation the center.

Grassroots organizations are constituted by neighborhood committees and EIG. Although not all neighborhood committees among the ones existing in Thiès participate in plastic collection for the center, their participation has increased during the last years.

Private investors are companies willing to invest in social entrepreneurship and/or environmentally-friendly enterprises (ESPERE, the GIZ - German cooperation - and Planet Finance). PROPLAST has been subject to evaluations and canvasses for external funding and obtain thereby external funding.

Finally several industrialists have contracts with the center (Transtech Industries, Sympa SA, i.e.).

The following Table 8 presents the role of each actor. It helps in understanding the actors' place in the system which defines then the types of relation and related implications.

Table 8: Role of the actors involved in the plastic valorization system in Thiès

	Active Participation											Passive Partici- pation
	Organization				Management				Mobilizing resources			
List of actors involved in the center’s activities	Who organizes the system?	Who identifies the problem?	Who proposes solution?	Who takes the final decision?	Who is takes part in the system management?	Who takes care of the system integration and acceptance into the urban ones?	Who assures the relations between actors?	Who evaluates the results of the system?	Who brings financial resources ?	Who brings technical competences?	Who mobilizes human ressources?	Who participates passively in the system?
The Municipality of Thiès												X
NGO LVIA		x	x			X	X	x				X
The center “PROPLAST industry SARL”	X	X	X	X	X	X	X	X	X	X	X	
Private investors									X			
Industries									X			
Grassroots Organizations										X	X	
Individual waste pickers											X	
Households												X
x : limited role X : extensive role												

Since its status change the center has become independent. The current distribution of roles shows clearly that the center is acting as a private enterprise by organizing its activity in an autonomous way.

The current role of the NGO is limited to a passive participation in the center's activities and the NGO focus rather on advising the center, facilitating the communication among actors and conducting environmental related programs. This role distribution and its evolution between the NGO and the center are satisfying since it is what the NGO aimed when implementing the project.

The apparent independence of the center concerns however only its organization and management. The system still needs to integrate other actors in order to run.

As Table 8 shows it, mobilizing resources can only be done by establishing partnerships with other actors. Grassroots organizations and individual waste pickers are integrated in the system through technical participation since they are input providers for the center. External funding from private investors has also helped to develop the activities of the center and has thereby largely participated to the success of the center.

The commercial partnerships of the center are diversified and numerous which shows the orientation of the center turned rather towards market development.

The municipality and households are characterized by a passive participation. The municipality is merely an observer and do not take part in the activities of the center.

The relations

The four categories of partnerships in the plastic valorization system of Thiès are presented in Table 9 below. Actors are also classified in the correspondent category.

Table 9: Features of partnerships in the plastic valorization system of Thiès

Partnerships' types	Partnerships' purposes	Partnerships' implications	The center's partners	
Civil Society - Private sector - Public sector	Partnerships in SWM	Partnerships that are concerned by the activities of the center	Grassroots Organizations	Individual waste pickers
Private sector - Civil Society Partnership	Partnerships for support	Partnerships that have a direct impact on the capacity of the center	NGO LVIA	Private investors
Private-Private partnerships	Partnerships in the commercial sphere	Partnerships that are concerned by the activities of the center	Industries	

PPP	Legitimate partnerships	Partnerships that have an impact on the general environment of the center	<i>The Municipality of Thiès</i>
Effective partnerships <i>Inoperative partnerships</i>			

Partnerships' quality

A general analysis is firstly conducted on partnerships taking part in the plastic treatment sector of Thiès (presented in Table 10). Secondly each partnership of the center with other actors is specially evaluated (presented in Table 11). Thereby a global picture on the quality level of the partnerships in general and of each partnership is given.

Table 10: General analysis of the partnerships' quality as regards to the project and its context⁷⁸

Criteria	Indicators	Evaluation
The program is in the line with global development policies	The program is based on partnerships	Positive
	Objectives of the partnership can be encompassed by national and/or international frame for development (MDGs, i.e.)	Positive
Preliminary agreements on the goals and outcomes of the program	All the partnerships agree on common goal and expected outcomes when launching the program	Positive
Dialogue about the program	Meetings are organized for discussion	Positive
	All the actors involved actively participate at the meetings	Mitigated
Shared organization and management of the program	Responsibilities in the program are legitimately distributed	Mitigated
Consideration of each other's constraints and difficulties	One's requirements are considered and integrated if necessary	Positive

The basis of the program is oriented towards sustainable development and promotes partnerships. The general evaluation on partnerships' quality in the plastic valorization system

⁷⁸ Partnerships' quality has been evaluated in the basis of the data collected from the interviews. The detailed evaluation on the gradation is available in in Annex 3 and Annex 4.

reveals a satisfactory quality. The importance of comprehension and cooperation has been well understood, implemented and respected by the main actors. The only mitigation in this evaluation is explained by the absence of local authorities. Although the municipality, APROSEN and the center have thought about projects in cooperation, nothing concrete came out of it. Because waste valorization is supposed to be a task of the public sector, more intervention from their side is wished. However they do not participate and therefore responsibilities are legitimately distributed. Their absence is source of frustration for the other actors who see in this a hindrance to development.

Table 11: Specific analysis on the relations' quality between the center and its partners⁷⁹

Criteria	Indicator	Evaluation		
		Partnership between the center and NGO LVIA	Partnership between the center and the grassroots organizations	Partnership between the center and industrialists
Reliability between the actors	The partnership was willing from both side and not imposed	Positive	Positive	Positive
	Partners know well each other's activities	Positive	Positive	Positive
	Wished relations became effective	Positive	Positive	Mitigated
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Positive	Positive	Mitigated
Respect of the procedures and agreements	Partners respect the procedures and agreement	Positive	Positive	Mitigated

⁷⁹ Partnerships' quality has been evaluated in the basis of the data collected from the interviews. The detailed evaluation on the gradation is available in Annex 3 and Annex 4.

Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Positive	Positive	Positive
	New projects are developed	Positive	Positive	Positive
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Positive	Positive	Positive

The contacts between the center and the civil society are intense and of good quality. Although the NGO LVIA has no direct role anymore in the center's activities, its relations with the center stay very good. They are still indirectly linked today and continue therefore to communicate can only be beneficial for the system. Furthermore PROPLAST feels grateful upon the NGO who deserves according to them transparency on the current situation of the center. Thereby reports on the center's activities and projects are promptly written for the NGO⁸⁰. The relations with the grassroots organizations are satisfactory as well due to the satisfactory communication and understanding. Representatives know well each other and they work on overcoming each other's constraints.

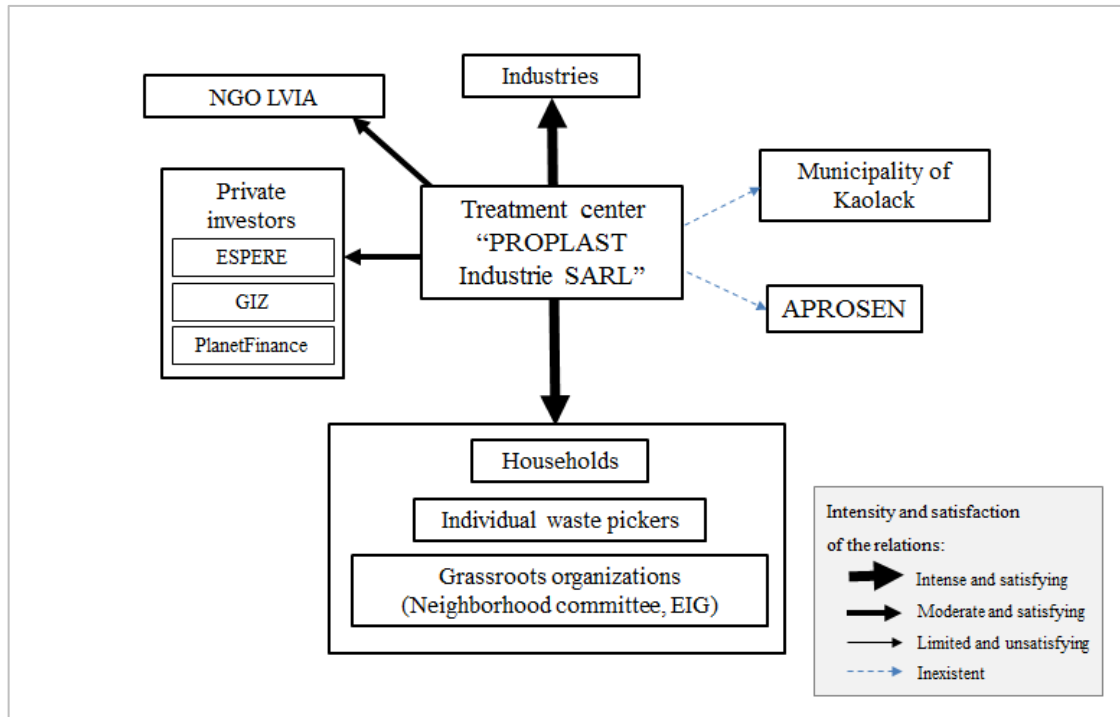
Although relations with industrialists are relatively good in general, it should yet be mitigated because of the pressure that they are likely to put on the center. Because of its limited capacities, the center can consequently loss of market share. The center deplores the conditions imposed by the industrialists as regards to the price and its fluctuations. Because industrialists are driven by profit, they can also retreat easily when they perceive risks. Especially at the beginning, some industrialists agreed on buying the valorized plastic but drew back during the sales because of doubts (LVIA, 2006).

Finally the relations with private investors have not evaluated in details considering that it deals merely with financial agreements. An evaluation more general has demonstrated that contacts happen promptly and were satisfying.

Figure 19 below gives an illustration as a summing-up on each partnership's intensity and satisfaction explained in the previous parts.

Figure 19: Relation intensity between the center of Thiès and the other actors

⁸⁰ Production manager of the center in Thiès, 2012



The analysis on the local governance in plastic valorization system in Thiès has revealed the dominance of the center and the civil society. Their interactions are numerous and of good quality, which enable the elaboration of sustainable collection organization. Besides the center gives a growing attention to its relations with industrialists in order to develop and enhanced the relations. This particular local governance has led to the specific organization of the system described in the next parts.

5.3.2.3. Organization and dynamics of the system in Thiès

Elaborated primary and secondary plastic collection

The cooperation between the center and the grassroots organizations have led to the elaboration of two schemes for plastic collection. Individual waste pickers and grassroots organizations undertake primary plastic collection. The individual waste pickers bring the plastic collected directly to the center. The second scheme implies that collectors linked to the neighborhood committees and official members bring the plastic collected to transfer sites where plastic is disposed by collectors, accumulated and then retrieved by the center.

The establishment of these two schemes and its integration into the urban system are the final result of successive changes. It had been acknowledged at the early creation of the center that establishing a partnership with grassroots organizations and making individuals participate in plastic collection were crucial to make the system run. Throughout the years, the center got more and more accepted into the urban system mainly due to a change in perceptions from the

population⁸¹. Some districts still outside the system request now their integration into the system.

The organization described above is embedded in a system which is not static but rather dynamic because confronted to influencing forces. These dynamics are analyzed in the following part.

Dynamics of the system

The following part analyzes the internal and external forces that had and/or have currently an effect on the plastic valorization system in Thiès, and the behavior that the system adopts as a respond to it.

Dynamics in the system's upstream part influencing downstream performances

The activities of the center depend firstly on the input that it receives. The remoteness of the center appeared as the principal issue since it adds to collectors additional transport costs and influence therefore the final quantity received by the center. Plastic quality is also crucial for the center in the sense that it influences material marketability and hence center's potential benefits. Strategies have been conducted to improve thus the performances of the upstream part and its influences on the downstream one. These enhanced collection schemes have enabled the center to process higher amount of good quality plastic. Industrialists are therefore satisfied by the outflow of the center and are likely to increase the amount of their order.

Dynamics in the system's downstream part influencing upstream performances

The center is facing diverse difficulties that might have negative impacts on its activities, performances, profitability and benefices. These difficulties find their origin in internal constraints of the center and uncertainties for the valorized plastic outflow. It can in return affect collection performances if the plastic needed by the center decrease for instance.

Financial difficulties

After facing large financial difficulties at its creation and being totally dependent on external funding, the center has now become autonomous and must therefore constantly seek for financial balance between the expenditures for the input and incomes from the output sell. Nowadays this financial balance is rather stable while the center continues to receive promptly external funds.

Technical difficulties

The initial center's capacities were very limited since the cutting and washing phases were done manually. With the acquisition of a washing machine for plastic pieces (donated by the European Community and Italian regions), working conditions have been enhanced while productivity and capacities have increased. Thanks to external funds the technologic platform has thus considerably improved.

⁸¹ Representative of LVIA, 2012

But despite this productivity growth, the capacity of the center still stays too limited considering the potential amount of plastic that could be collected in the entire city and the increasing interests of industrialists on valorized plastic. There might be a discrepancy between industrialists' orders and the outcomes of the center which limits possibilities to expand the center's activities.

Commercial outlets difficulties

Especially at the creation of the center, some industrialists showed some reluctance upon the center activities which appeared to them as social work whose reliability is questionable. The presence of women of certain age and not educated among the employees was not a guarantee of efficiency for them⁸². Industrialists need to be sure of the high quality of valorized plastic before putting it in their production chain. Change in perceptions on the center and proof of the valorized plastic quality had therefore to be done upon industrialists. Once the first buyers were convinced, the center had been able to canvass intensively for other commercial partners on the basis of this first successful contract. Nowadays a growing number of industrialists put in an order for valorized plastic from the center and the valorized plastic has been thereby integrated in production chain by 10%, 30% or even 100% in certain cases (APROSEN & WWF, 2010, p.21).

The relevance of this system and the necessity to always improve its dynamics are proved by the positive impacts that guiding plastic flows has on the economic, social and environmental spheres.

Economic, social, and environmental implications

Economic implications

When the NGO LVIA has created the center, 15 persons had been hired. In 10 years, the center has doubled the number of its employees and has now 30 persons working at the center. Moreover the activities of the center generate also revenues for the ones who decide to take part in plastic collection. Plastic collectors receive monthly revenues according to the amount of plastic brought to the center or the transfer sites. Furthermore the schemes for plastic collection enable anybody to take spontaneously part in the system.

Social implications

The center's activities have positive impacts on the inhabitants' living conditions essentially thanks to the healthier environment that it enables to have. Disease and infection due to waste accumulation have hence been reduced. Living standards of the employees and collectors have also been enhanced.

Furthermore, the center's activities have participated in enhancing sexual parity and gender perceptions (LVIA, 2006). Women constitute a large part of the employees of the center and the representatives and managers in neighbourhood comities. The large presence of women has participated in their emancipation and the recognition of their ability to work.

⁸² Representative of LVIA, 2012

Environmental implications

The center's activities have enabled to reduce the amount of waste unvalorized that normally end in uncontrolled landfills. The associated environmental degradations have accordingly been reduced. Moreover the practice of setting off a fire in overloaded landfill is now less used. A study conducted on Thiès' carbon footprint revealed a clear reduction in CO2 emissions since the implantation of the center⁸³.

Analyzing the functioning of the center, the governance in plastic valorization system in Thiès and the dynamics of this system enables to explore where the perspectives for the development of the system rely.

5.3.3. Strengths, weaknesses, opportunities and threats of the plastic valorization system in Thiès

The perspectives of development for the plastic valorization system in Thiès are explored by highlighting its strengths, weaknesses, opportunities and threats. It has been enabled by conducting a SWOT analysis presented in Table 12.

⁸³ Representative of LVIA, 2012

Table 12: SWOT for the treatment plastic system in Thiès

<p style="text-align: center;"><u>Strengths</u></p> <p>System's governance</p> <ul style="list-style-type: none"> • Participatory approach is successful • Responsibility distribution is clear • Communication among the actors is good • General quality of the partnerships is good • The center is transparency on its activities <p>System's functioning</p> <ul style="list-style-type: none"> • The technological platform is developed • Supply is assured thanks to expected growing waste generation • Plastic collection (primary and secondary collection) enables high quality of the plastic collected • The past evolutions and current objectives in plastic collection schemes are encouraging and promising to overcome the remaining difficulties <p>Others</p> <ul style="list-style-type: none"> • Economic, social and environmental benefits of the center's activities have been proven • The center is financially autonomous and economically viable (balance between expenses and benefit is reached) • The center is dynamic in canvassing new commercial partners and seeks for diversifying the nature of its commercial partnerships. 	<p style="text-align: center;"><u>Weaknesses</u></p> <p>System's governance</p> <ul style="list-style-type: none"> • There are some difficulties in communicating with some actors <p>System's functioning</p> <ul style="list-style-type: none"> • Plastic collection coverage is still limited • The processing capacities of the center are limited • Quality of valorized plastic can easily degrade which is risky in commercial partnerships <p>Others</p> <ul style="list-style-type: none"> • The financial difficulties limit the possibilities to invest in processing capacities
<p style="text-align: center;"><u>Opportunities</u></p> <p>System's governance</p> <ul style="list-style-type: none"> • Most of the partnerships are of good quality and they are therefore likely to influence positively the center's performances • There is a demand from representatives of other municipalities to exchange knowledge and experiences concerning plastic treatment. <p>Dynamics of the system</p> <ul style="list-style-type: none"> • Dynamics in the system's upstream part influence efficiently the downstream part • Dynamics in the system's downstream part influence efficiently the upstream part <p>Others</p> <ul style="list-style-type: none"> • There is an enabling environment thanks to the growing ecological environmental awareness • Awareness programs keeps on being conducted upon the large public and schools • The commercial outlets are numerous • The geographical position is strategic 	<p style="text-align: center;"><u>Threats</u></p> <p>System's governance</p> <ul style="list-style-type: none"> • There is a total absence of local authorities in the governance <p>Others</p> <ul style="list-style-type: none"> • There is a deterring environment because of waste nuisance still high • Negative perceptions on waste are still spread • Profitability of treatment activities is hard to reach • Commercial outlets for granule are highly limited

Considering the strengths and weaknesses of the center, and the opportunities and threats in its environment, the perspectives for the center rely in developing and strengthening the elements helpful to achieve the center's development, and limiting and overcoming the elements constraining the achievement of the system's development. It takes place within the center's organization and in its environment.

Conclusion

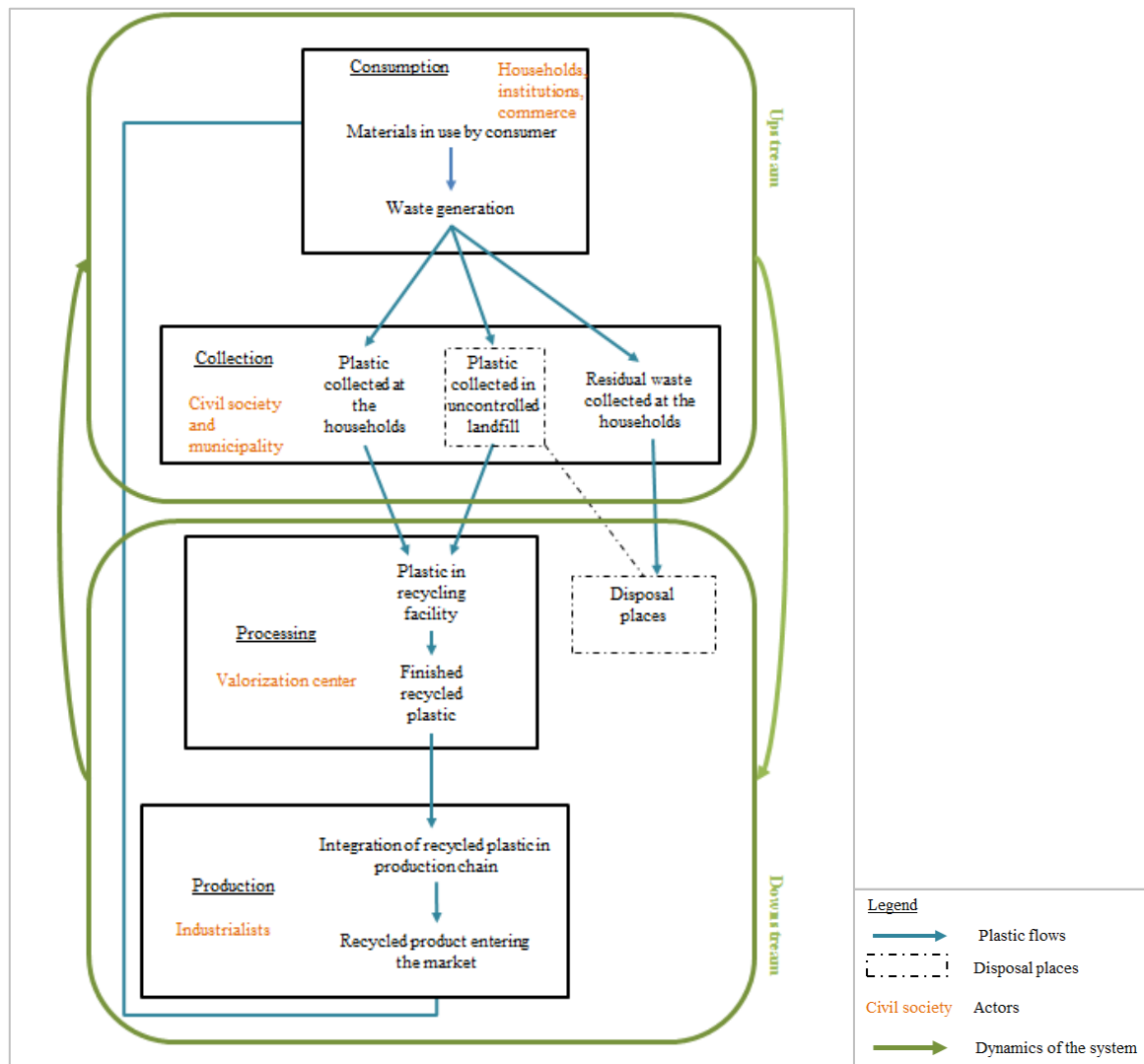
The treatment center in Thiès is nowadays the most advanced one in Senegal and is hence in a position of leadership. Its perspectives for development are numerous and promising. It is assumed that the progressiveness characterizing most of its partnerships has enabled the implementation and development of an efficient organization and dynamic system. Although the integration of the valorization system in the urban ones is not at its optimum, the center has decided to give more attention to the downstream part of the system. The center is therefore intensively canvassing for new commercial partnerships and diversifies their nature. It is hoped that it will indirectly improve the integration of the upstream part of the system in the urban ones, and directly participate to the development of the center.

5.4. Comparative analysis

The comparative analysis aims at showing the similarities between the two valorization systems, as regards to their organizational aspects.

Because these centers have been created basically for the same goal – treating plastic waste -, the basis of their functioning and the basic structure of their systems are similar. Figure 20 below gives a representation of the plastic valorization system, showing the main components, actors' places, material flows and influences.

Figure 20: Plastic valorization system



Based on this structure, a specific organization of the actors is applied. The comparative analysis aims at highlighting the constraints and opportunities that both systems meet in their organization. It is based on the SWOT analyses of the two case studies (cf. Table 7 and Table 12). Thereby the main variables influencing their development are identified.

5.4.1. Governance in valorization system based on the civil society and turning towards the private sector

In both cases, the sector of plastic valorization is getting a growing interest among the civil society and the private sector, while the public sector is set back. Although waste treatment and valorization is considered in the Code of the Environment (2001) as a municipal duty, local authorities are either passive or totally absent. To counteract this failure, the civil society becomes therefore particularly dynamic. Thereby, collection is carried on mainly by the civil

society or informal workers. On one hand NGOs have a crucial role by enabling the implementation of valorization system and/or stimulating its running. And on the other hand, participatory approach has been largely promoted which proves the relevance of communities' integration in the system and the compulsion to do so. On the other hand, private sector is willing to participate and the civil society is seeking for opportunities in the private sector. The private sector participates in the system by either funding directly the system for social purposes, or indirectly by buying the center's outflows for commercial purposes. However, partnerships between centers and industrialists present inequalities in the relations. Centers need more the industrialists than the industrialists need the centers since supply sources of plastic are nowadays more numerous than buyers of valorized plastic. With this dominating position, industrialists can impose their conditions which are not always in the advantage of the center. Figure 20 presents and positions the main actors in the system.

Figure 20 presents and positions the main actors in the system.

The number of actors involved in valorization governance differs according to local specificities. The larger the governance is, the more important and challenging communication and coordination become.

Governance in Thiès' valorization system is reduced and the center is relatively autonomous by taking many responsibilities. The other tasks have been clearly assigned to the civil society and the system runs relatively efficiently. In Kaolack, the system still needs several improvements partly because its larger governance confronts communication problems. It prevents for instance a clear task distribution or efficient coordination. As a consequence the systems' performances are not at their optimum. Both cases have therefore proven the importance of having and maintaining relations of good quality. It influences positively the performances of the center by enabling the partnerships to be progressive and constructive. Regular meetings and transparency are thus required. It enables to understand better each other's opportunities and constraints, create a trustful atmosphere and work more efficiently on improvements possibilities.

5.4.2. The functioning of the system facing several constraints

Supply of plastic waste is assured in the two cases and in any Senegalese municipalities since everybody produces waste, including plastic waste. However this growing supply of plastic waste is not enjoyed at its maximum by the centers. There are two reasons for that: the quantity of plastic collected stay inferior to the plastic waste generated and the plastic collected might have low quality. These two elements are directly determined by the schemes of plastic collection. It encompasses the organization of the actors in collecting and transporting it, and the spatial organization. However the geographical coverage of the schemes stays relatively limited and does not go beyond municipal borders in any of the case studies. Collection schemes are nevertheless never definite but rather always under construction. The evolutions that happened so far are promising for the future. The new ambition relies in waste sorting so as to facilitate plastic collection and improve plastic quality. Implementing it requires technical and organization adaptation, and especially the participation of the communities.

The process of plastic valorization is facing also several constraints in both studies. Firstly management during the valorization process must be carefully done in order to maintain the quality of the plastic valorized. Even a small mistake in plastic segregation degrades largely the quality of the end material. Secondly the analyses on the case studies have revealed that centers have too low processing capacities compare to the amount of plastic waste generated. In order to develop the centers' activities, the capacities must hence be increased. Otherwise efforts put in improving collection schemes are neither necessary nor relevant. Increasing the capacities requires investment in equipment, infrastructure and/or employees which confront centers with financial requirements hard to fulfill for both of them. The difficulties for the centers to be economically viable are caused by the profitability hard to reach in this sector. Buying plastic to the collectors, treating it and transporting it until the buyers, represent high costs for the center. The price of valorized plastic is however too low since it hardly covers these previous expenses. These financial and technical limitations can be overcome with strict financial management and prompt external subsidies. It improves their economic viability and enables to invest in equipment and infrastructures.

5.4.3. The dynamics of the systems influenced by internal and external forces

In both cases, the systems are influenced by internal and external forces, which impact negatively or positively on the system. Specific measures influence these forces which become thereby systematically positive stimulations. As shown on Figure 20, p.117. the upstream part of the system influences the downstream one, and vice versa, creating thereby feedback loops.

Influence of the upstream part of the system on the downstream one

The upstream part of the system presents some constraints which can degrade the performances of the downstream part. Adaptations to these constraints are therefore needed so the upstream part can be efficient and influences hence positively the downstream part. In the plastic valorization systems analyzed, it has taken place by making the population understand the relevance of the centers' activities in order to make them participate in the systems. Secondly adaptations of the collection schemes to the constraints of waste generators and waste collectors have been carried on. Thereby collection schemes have been enhanced and the valorization centers receive satisfactory supply for. The centers can therefore meet the demand of the industrialists.

Influence of the downstream part of the system on the upstream one

The downstream part of the system influences also the upstream one. The influencing forces find their origin in the centers' constraints and the industrialists' requirements. The analyses have highlighted that the centers face financial and technical difficulties that can deteriorate their performances because it limits their processing capacities. Overcoming these constraints helps to meet the industrialists demand and thereby to evacuate the valorized plastic and multiply the commercial opportunities. When the center is certain to be able to sell its material, it can ask for more plastic upon the collectors. Thereby plastic collection is stimulated.

External influences

External influences are economic and political, and represent often threats for the system's running.

Firstly economic influences come from the market of recycled plastic and its conditions. Valorized plastic price is relatively low and instable. Since plastic is derived from oil, its price depends therefore on oil price fluctuations. When the oil price decreases, plastic valorized price has to follow this trend otherwise it losses in competitiveness. Stocking valorized plastic when oil price is low can represent a solution but only temporary. In the cases analyzed, insufficient financial reserves prevent the center to stock for more than two months. Establishment by the State of economic tools with a compensation system that would cover the fluctuations' prices for the center would be a strategy to overcome this economic difficulty.

Secondly there are political influences. As explained in section 3.2.2, Institutional instability and incomplete decentralization (p.60), Senegal is facing institutional instability and incomplete decentralization. On one hand the legislative frame does not define accurately enough the responsibility of local authorities in treating and valorizing waste⁸⁴. There is also no control on the respect of this legislative frame. Finally municipalities do not dispose of enough financial resources to cover the costs of treating waste. As a consequence they do not take their entire responsibility which prevents the sector to develop in good conditions. For the benefice of the entire Senegalese society the legislative frame has to be more accurately redefined, stable and accompanied with the necessary financial resources.

Feedback loops in the system

The resources and livelihood group in the Tata Institute of Pune (India) observes in waste management system “a dynamic and feedback structure [...], which depends on multiple factors, including a variety of technical, economic and social factors” (undated, p.2). The several influences described in the above sections lead indeed to feedback loops within the analyzed systems.

Efficient plastic collection assures satisfactory supply for the center who can meet the demand of the industrialists. When the industrialists are satisfied, they increase in return their demand for valorized plastic. Consequently the demand for plastic waste upon the collectors will increase which stimulate the collectors in their work. Because of the financial incentives, they will enhance their collection's performances and they will supply the center with larger amount of plastic that has a higher quality. It matches thereby the industrialists' demand. Satisfying industrialists' demand and even multiplying commercial outlets, in an enabling economic environment, increase the centers' revenues and enables therefore to invest in the plastic processing capacities. The center can thereby accept more plastic upon the collector which stimulates positively plastic collection. This positive feedback loop is highly productive.

⁸⁴ The Code of the Environment, 2001

Conclusion

The separate analyses on the case studies and their comparison have enabled to highlight the challenges both centers are confronted to: managing efficiently the flows and their fluctuations. It encompasses then three defies. The first one deals with insuring sufficient input while being able to process it as well as evacuating the output. Secondly input has to be accepted in the center despite the fluctuating outlets for the output. And the third challenge is that outflow is guaranteed despite input fluctuations. Difficulties rely in each of them and have to be tackled for the efficiency of the system. For that, each center has developed its own strategy. Furthermore their stage of development differs as well and the environment they evolve in presents diverse opportunities and constraints. Consequently, the two centers show some dissimilarity in their organization and in the governance and dynamics of their system. While Kaolack is still working on establishing in a sustainable way its activity in the urban system, Thiès is willing to multiply its commercial outlets. More attention is apparently given to the upstream part of the system in Kaolack while Thiès focus on the downstream one.

But beyond these aspects, specific variables have been recognized in both cases as determining for the centers' development. In the upstream part of the system, the participation of the community, the quantity collected and the quality of the plastic collected influence strongly the performances of the entire system. In the downstream part of the system on the other hand, the processing capacities, the financial system and the outflow are affecting the system. Communication and coordination between the actors sway the entire system. Finally external influences stand in the economic and political spheres since it determines if the environment is enabling and deterring for waste treatment. Taking adequate actions on these variables would therefore stimulate positively the system and maximize therefore the systems' performances.

According to UN-Habitat (2009), a sector development should start from the existing strengths and build upon them. The Senegalese sector of waste valorization seems therefore to have its highest potential in the development of local centers such as the ones in Kaolack and Thiès. Understanding local centers' systems enables to explore the possibilities for the sector development. The following chapter aims at investigating these perspectives.

Chapter 6

Good Governance in Waste Valorization in Senegal

Organizing a sector corresponds mainly to the arrangement of stakeholders' actions and relations. Considering that the actors involved are from the public sector, the private sector and the civil society, their organization adopts a governance approach. By definition, good governance is efficient organization among an array of diverse actors who cooperate according to an inclusive approach (cf. List of definitions). It enhances sector's efficiency by avoiding individual and isolated actions, and therefore isolated outcomes and actions' superposition, which do not benefit to sector development. Oppositely, good governance enables fruitful cooperation, avoids harmful competition and maximizes thereby the outcomes.

Waste valorization sector in Senegal is at an underdevelopment stage. Infrastructures are only starting to emerge and are therefore still tremendously lacking when contemplating the national scale. The development of the sector is therefore necessary and would accordingly take place through the definition of governance. It would help to maximize sector performances and manage better waste. Perspectives for the development of the sector rely therefore in the actions driven by good governance.

This chapter defines hypothetical good governance in the Senegalese valorization sector by defining the stakeholders, their actions and relations, and the structure in which they could be embedded. These descriptions are based on the analysis of the two selected case studies presented in Chapter 5. Thereby this hypothetical governance is a possible scenario for the Senegalese valorization sector.

Accordingly, the first section of this chapter exposes the actions needed at the local level and the actors expected to conduct it. This section - partly based on the analyses in Chapter 5 – enables to explore the possibilities and requirements for the development of local centers. Thereby local perspectives are highlighted. Secondly the structure that would direct governance to the hypothetical good state is investigated. While the foundation of the sector relies indeed on local units, structuration and organization of it at a national level are also crucial in order to implement efficiently waste valorization.

6.1. Perspectives and related governance for local development of the valorization sector

The foundation of the sector development relies more precisely on the strengthening of local systems, the diversification of their activities and their multiplication.

6.1.1. Strengthening local system's performances

The analyses presented in Chapter 5 have highlighted the key variables that influence waste valorization system and the implicated actors. Specific actions on these variables can stimulate positively the system's performances. Development perspectives are thereby identified by highlighting where the efforts should be put - which actions on which variables - and who

should do it. The nine key variables that have been identified in the analysis on local structures in Chapter 5 are the following:

- Community participation
- Waste quantity
- Waste quality
- Financial system
- Processing capacities
- Outflow
- Relations and communication
- The economic environment
- The political environment

The following section defines the actions stimulating these variables and the actors involved.

Actions on the variables and actors involved

- Community participation

Community participation refers on one hand to the participation of households in disposing adequately their waste and eventually sorting it. On the other hand it consists in integrating grassroots organizations and optimizing their participation which is enabled by adapting the system according to the constraints of each actor.

Community participation might appear naturally among a part of the population. However it is often the case that the participation of a large part of the inhabitants needs to be initiated. For doing so, the valorization center in cooperation with the municipality, the grassroots organizations and NGOs if present, are in charge of organizing awareness programs on waste related issues and waste valorization implications and eventually visit of the center. The Boxes 21 and 22⁸⁵ illustrate how community participation has been concretely initiated in the case studies. Also, technical assistance might be useful to increase community participation through the

Box 21 - Tackling communities' reluctance to participate in Kaolack (Senegal)

The apparent reluctance of the population in Kaolack to participate in SWM is caused by negative perceptions on waste and wrong information on waste valorization. Consequently they refused firstly to change their behavior. Strategies to overcome this difficulty have focused on proving the viability and utility of recycled products by installing septic tanks made out of recycled plastic. Communities have thus understood the numerous gains of recycling plastic for their living conditions.

Box 22 - Communicating with the communities as a key for efficient participation in Thiès (Senegal)

When implementing collection schemes in Thiès, communication channels have been created in order to bring the necessary information to the population. It was particularly needed in the reluctant districts, most of the time being the high-income ones where inhabitants perceive waste sorting as degrading. Inhabitants in lower-income districts saw in this program the opportunity to earn money, their mobilization were consequently large and less awareness programs have consequently been organized.

⁸⁵ Representative of LVIA, 2012

donation of bins for instance since it helps waste disposal.

- Waste quantity

Collection scheme determines the amount and type of waste received by valorization center. Efficient collection scheme is defined by its ability to remove the totality of waste generated away from its source and to transport it to adequate valorization places. Box 23^{86 87 88 89} presents the case of a specific collection schemes aiming at maximizing collected waste quantity.

Increasing the quantity of collected waste requires avoiding leakage during collection and enlarging the spatial coverage of the collection service. Large spatial coverage encompasses all the municipality's districts as well as the surrounding rural communities that are of too-reduced size to valorize themselves waste. Accordingly, inter-

municipalities partnerships maximize collected waste quantity. Transfer sites enable this enlargement by limiting the transportation loads and costs of primary collectors, which might prevent their participation.

- Waste quality

Mixing waste types during the collection alters the material quality. Disposing waste in landfill, even temporary, worsens plastic quality and increases the center's processing costs. Waste quality optimum is reached when collected already sorted directly at its generation source, avoiding hence any contact with other waste types⁹⁰. Door-to-door collection and initial sorting among

Box 23 - The “double collection scheme” increasing collected waste quantity, in Kaolack (Senegal)

When the valorization center has been created in Kaolack, some collectors were in charge of the collection of plastic and others in charge of the residual ones. The plastic collectors received money from the center and the residual households' waste collectors were paid by the neighborhood committees. However collecting only plastic is less profitable for the collectors than collecting residual waste. The unequal revenue between the two collectors made plastic collection not financially interesting and plastic collectors shift therefore progressively to residual waste collection. In order to maintain the plastic collection and the “double collection” has been adopted. The two schemes are not running in parallel but are instead linked and complementing each other, which avoid financial inequalities. Collectors are not specialized anymore in one type of waste and they receive thus payments every day from the neighborhood committees for the residual waste and from the center once a week for plastic collected.

Box 24 - Improving plastic quality to enhance valorization center's performances in Thiès (Senegal)

A strategy to improve plastic quality has been conducted in Thiès consisting in door-to-door collection schemes. Thereby, collectors gather plastic directly at the households who have either already segregated it or put it temporary with other waste types. In the first case the quality is high while in the second it has been slightly worsened. Still it conserves a relative satisfactory quality, especially when compared to waste disposed in landfilled with hospitals' waste.

⁸⁶ Representative of APROSEN Kaolack, 2012

⁸⁷ Representative of CARITAS Kaolack, 2012

⁸⁸ Representative of the neighborhood committee "Gawane"

⁸⁹ Manager of the center in Kaolack, 2012

⁹⁰ Manager of the center in Kaolack, 2012

wastes enable it. Box 24⁹¹ gives an illustration of the first aspect. However the feasibility of establishing waste sorting has been questioned by several interviewees (cf. Box 24)⁹².

Box 24 - Interviews' fragments on waste sorting

“Awareness programs on waste sorting are highly needed to make people understand the use of it and motivate them to change their habits”. “Also, it needs to be clear that they should not expect a repayment when doing this effort. Instead, they should integrate it as a civic duty”.

Finally technical support helps in avoiding waste mixture. The donation of two differentiable bins by the Peace Corps (American agency acting for development) in Joal, has helped physically the population to segregate their waste between organic and non-organic waste for the compost center⁹³.

Considering that SWM is a public service whose access should be guaranteed to everyone means that local authorities are in charge of assuring the good performances of waste collection. The civil society has yet also proven its efficiency in handling this task and the participation of the private sector presents also advantages. Thereby partnership between the local authority, the valorization center and the civil society appears as the best combination for waste collection organization.

- Financial system

Financial system determines the performances of valorization system. Its main core is the center which has three possible sources of funding: the benefits made on its production, the contribution of beneficiaries (which are in that case the inhabitants) and external funding. All these financial incomes combined enables to buy the input to collectors and to pay the production factors (employees, equipment and infrastructure maintaining, other inputs such as water and electricity, and capacities investment).

Centers are primarily making money out of the treated material sell. Good balance between benefits and expenses are assured by the means of a strict financial management controlling well the inputs and outputs flows with the help of prognostics. Besides, financial reserves guarantee at least the monthly payments of the basic fix expenses. Design a good financial system might is a constructivist process as Box 6 illustrates it. External financial support, especially at the center's creation, is often needed. Private

Box 25 - Financial system adaptation in Kaolack (Senegal)

The insufficiency of financial reserves impeded the center to pay directly the collectors every time they brought plastic. It has been agreed on paying them the accumulated amount at the end of the month when the center would have received the payments from the industrialists. This financial system stimulates the upstream's performances by limiting revenue fluctuations.

⁹¹ Representative of LVIA, 2012

⁹² Assistance of the representative of Caritas Kaolack and representative of the neighborhood committee "Ndorong 1", 2012

⁹³ <http://www.environnement-afrique.info/?Projet-integre-de-gestion-et-de> [Accessed on 7th July 2012]

investors, NGOs and particularly the authorities (local, regional and national) might be of financial help. Yet this support should not turn into assistance but should rather stay occasional so the center can become financially autonomous.

- Processing capacities

Processing capacities are particularly important in the system since they determine the amount of input accepted by the center and the amount of output that can be sold. It influences therefore indirectly the activities of collectors and the commercial dynamism of the center.

The main purpose of a center is not to increase its profit but rather process the maximum amount of waste. Accordingly processing capacities should aim at matching the amount of waste generated in the largest possible spatial coverage of the collection service. In order to reach this stage, processing capacities might need to be increased. It encompasses the acquisition of new equipment, improvement of the technological platform and job creation. These tasks can only be accomplished by the center. However, processing capacities are determined by technical and financial aspects often limiting small-size structures. Both technical and financial supports from private investors, NGOs and the authorities might be also needed to increase processing capacities (cf. Box 25).

Box 25 - Overcoming technical difficulties in order to increase processing capacities in the valorization center in Kaolack (Senegal)

The European Commission has offered a washing machine for plastic pieces. Before that each plastic pieces was systematically washed by hand which led to a productivity of only 1500 kilos per month. With the acquisition of the new machine more than 6000 kilos of plastic can now be washed every month. Getting new equipment enables thus to increase the productivity and the capacities of the center.

- Outflow

Insuring the outflow of the centers' materials enables to recover revenue and process thus new inputs. However this stage in the system is challenging since centers are often put under commercial pressure where buyers assert their own terms.

First of all, the center has to canvass for commercial partners, as illustrated in Box 26, by convincing industrialists and satisfying as much as they can buyers' demands as regard to the amount and the quality ordered. Once a commercial basis is implemented, the multiplication of commercial opportunities might follow. Creating a commercial pole within the center and designating one actor in charge of help in these tasks.

Box 26 - Canvassing commercial partners in Thiès (Senegal)

The NGO LVIA helped the valorization center in Thiès to canvass for commercial partners. For that, the NGO has distributed samples of treated plastic to industrialists so they could test it. It has been a success and the commercial partners multiplied. The center has now created a commercial pole within the center focus on canvassing commercial partners and aiming also at diversifying the commercial outlets.

- Relations and communication

When relations between the actors are good, clear responsibility distribution can be established. The atmosphere is a trustful one characterized by efficient negotiation and respect of the agreements. Without these elements, valorization system's performances cannot be at their optimum. Efficient communication is essential and is determined by the frequency and the quality of contacts. Organizing regular meetings where all the partners are present and smaller-size meetings are premises for satisfactory communication. Considering each other's difficulties and objectives enables fruitful negotiations.

Assuring the relations between partners takes place at the system scale and all participants are therefore in charge of making it work. Yet municipalities are officially the one responsible of the entire system and should accordingly undertake the task of organizing meetings. In situation where participation of municipalities is limited or inexistent, the responsibility of assuring satisfactory communication falls upon the center.

- The economic environment

The economic environment, and more precisely the market, determines prices. It is yet often judged as too low and highly unstable, which impact negatively on the centers' revenues, its activities and thus on the system's performances.

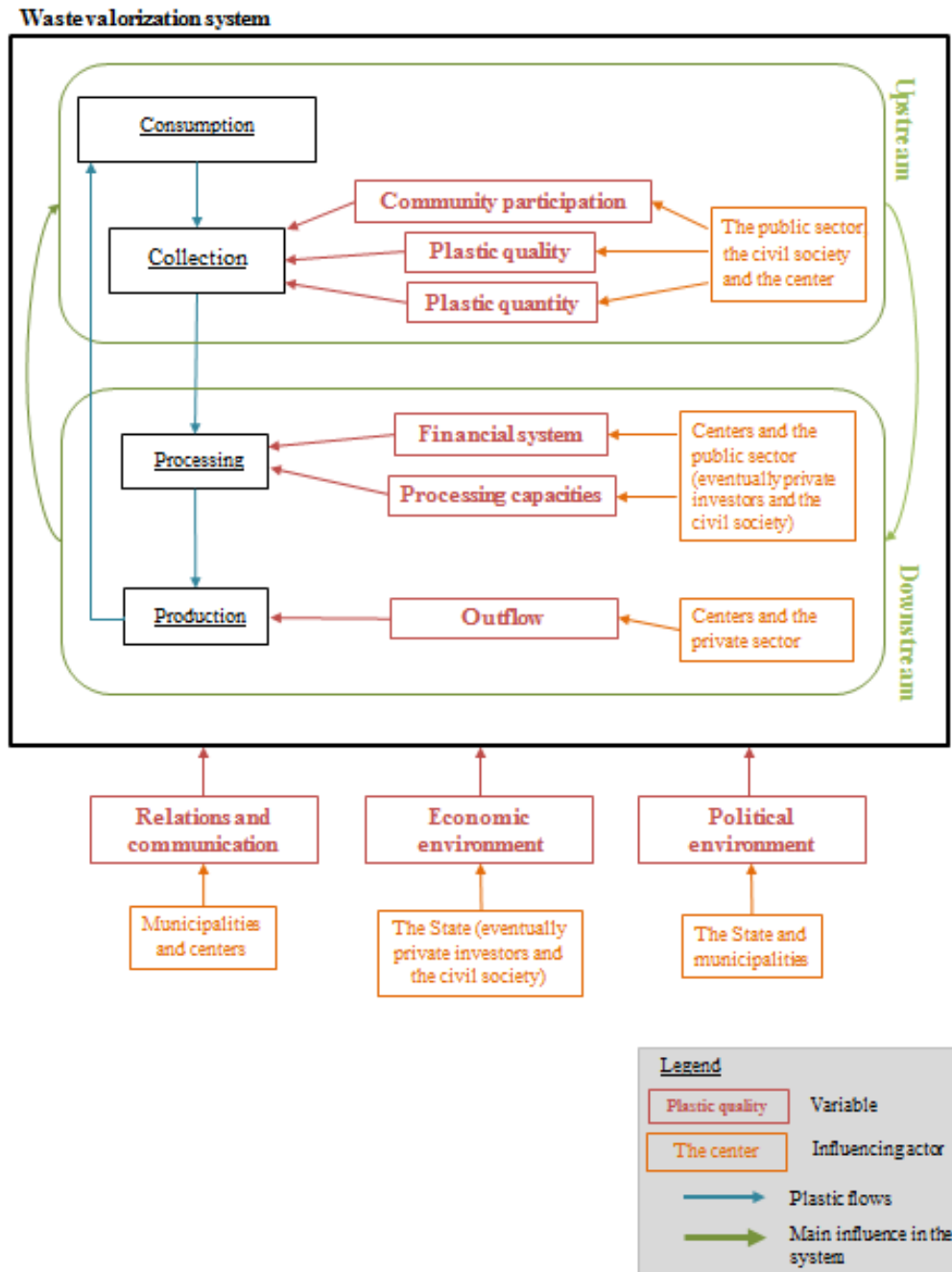
Prices fluctuations should therefore be limited and even avoided. On the side of centers, the strategy of stocking materials that can be valorized when prices are low can be applied. It necessitates however that centers' financial reserves are sufficient enough to be able to stop selling the time prices increase again. Action on the side of the State can also be taken by influencing the prices or the import, i.e.

- The political environment

The political environment influences largely governance in waste valorization. The State is the only actor determining it officially through the formulation of legal framework and by guaranteeing its constancy and the existence of subsidies for local authorities. A legal frame presenting in a clear and accurate way role distribution and a description of the tasks assigned would limit governance confusion. Furthermore, subsidies from the State would help municipalities in managing in a sustainable way their waste.

The following figure gives a simplify illustration of waste valorization system with its main variables and the actors expected to be in charge of.

Figure 21: Waste valorization system and its main variables



Stimulating positively these variables has four main purposes for valorization centers:

- Overcoming internal difficulties
- Tackling external constraints
- Multiplying opportunities

- Strengthening the positive influences within the system

According to the strategy adopted by the center, some variables receive more attention than others. Although centers are free to choose their strategy, no variable should be ignored.

6.1.2. Diversifying local system's activities

The end-goal of centers is to be complete in the sense that their valorization activities cover all types of waste. Thereby, diversification is in that sense preferred to specialization.

Diversification takes place through the multiplication of waste types valorized. After identifying and understanding well how valorization sub-systems can be created, developed and maintained (cf. 6.1.1), development plans for other valorization sub-systems can be elaborated. It includes getting the necessary equipment and knowledge, and the setup of organizational and commercial partnerships. Community participation is also crucial since diversifying waste valorization requires waste sorting. Finally investment in adequate equipment and implementation of specific collection schemes are necessary.

Besides, specific spatial organization of these sub-systems would enable the optimization of the performances of the entire waste valorization sector. Clustering the different types of valorization would simplify collection schemes and enable coordination between them. Instead of having one collection scheme per waste type, several of them could be collected meanwhile. However it should be made with adequate transportation means so wastes do not mix during transportation – carts or trucks with separated containers for instance -. Such center's activities expansion increases the presence of neighborhood scale facilities and maximizes therefore local waste valorization. Finally the cluster should be implemented next to the official controlled landfill so secondary sortings can be made without implying other transportation costs.

Diversification is yet hardly doable when isolated. Inter-communal partnerships appear in that sense beneficial when diversifying center's activities. It enables to share knowledge and it puts in common waste valorization activities which is necessary to optimize the sector's performances.

6.1.3. Multiplying local systems

Multiplication of systems throughout the country relates to decentralization of units in the valorization sector. Decentralization is preferred in the valorization sector since waste generation has sources everywhere. Every municipality of more than a certain number of inhabitants should have valorization centers. Decentralization saves on the other hand transportation costs. Considering that a large part of the valorization sector relies in the informal sector, structuring their activities would lead to the appearance of new official valorization centers. Their progressive integration into the formal sector is therefore a prerequisite to accelerate decentralization. Besides, the development of local initiatives should be encouraged.

5.1.1.1 Integrating informal workers and informal units into the formal sector

UN-Habitat has evaluated that projects integrating the informal sector lead to significant win-win approaches by maintaining an economic and operational space for them (2009). Many experiences show indeed that ignoring the existing informal sector during the installation of a new formal recycling system can be highly counterproductive (Wilson, 2006). The informal workers expected to be integrated are the waste pickers who execute the collection and waste recovers/recyclers who process waste to valorize it. Integrating these workers into the formal sector is necessary for improving their living and working conditions, and for enhancing the quality of their work. Wilson argues that the less organized the informal recycling sector is, the more vulnerable they are to exploitation from intermediate dealers, and the less the people involved are capable of adding value to the material they collect (2006, p.800). The absence of an organized supportive network causes indeed the vulnerability of informal waste pickers and prevents them to up-grade their activities.

Integration consists in sub-contracting collection with waste pickers and employing waste recovers/recyclers in valorization centers. In her thesis, Mertanen explored the possibilities in the shift from informal situation for waste pickers to formal one through their integration in the public sector (2011). She identifies several major steps necessary in this process, among which are mobilization, association formation, collaboration and hiring in the public services (Mertanen, 2011). By elaborating and signing contracts with local authorities, local initiatives evolve thereby into local movements which are employed by the authorities. Finally the last stage in the integration process is the shift from local movements to local government where waste workers become officially employees of the public sector. However, the relevance of integrating the totality of informal workers into the public sector is questionable. Among the interviewees, only one considered that waste valorization should be a public service managed exclusively by public authorities⁹⁴. All the others did not deny the necessary participation of the public sector but claimed also that informal sector cannot be ignored. Furthermore formal private sector

Box 27 – Progressive integration of informal workers at the creation of a valorization center

A center for plastic valorization is currently being created in the landfill Mbeubeus (Malika) under the initiative of Thiès' valorization center's director. The conditions of installation were particular because of the numerous informal networks already deeply implemented. Actors are informal professionals controlling valorization systems and the main organizers and regulators are called "Baol Baol". The implementation of the new center required therefore to get in contact with the "Baol Baol" and be integrated into their networks. At the creation of the center, information about its activities needed to be transmitted to the plastic collectors of the landfill and intermediaries. The "Baol Baol" took care of this task. In a first period of time, the center sub-contracts informally plastic collection with waste pickers and intends to sub-contract formally the pickers in a near future. Besides, some waste workers are expected to be integrated in the center since it needs also employees to run the machines. The recruiting will take place in the landfill among the waste workers. As a result the implementation of the new center stimulates the activities of collectors and creates jobs. It generates revenue which improves partly the socio-economic situation in the landfill and expands the formal sector.

⁹⁴ Manager of the center in Kaolack, 2012

should also take part in the system through a Public-Private Partnership^{95 96 97}. In that sense the integration of the informal sector encompasses two aspects: its partial integration into the public sector and its partial integration into the formal private sector. This last process takes place through the same steps identified by Mertanen (2011), but the last stage is replaced by the legalization of the association through the creation of small-enterprises. In the absence or relatively low participation of public authorities in Senegal, the second process is more likely to happen than the first one. The experience presented in Box 27⁹⁸ gives an instance on the integration process of waste pickers into the private sector.

5.1.1.2 Helping the development of initiatives

Initiatives are likely to develop when training courses, management assistance and financial support are provided. Supporting programs encompasses different courses on hygiene, safety, cooperative networking, valorization processes, management of associations, accounting, working rights and negotiation skills. Increasing understanding motivates people and enables them to take initiatives. Moreover training informal workers help in enhancing their ability to add value to collected materials (Wilson, 2006). Financial resources are then crucial to implement initiatives. Access to credit should be promoted more than external subsidies since it accounts more the beneficiaries. It is indeed likely to help associations to become more autonomous and capable, and to reach financial independency. They can thereby evolve toward formal management. The case of the valorization center in Thiès has demonstrated it.

The promotion of association formation by the authorities and NGOs influence positively community empowerment and stimulate thereby the development of initiatives. Caritas, IAGU, LVIA or ASDES are instances of NGOs acting currently in this field in Senegal. Besides local authorities are actors legitimately supposed to be in charge of assisting such structures in their development.

Building progressively valorization centers while integrating gradually the informal local waste workers and motivating initiatives are prerequisite for developing the sector locally. Furthermore it would enable to transform the uncontrolled landfill, exploited and control by the informal sector, which would shift into an official controlled one equipped with diverse valorization centers. Activities are maximized, space is optimized and the formal sector expands. As a consequence local workers would gain in their working conditions, and maximized valorization would bring all the associated positive environmental and economic impacts. However, this is not sufficient to develop a sector on larger scale. Perspectives are therefore also contemplated from a national scale.

6.2.Perspectives and related governance for national development of valorization sector

According to APROSEN, a major weakness of the sector relies in the absence of horizontal organization of the actors whose actions correspond thus to individual strategies (2009, p.59). It

⁹⁵ Representative of APROSEN Kaolack, 2012

⁹⁶ Municipality councillor in Kaolack, 2012

⁹⁷ Representative of the neighborhood committee "Gawane", 2012

⁹⁸ Production manager of the center in Thiès, 2012

prevents to overcome the sector's fundamental difficulties and to enjoy the existing opportunities (Chapter 4). Structuring and organizing a sector are however complex tasks which implies conflicts of interest.

6.2.1. Structuring and organizing the sector

6.2.1.1. The framework and its implications

Structuring and organizing the sector go through networking. The lack of connections between actors makes that the consequent decentralization is unproductive. Decentralization presents limits that only networking could overcome. There are three main reasons explaining the need for networking. Firstly capacity building consists in enlarging infrastructures, diversifying equipment, enlarging knowledge and multiplying partners. It requires hence efforts that stakeholders should put in common. Financial investments are particularly heavy when dealing with waste valorization. Necessary equipment and infrastructure are basically pricy and their necessary diversity worsens the situation. Each waste type requires indeed specific equipment and infrastructures. Secondly, the need for networking comes from the transdisciplinarity nature of waste valorization. It is indeed not just an engineering discipline but attracts rather people from a range of disciplines and with a range of competencies. Solid waste planning is populated by planners, business managers, economists, lawyers, natural scientists, environmentalists, farmers, sociologists, medical doctors, statisticians, IT specialists and political scientists. This list inspired by one made by UN-Habitat (2009) is yet not complete considering that there are also numerous societal actors indirectly linked to waste valorization. Finally Senegalese municipalities are often spatially constrained. Clustering the infrastructures would limit spatial extension.

UN-Habitat confirms that “waste treatment and disposal may need to be organized on a unified basis across the metropolitan area as a whole” (2009, p. 44). The management facilities should be regionally shared through inter-municipal cooperation. Linkages among the actors should therefore be created between the valorization centers, local municipalities and third parties taking part in the system, designing thereby a large and dense network. When looking closer, each waste type has specific actors, especially among buyers. Therefore each waste type matches a sub-network. All sub-networks are embedded in the national general one.

Network's members work in common with predominant environmental and social motivations. However such disinterested approach has questionable realism. The large majority of interviewees claimed that financial motivations were crucial when dealing with networking. Implementing such structure necessitates that actors are therefore convinced of finding interests in becoming members. The network is therefore expected to present financial advantages for waste actors, which would motivate their participation. Finally competitive instinct is a driving force in sector comprising economic advantages. It should yet be set aside in the benefit of cooperation which is expected to bring larger economic advantages.

6.2.1.2. Purposes

Structuring the sector with the mean of a network aims at overcoming the main sector's difficulties (Chapter 4), enhancing the sector's performances and thus developing the sector. Creating linkages between the actors is done for several purposes presented in the following list.

- Network enables to share knowledge and experiences on waste valorization among the members. For actors who deal with the same waste types, this share can help in overcoming technical or commercial difficulties. In situation where the waste types treated differ, knowledge exchange on respective waste type facilitates diversification. The center in Kaolack has received already several representatives from other municipalities willing to get information on plastic valorization. Training pole could thereby be created within centers to ease exchanges.
- Network encourages and supports local initiatives. For instance, an advanced center meetings representatives of grassroots organizations would be able to advise and assist activities' development. The center PROPLAST in Thiès has particularly encouraged and helped the development of the center in Joal after having met motivated waste workers.
- Amounts of waste and demand for treated waste are not spatially homogenous. Network enables centers to exchange information on their amount of input available and needed, and on their amount of output available and ordered. According to these information and the orders that they received, centers can exchange stocks among them. For instance, a center has a surplus of waste compare to the orders it received. It spreads this information through the network to the other centers among which there is probably one in need for input. Networking enables hence to manage better the stocks and flows.
- By being in contact and exchanging stocks, the centers become interdepend. It obliges for cooperation and prevents competitiveness which might be harmful for the sector development.
- Strong and unified actors are less likely to fail under economic pressure. Thereby they would be able to assert their terms to buyers. These terms would be common to all and formulated after consultation of all actors.
- The integration of industrialists in the network facilitates the meeting of supply of treated waste and the demand for using it. Industrialists in need of treated waste for their production process can enter the network and get thereby in contact with adequate suppliers.
- The network could create an environmentally and socially friendly image for the members by putting in the foreground the environmental and social positive implications of their activities. Entering the network could be a mean for the members to get recognition as regards to their environmental and social commitments.
- Finally the network could also help in making recycled products more available for consumers by presenting them in a guide. Only the products made by network's members would be listed, which is also an efficient marketing tool.

6.2.1.3. Application of networking

A Senegal valorization network would encompass nowadays sub-networks for e-waste/scraps, organic waste and plastic wastes. Considering the technical requirement for valorization process and the availability of the waste type, the network should be more or less decentralized.

Application of networking is hypothetical, but the realism of such structure has been tested on PEHD plastic valorization sector, providing hence a more concrete illustration of networking.

The sub-network for e-waste/scrap would gather collectors (municipalities, and e-waste and scrap pickers organized into grassroots organizations or EIG), foundries, national industries and foreign buyers. Scrap and e-waste are available especially in the capital's region, and the equipment needed for valorization is particularly pricy requiring advanced knowledge. For these reasons foundries should have a large spatial coverage and a centralized sub-network would be thus more feasible in Senegal.

The sub-network for organic waste would gather collectors (municipalities, grassroots organizations and EIG), compost centers, market gardeners, private or public gardeners, farmers and horticulturists. The supply of organic waste is high in both rural and urban settlements, and compost centers do not require large equipment or advanced knowledge. Therefore compost centers should be implemented in every municipality, and the sub-network should consequently be relatively decentralized.

The sub-network for plastic wastes would gather collectors (municipalities, grassroots organizations and EIG), plastic valorization centers, national industries and foreign buyers. Plastic wastes are available in relatively large quantity in both rural and urban settlements. Its valorization requires equipment and technical knowledge. Accordingly plastic valorization centers should be implemented in every region, and the sub-network should be relatively decentralized.

When meeting representatives in PEHD plastic waste valorization, the past experiences of networking have been firstly explored (cf. Box 28). Then the applicability of the networking model previously described has been explored. Possibilities to implement networking between the existing plastic valorization centers and the ones under construction have been explored. Firstly, partnership between the two most developed plastic valorization centers in Kaolack and Thiès has been analyzed, revealing limited contacts and little cooperation. Yet, each presents advantages and disadvantages, and they could thereby complete each other.

The center in Kaolack has difficulties in managing its stocks and the center in Thiès has larger processing capacities. The center in Thiès has advantageous geographical position - due to the proximity with numerous commercial outlets - and the center in Kaolack can collect a large amount of plastic. Collaboration would therefore help in overcoming difficulties for each. The two apparent reasons explaining the lack of cooperation between the centers concerns firstly the

Box 28 - Experiences of knowledge exchanges between Senegalese municipalities

Some Senegalese municipalities have realized that exchanging knowledge, experiences and stocks might constitute opportunities for improvements. Because they got informed and understood the positive implications in valorizing waste, some municipalities' representatives turn towards the existing plastic valorization centers to get more information and sometimes even assistance. The center in Kaolack has provided a training course to Saint-Louis' representatives. The center in Thiès helped Joal's representatives in the creation of its center and assists it to sell its materials. More cooperation between the current stakeholders and people interested in valorization would enable to integrate more actors in valorization governance.

transportation costs implied by the exchanges which question the partnership's profitability, and secondly the failing communication. Both center's managers acknowledged during interviews the relevance and need to cooperate^{99 100}. Yet nothing concrete is happening and the two centers are rather competitors than complementing each other. Regular meetings would be essential to elaborate the conditions of partnerships: modalities for exchanging stocks (and attempting to resolve the transportation costs problems), sharing technical knowledge and commercial partners.

The municipality of Saint-Louis is currently creating a plastic valorization center. They have received beforehand training courses in the valorization center in Kaolack in order to get the necessary knowledge on plastic valorization center management. They fear however at the opening of the structure to meet some financial, technical and commercial difficulties. The project's initiators were convinced that having contacts with an existing structure running similar activities would be beneficial for them by helping them to overcome their difficulties. On the other side the center PROPLAST was interesting in getting in contact with valorization structures. Explaining to each representative the situation of the other center and providing the necessary information have enabled to put them in contact so they can explore together the possibilities for a partnership. Both have interests in building this partnership but they firstly needed to get in contact.

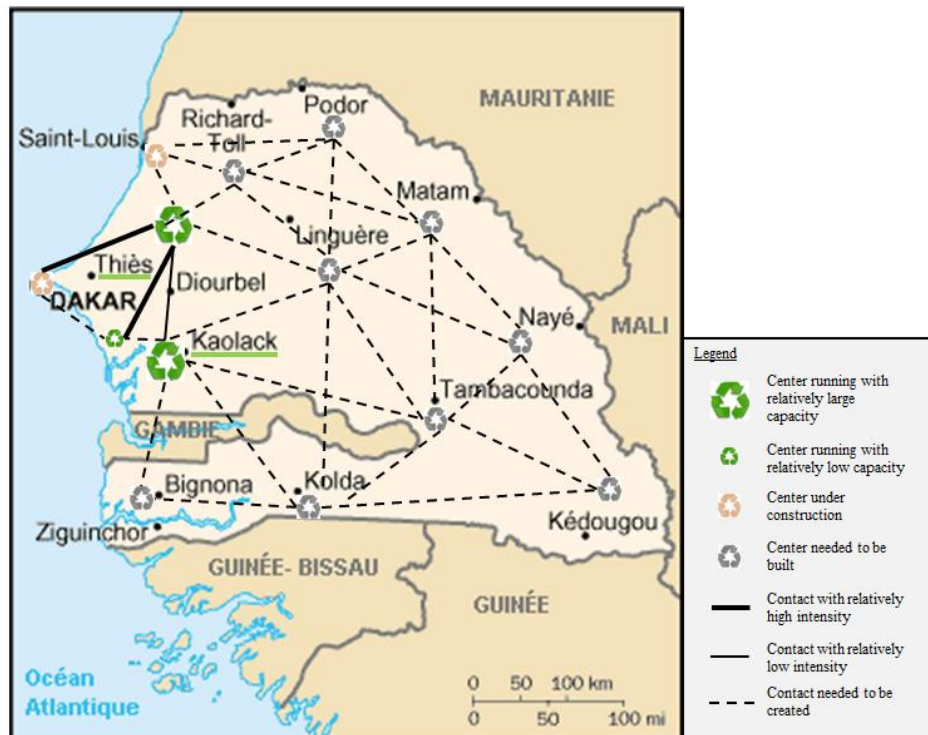
The center PROPLAST in Thiès appeared to be particularly interested in implementing a network and has already started to think about creating one. Their motivation relies in the implied cooperation protecting from competitiveness. Because of the high dynamism of valorization sector, the market is very competitive and possible enters of foreign enterprises might degrade the national and local markets. Secondly solid networking can put considerable pressure on public authorities.

All sub-networks act in an integrative approach and are embedded in a national valorization network. It would consequently gather and put in contact all actors mentioned before: municipalities, grassroots organizations, EIG, valorization centers – encompassing foundries, compost centers and plastic valorization centers -, local, national and international buyers. The following map presents the hypothetical network that could be applied in Senegal. It illustrates one aspect of the hypothetical network. The valorization centers' implementation concerns in the scenario the entire country and it is considered that every municipality inhabited by more than a certain number of people should be equipped with valorization centers. But besides bringing together all valorization centers, the network incorporates also industrialists, waste collectors and municipalities.

⁹⁹ Manager of the center in Kaolack, 2012

¹⁰⁰ Director of the center in Thiès, 2012

Figure 22: Localization map of existing and expected valorization centers in Senegal



(Based on a map retrieved from:
<http://www.senegal-online.com/francais/cartographie/senegal.htm>, 2012)

The threshold defining the minimum numbers of inhabitants is established according to the minimum amount of waste needed to reach profitability for the center. For instance, waste generated is estimated at 0.6kg per inhabitant in urban areas every day (LVIA, undated, p.6), which corresponds to 18kg per inhabitant per month. The plastic valorization center in Thiès and in Kaolack have evaluated that a minimum of 12 tons of plastic ought to be processed in order to reach profitability. In a municipality of 10 000 inhabitants, the average waste generation is 180 000kg per month (0.6kg multiplied by 10 000 inhabitants). Considering that 20 per cent of waste generated are plastic waste (Diallo, 2007), the municipality generates therefore 36 tons of plastic waste per month which is higher than the minimum required by centers. Consequently this municipality is expected to install plastic valorization center. For the concretization of the hypothetical model, such calculations would be need for every type of waste. Further researches are however needed for it because the profitability level of centers of other waste types is still unknown. This level is specific to every nation since profitability is largely determined by national characteristic (average salary, i.e.). Then, such evaluations enable to determine the exact composition of municipal waste valorization centers, regional ones and national ones.

It appears that there have been already in Senegal some premises of networking which have moreover revealed to be beneficial for the partners. It has however never developed and has even been stopped in some cases. The main reason seemed to be that nobody took the responsibility of organizing it.

6.2.2. Governance in the network

Ahmed and Ali (2004, p.477) rise the question “whether partnerships form naturally by pressures of mutual interest or whether a facilitating role by an external agency is necessary for the convergence”. Partnerships form indeed naturally as soon as two actors realize their interest in having contacts and setting up cooperation. However meeting of interests can take time or be constrained by incomprehension and a facilitator would accelerate and facilitate this process. Considering SWM as a public service relates also to assigning the responsibility of structuring and organizing the sector to the State. But local governments do not have the necessary capacities to shift from a role of service provider to a role of partnerships organizers (Ahmed&Ali, 2004). UN-Habitat recognizes that “regional cooperation and fair cost-sharing arrangements represents an ongoing challenge to city authorities” (2009, p.44). The weakness of municipalities in setting up partnerships proves the need for an external facilitator in such transition. Furthermore the process of structuring a system is likely to be confronted with conflict of interests. The facilitating entity should therefore be an external and thus independent one with no conflict of interest. Yet the legitimacy of its actions might be questionable if it is not incorporated in public sector.

The institution would help to create, shape and organize the network in order to structure the sector. Its role would be to build bridges between the actors by bringing them in contact. Then it would organize these linkages by facilitating the relations between the actors and attempting to enhance partnerships’ quality. Thereby the institution would maximize the positive outputs of partnerships. The instance of the failing partnership between the centers in Kaolack and Thiès proved the necessity and relevance of a facilitator. Then, the institution’s aim is not to regulate or implement systematically concrete structures but rather accompany and assist initiatives. Interviewees saw in this fictive institution the risk for a central entity detached from local context and whose purpose is to reproduce formalized valorization model. A centralized entity encompasses risks of being disconnected from local governance^{101 102}, which is often counterproductive. Oppositely, the institution would aim rather at bringing people experts on their own local specificities in contact.

When asking upon the interviewees about the relevance of a central public institution organizing the system, most of them appeared relatively skeptical. There is in fact low trust in national institutional due to the successive failures that happened during the last decade¹⁰³. The national agency APROSEN was supposed to have this role but have been dissolved. Furthermore it seems that the agency was more focus on its programs, did not pay enough attention to others and did not adopt a view large enough on the sector. Mistrust and disappointment toward public institutions have thus been perceived during field researches and confirmed in interviews. Yet the cooperation of the State in the installation of a network is crucial since they can provide subventions and the necessary spaces.

¹⁰¹ Manager of the center in Kaolack, 2012

¹⁰² Director of Saint-Louis' urban development agency , 2012

¹⁰³ Representative of LVIA, 2012

Conclusion

The enabling factors for valorization development in Senegal rely partly in the establishment of good governance. This chapter has presented the features of a hypothetical model for good governance that would structure, organize and maximize the sector's performances. This hypothetical governance is composed of the public sector, private sector, civil society and informal sector. Each of them has specific role to play, by the scale at which they are acting and thus by their place in the system when contemplating the local scale (cf. Figure 20: Plastic valorization system, p.117).

On one hand, actors' actions should be directed towards the 9 main influencing variables identified, which would determine the performances of local valorization system. Thanks to specific actions, the outcomes of local systems can be thus maximized. Therefore, the valorization sector is considered as developed at a local scale when local valorization systems are efficient, but also numerous and diversified. At the national level, the creation of a network gathering stakeholders would enable the structuration and organization of the sector. The presence of an external public institution would facilitate it. Networks' advantages are numerous for all actors involved and its applicability has therefore been explored. It appears that Senegal present early premises of similar network and that the outlooks are promising.

To conclude, the development perspectives of waste valorization sector in Senegal rely in the combination of a relatively decentralized repartition of valorization centers, with and local organizers and a centralized assisting entity.

Chapter 7

Valorizing Waste for Achieving Sustainable SWM in Senegal

Sustainable SWM is characterized by the reduction of waste generated, the presence of a waste cycle for wastes that can be valorized and an efficient running of the waste system for residual waste. Valorization has an important role in such management by directing intelligibly specific wastes flows and forming a cycle (cf. Figure 10, p.50). Thereby it can be considered as one of the leaders towards sustainability, especially when considering that more than the half of generated waste in low-income countries has the potentials to be valorized (Arunprasad, 2009). Valorization does steer SWM towards sustainability and governance in valorization steers it in a specific way. The expected governance (described in Chapter 6) should be in adequacy with the country's systems (economic, legislative, i.e.) and is hence shaped according to the Senegalese context and local specificities. When considering valorization's influences on SWM, the governance in valorization adds consequently specificities.

This chapter explains the role of valorization in the progressive shift of Senegalese SWM towards a more sustainable management. It a first part, the stimulations that valorization has on the performances of the other SWM stages is described and developed. It is partly based on some Senegalese experiences. Secondly, the extent to which it is a driving force towards sustainability is explained and illustrated with premises of waste cycle identified in Senegal. And since governance in valorization influences the overall role of valorization, this chapter contemplates also the participation of governance in the shift towards sustainability.

7.1.Influences on the efficiency of SWM

Efficiency in SWM is measured upon the performances of waste collection, waste transport and waste treatment. SWM is considered as efficient when the totality of waste generated is removed away from its generation source, waste is transported without any leakage to adequate places and finally, waste is treated and eliminated in the best environmentally-friendly and working conditions. Efficient SWM implies also adequate initial waste disposal, meaning that waste is merely present in public spaces within adequate bins. Valorization can potentially improve the efficiency of SWM by enhancing the performances of these management stages.

Considering that in Senegal collection and transport still meet difficulties, and treatment for elimination is nearly nonexistent, waste valorization would in that way help for improvements. Successful experiences proving it exist and development perspectives are built upon it.

7.1.1. Waste collection and transport stimulated

Valorizing waste is good incentive for improving waste collection and transport due to a large extent to the economic interests it encompasses. It motivates actors to enhance collection schemes' organization. The more waste is collected, the more waste can be valorized and therefore the more revenue will be generated. Accordingly, spatial coverage of the service is expected to be large and leakage are absent during collection and transport. Among the interviewees met in Kaolack and Thiès, no one denied the role of waste valorization in

improving collection performances, and the case studies' analyses (Chapter 5) have highlighted these precise impacts. The systematic collection of one type of waste has participated in improving general collection performances through direct enhancements of this specific collection and indirect stimulations of the other collections.

Because the valorization centers needed input, organizing plastic collection schemes was indispensable. Along the time, organizations have met improvements by enlarging the spatial specific collection coverage and vanishing leakages. Nowadays plastic collections in both cases are relatively efficient and have consequently disappeared from public spaces¹⁰⁴. The final goal is to collect the totality of plastic waste generated of the largest spatial coverage possible. The case studies have proven that finding a use in waste sets up a goal for its collection. Means to reach this goal have consisted therefore in organizing collection schemes but also in finding incentives to run it. Financial incentives have proven its effectiveness by motivating waste pickers and enhancing the efficiency of their work (larger quantity and higher quality). Observing utility in plastic waste and making profit out of it made therefore plastic collection relevant and efficient. From a systemic approach, the downstream part of the system (treatment processing for valorization and evacuation of the valorized waste) stimulates positively the upstream one (collection and transport). Furthermore these improvements are not happening in the detriment of residual waste collection and participate on the contrary in its enhancement. In the case study in Kaolack, the development of plastic collection scheme has been partly integrated in the general waste collection. Its strict frame has stimulated the general waste collection and participated thereby to its overall up-grading. In the current governance in valorization, collection is undertaken by grassroots organizations, EIG and informal workers. This specificity in valorization governance stimulates thus community participation in collection. This is an important aspect in Senegal since it enables to integrate formal structures of small-size and informal sector. In that way it maximizes the acceptance and effectiveness of collection and it benefits to all. The picture on the right hand side shows a young waste picker collecting the PEHD plastic valorized by the center in Kaolack. While acknowledging that this activity is not adequate for children of that age, this informal job opportunity enables a relative elevation of living standards.

Picture 14 : Informal waste picker collecting specially PEHD plastic, Kaolack (Senegal)



Source: Author, 2012

Therefore it is assumed that valorization center would systematically stimulate the collection of the waste type it valorizes. When every region would dispose of valorization centers for all waste types, collections of more than the half of waste generated would improve. The amount of

¹⁰⁴ The plastic considered here is in fact merely the PEHD which is one plastic type among seven. In order to simplify the understanding and reduce technical confusion, the type of plastic has not been specified when considering the case studies, although it concerns only this one.

waste accordingly evacuated away from public spaces would be consequent. However, positive stimulations are not straightforward. In fact it should not hide from the view that collection schemes, if not integrated, act in parallel of each other preventing possible influence. Furthermore the financial incentives can also worsen the situation by advantaging one collection schemes in the detriment of others. As a conclusion, specific waste types collection schemes should not compete with each other but rather complement each other. Elaborating general waste collection system where respective waste types' collections are integrated would be therefore beneficial for the overall management. Such system requires on one hand waste segregation at its source. The earlier this segregation is done, the higher the quality of the waste is, and the more value will be recovered to waste. On the other hand then, adequate transportation means are required to keep the different waste types separated. Control ought to be processed along the chain in order to perfect waste segregation quality. Strict organization with cooperation and adequate equipment are accordingly expected.

7.1.2. Waste treatment for elimination facilitated

In the absence of valorization, the totality of waste is considered as residual one. The amount expected to be eliminated is consequently large. By reducing this amount, waste valorization improves waste treatment performances. Segregation between residual waste and the ones having a potential in valorization, enables to diminish tremendously the amount of waste needed to be transported and disposed in landfill. And correspondent costs decrease as well. Considering that in low-income countries - including in Senegal - 53 per cent of waste generated can potentially be valorized, developing and maximizing valorization would diminish by half the amount of waste expected to be eliminated and divide therefore by two costs implied by proper waste elimination (Arunprasad, 2009). Waste treatment is more likely to develop with reduced expected funding.

From a more general point of view, there is lack of waste related data, especially in rural regions, preventing to calculate the reduction of disposed waste if valorization would reach its maximum performances and the associated costs diminution. Despite this vagueness, the financial stimulations are theoretically undeniable. In the two case studies it has been confirmed that waste valorization has helped in diminishing the amount of waste disposed in landfill thanks to the removal of all PEHD plastic. However waste elimination has not been developed in parallel. Governance in valorization has no influence in the situation and it depends in fact of the collection and treatment governance according to which municipalities are in charge of eliminating waste. But municipalities do not take their responsibility and costs reductions are not sufficient motivations. This weak point in Senegalese SWM governance prevents development of elimination and therefore

Picture 15: Children washing their hands in the middle of an informal waste disposal, highly exposed to infections and diseases



Source: Author, 2012

proper management. It reveals also that some aspects in SWM are out of the reach of actors in valorization governance.

Developing and maximizing waste valorization in Senegal would therefore partly stimulate SWM efficiency. It would especially diminish waste accumulations in public places and (un)controlled landfill, and the related harmful impacts. Unacceptable situations, such as the one presented on Picture 15, are therefore more likely to disappear. By acting on the main variables determining local valorization systems' performances (Chapter 6), system would gain in dynamism and participates therefore to the up-grading of the overall waste management. It exists yet limits relying in the governance in SWM that might confront the governance in valorization.

7.2. Valorization as one of the driven force towards sustainability

Sustainability is about preserving the environment while enabling dynamism in economic activities and socially acceptable conditions. Sustainable SWM embraces accordingly this definition and aims, beyond efficiency, at managing resources in a way that profits to everyone. Valorization has a key role for doing so, but is however not sufficient.

7.2.1. Valorizing for closing a virtuous waste cycle

No similar scheme to the one characterizing efficiency exists in Senegal so far and but it is developing. More than avoiding any kind of harmful impacts of mismanaged waste, valorization enables to implement a virtuous waste cycle. Developing it in Senegal corresponds to strengthening the emerging one.

Valorized wastes are integrated by industrial in their production process. The more wastes are valorized, the more waste can potentially be integrated in production processes. It has been

Picture 16: Chairs made out of valorized plastic by the industry "Transtech", client of the center in Thiès



Source: www.jeuneafrique.com

observed among the clients of the valorization center in Thiès, who increase for the last years the share of valorized materials in their products. Waste, outside the residual ones, is thereby rather considered as resources than waste. The picture on the left hand side shows products produced with the plastic collected and valorized in Thiès. These industrialists participate in closing the loop and increase its dynamisms. Their integration in the governance is particularly important. It is happening already and the establishment of the network described in the Chapter 6 would maximize that. Accordingly valorization governance integrates and would continue to integrate a large array of actors within an inclusive approach, benefiting to all.

Closing the cycle has large economic, social and environmental benefits (job creation, revenue generation, living standard enhancement, pollution reduction, i.e.). Because of the degraded

socio-economic and environmental situations in Senegal, it appears as particularly needed to enjoy these benefits. Some of them are already observable. On one hand, integration of valorized material is made instead of raw material (latex, iron or crude oil) use. With an increasing share of valorized materials in products are, the demand for raw material will get lower. Besides decreasing the demand and thus the exploitation of natural resources from a global point of view, it helps Senegal to diminish its importations. Industries implemented in the country import in fact nearly the totality of the raw materials needed. The largest valorization is, the lowest raw materials imports are, better the commercial balance is and the lowest commercial dependency will therefore be. Besides, social benefits are especially observable among centers' new workers and among population who can now enjoy an environment where waste is relatively less present. Working and living conditions have been enhanced with especially lower sanitary risks.

However, valorizing nowadays corresponds to treating waste whose amount keeps on increasing, which does not resolve the problem at its source. In order to reach sustainability, reduction of the amount of waste produced is essential as well.

7.2.2. “Reduction” as another essential element in sustainability

A complete sustainable approach in SWM is described by the three “R”: Reducing, Reusing and Recycling (cf. Chapter 2). Valorization however covers only two “R” (Reusing and Recycling) and finds hence its limits in this aspect. The third “R” (Reducing) is yet crucial for sustainability and consists in preventing waste generation by different means upon households and industrialists. As a consequence, waste valorization does not suffice for SD and should be developed in parallel of prevention programs. Because it requires deep societal changes, waste prevention is highly challenging for any societies.

Despite of that, awareness in Senegal is growing which makes transformations more likely to happen. In 1997 Zombre Couibaly has written a Phd Thesis at the University of Dakar (UCAD) on plastic recycling and plastic reduction, giving a particular attention in changing consumption habits and increasing industrialists responsibility. The importance of reducing waste has thus been highlighted 15 years ago in the Senegalese academic sphere, and yet, current applications are yet still hardly visible. Researches on this topic continue to be conducted describing the main steps upon waste prevention. It deals essentially with modifying production and consumption patterns where social behaviors change and Senegalese consumers adopt a “responsible consumption” (Niang, 2005, p. 41). In 2006, the municipality of Thiès has launched a project aiming at implementing the “3R” concept and has accordingly paid attention to waste reduction. A guide advising consumers has been formulated (IPEN, 2006). Consumers in general are expected to consume less and better, but reluctance in front of such requirements are observable - especially when consumers are not aware of their responsibility in waste related issues -. Although environment education and environmental awareness is visibly growing in Senegal, such behavioral changes are embedded in a long-term process.

It exist also several possible economic, fiscal and legislative tools helping in such shift. Price fixation on plastic bags in shops and decreasing taxation for industrialists reducing their

products' packaging is example among others (APROSEN & WWF, 2010). A concept in this line of actions which is developing lately is the Extended Producer Responsibility (EPR) (UN-Habitat, 2008). The concept promotes the shift from marketing recycle products to the integration of waste cycles by the industrialists themselves. It goes further in the resources management approach by making producer responsible for the waste cycles of their products' materials. Since they are expected to take care of their waste valorization, it is assumed that product design will then be modified integrating more materials easy to valorize and less materials challenging or impossible to valorize. Eco-design will be thereby promoted. Such examples of management have been observed in Senegal. However the profitability of such scheme is difficult to reach since it obliges industrialists to invest in adequate equipment and maybe, enlarge their surface to install it. Because of the absence of regulation on it, the application of EPR depends merely on the willingness of industries and therefore on EPR's potential economic advantages. On the other hand, this type of regulation might be harmful for local valorization centers since it represents competition.

Conclusion

Valorization has a major role in the progressive shift of Senegalese SWM towards a more sustainable management. Firstly, valorization participates in making SWM more sustainable by making the other SWM stages more efficient. Secondly, valorization is a key for shaping a waste cycle where the notion of waste is rejected. Therefore, valorization can be considered as one of the leaders towards sustainability. Besides, valorization has also an important role to play in improving social conditions. In Senegal, expanding valorization would participate in the integration of the informal sector. This process has positive social, economic and environmental impacts. These positive features prove the relevance of developing valorization. It is then influenced by the governance in valorization. Good valorization governance would stimulate the role of the sector in a way that benefit to all.

However, the role of valorization is not complete. It helps in reducing the amount of waste ending in landfill but does not impact on the source of the problem: waste generation. Valorization does not encompass the aspect of "Reducing" the amount of waste produced. Therefore, waste valorization must be developed in parallel of prevention programs in order to achieve SD.

Although waste valorization is not sufficient to steer SWM towards sustainability, its contribution is undeniable and its implementation inevitable. It enables to consider waste as a resource and links thus its management to resources management, which is an essential aspect in sustainability.

Chapter 8

Discussion and Conclusion

Because of the general worrying waste situation in Senegal and its negative implications for the society, there is an urgent need to develop SWM and in a sustainable way. The aim of this research is to demonstrate how, in Senegal, developing waste valorization would participate to an overall up-grading of SWM and would direct it towards sustainability. The factors to develop the sector of waste valorization in Senegal have been firstly investigated. In a second period of time, the particular influence of valorization on the rest of the Senegalese SWM and its sustainable aspect have been explored. Thereby, the findings of the research constitute on one hand an advisory report for Senegalese waste actors and on the other hand, an evaluation of the development possibilities of valorization in developing countries. This chapter aims at presenting clearly these two expected outcomes in order to conclude the research.

The first part of this chapter concerns the perspectives for valorization sector improvement in Senegal. The research questions are answered and recommendations for actors directly or indirectly linked to waste valorization are formulated. Secondly, the empirical findings are mirrored with the theoretical ones - presented in Chapter 2 -. Accordingly, technics and governance in Senegalese SWM are compared to the theories. It constitutes the discussion part which highlights the specificities of the Senegalese valorization sector in its nature and development process. Academic knowledge on sustainable SWM in developing countries can hence be broadened. Finally, possible enlargements of the research scope are presented, suggesting thus other potential paths of investigation.

8.1. General conclusion

8.1.1. Research's objectives and results

The disastrous consequences that mismanaged waste has on the society and its environment justify the topic of the present research. The case of Senegal has been chosen because of its particularly worrying waste situation. Thanks to the worldwide trend and international researches, it has been acknowledged that waste valorization has major role in reaching sustainability. Therefore, the factors to develop this sector have been investigated, as well as its impacts on the rest of the SWM. The findings of the research have highlighted the major role of governance in creating an enabling environment. A scenario for good governance in Senegalese valorization sector has thus been designed. The purpose of the research has been thereby to prove that governance in a strategic stage of SWM enables to manage waste in a sustainable way, by answering the main research question: ***“To what extent does good governance in waste valorization sector steer SWM in Senegal towards sustainability?”***

In order to give a clear response, the research has been divided in three parts, each relating to a sub-question.

The situation in Senegal as regards to its waste has been firstly analyzed in order to answer the sub-question: *“What is the current state of SWM and more specifically waste valorization in Senegal?”*. The findings of the research have revealed that the situation in Senegal is problematic and worrying. While the waste generation keeps on increasing, its management meets failures at every stage. Collection is not systematically applied, and when it is, the schemes' efficiency is often not at its maximum. Only a part of the waste disposed in public spaces is removed and the waste collected is merely dumped further away in places lacking adequate installation. There is rarely a final goal to waste collection, such as elimination or valorization. The situation is particularly worrying because the harmful consequences of

mismanaged waste are particularly visible across the country. Furthermore, the amount of waste that has to be managed keeps on growing. It means that the social, environmental and economic situations will keep on worsening if an efficient management is not implemented. But crisis brings changes (UN-Habitat, 2009), and awareness is accordingly growing on waste related challenges. People progressively realize their responsibility in these issues, initiatives are taken and the sector is getting dynamic for the last decade.

The promising evolutions are due to the large potential that valorization encompasses which have been progressively put in light during the last decade. Centrifugal forces stimulate changes and the economic potential of waste, combined with its high availability, has been recognized as the most influencing one. It is therefore assumed that these characteristics will enable to tackle negative waste perceptions and stimulate valorization related initiatives. Premises of changes are already observable in Senegal through the evolutions in waste perceptions, the emergence of local structures across the country and the development of waste markets. The interest is visibly growing among the civil society, the private sector, especially the informal part, and to a smaller extent the public sector. Strategies in both the informal and formal sectors are happening giving therefore an aspect of high dynamism to the Senegalese valorization sector. Perspectives are promising and the implementation of a virtuous circle where initiatives multiply, and institutional and legal frameworks develop, is possible.

In the current situation however, valorization is only emerging in the formal sector and presents therefore unstructured aspect with isolated initiatives. Local structures met several difficulties partly due to the complexity and challenge to develop a valorization activity in a failing SWM context. Organizing the sector appears therefore as crucial. And because of the multiplicity of stakeholder, it necessitates to define governance.

The second part of the research has consisted in analyzing governance in the valorization sector in order to answer the sub-question: “*What type of governance does enable to develop waste valorization sector?*”. The aim was to define hypothetical good governance in the Senegalese valorization sector. For that the new governance that has followed the emergence of formal valorization sector has been firstly explored. Based on these findings, a model for good governance has been designed. It takes place at both local and national levels and gives a structure to waste actors.

According to the definition of good governance¹⁰⁵, the public sector, the private sector and the civil society cooperate while adopting an approach based on inclusivity. The model adopts this approach by giving to the three spheres an active role. Because of the extensity of the informal sector in Senegal, its integration is also crucial.

The horizontal organization of the actors goes then through a network structure. Such structure advantages cooperation in the detriment of competitiveness. The decentralization, implied by the creation of multiple local structures organized by local governance, necessitates a facilitator managing the network at a national scale. The applicability of the network would therefore be enabled by the presence of a central institution.

This hypothetical good governance would develop the sector locally by strengthening and multiplying valorization structures, and nationally by structuring the activities and expanding the practices of valorization. Thereby, the development perspectives of waste valorization sector in Senegal encompass the combination of a relatively decentralized repartition of valorization centers, with local organizers and a centralized assisting entity. An efficient and non-marginalizing organization is a major step towards sustainability where valorization performances would reach its maximum and the amount of waste ending in landfilled would consequently be at its minimum. This specific structure would therefore guide the valorization sector towards an advanced stage of development.

¹⁰⁵ cf. Glossary of terms

Thirdly, it was intended to describe accurately the influences of waste valorization on the Senegalese SWM. The role of valorization, as well as its limits, in the shift of SWM towards sustainability has been highlighted which has enabled to answer to the last sub-question: *“In how far does waste valorization steer SWM towards sustainability?”*. Valorization participates in making SWM more sustainable by making it firstly more efficient. It stimulates indeed the performances of the other stages of SWM. Due to the economic interests that valorization gives to waste, collecting waste relates to generating revenues, which is encouraging collectors. Findings economic advantages in an activity is often a driving force for its development¹⁰⁶. Financial motivations are indeed the engine for change in many situations. Where valorization has been developed in Senegal, this positive stimulation has been observed. As a result, developing valorization at a large scale tends to maximize waste collection. On the other hand valorization diminishes the final amount of waste that is expected to be eliminated. Thus, it gives incentives for developing waste treatment since it reduces the expected costs.

Secondly, valorization enables the implementation of a waste cycle (cf. Figure 10, p.50) where waste flows are intelligibly directed. Closing the loop in SWM corresponds to rejecting the notion of waste. Correspondingly, waste gets a second life by going back in industrialists' production processes instead of accumulating in landfill or being incinerated. Economic value is therefore restored to waste and large amount of revenue can be generated. Senegal is facing serious problems in its economic sphere and the development of a new sector would be highly beneficial for the society. Moreover, valorization encompasses also direct and indirect positive social and environmental implications. A main one relies in the integration of the informal sector stimulated by the development of valorization. In the Senegalese situation, this aspect would enable to improve the social conditions of a relatively large part of the population. It would also improve the activities' performances and quality. Besides, the environmental benefits of valorization concern mainly the reductions of pollution and of resources exploitation. Valorization does steer SWM towards sustainability; and governance in valorization steers it in a specific way. In the hypothetical model, community participation is promoted which accelerates the integration of formal structures of small-size and informal sector. In that way, it maximizes the acceptance and effectiveness of collection and it benefits to all, which is an important aspect in Senegal.

However, the role of valorization is not complete. It helps in reducing the amount of waste ending in landfill but does not impact on the source of the problem which is the waste generation. Sustainable approach in SWM is described by the three “R” (Reducing, Reusing and Recycling) (cf. Chapter 2) where valorization covers however only two “R” (Reusing and Recycling). The third “R” (Reducing) is yet crucial considering the growing amount of waste that every society is nowadays generating. Therefore, valorization finds in this aspect its limits and should hence be applied in parallel of prevention programs.

Still, valorization' contribution in steering SWM towards sustainability is undeniable and stays large.

The few experiences in Senegal have already proved it which attests the necessity of developing valorization but also highlights the rapidity with which the development of this sector becomes relevant for the society.

As a conclusion, good governance would help the development of the valorization sector in Senegal. Since this process enables an up-grading of SWM and adopts a new approach on waste, it would steer the entire SWM sector towards sustainability. However reaching sustainability has other requirements that valorization does not enable to reach. Good valorization governance would therefore partly lead to sustainable SWM.

¹⁰⁶ Director of Saint-Louis' urban development agency , 2012

8.1.2. Outlook of the results

The development perspectives for the valorization sector rely partly in overcoming the organizational difficulties. The present research has intended to put the light on the elements determining the development of the sector. The practical usefulness of the empirical findings and related conclusions would be observable if stakeholders get inspired by it. In order to facilitate this process, a set of recommendations have therefore been formulated, emphasizing the crucial aspects for valorization local and national development. Furthermore, it aims also at giving guidance for creating an enabling environment.

8.1.2.1. Recommendations for formal local valorization

Developing formal local valorization goes through the strengthening of already existing structures and the creation of new ones.

The recommendations at a local scale are based on the findings from the case studies' analyses. Accordingly the guidelines have been orientated according their common strengths, weaknesses, opportunities and threats (cf. Chapter 5, and Table 7 and Table 12). Considering that the case studies selected are the two most advanced valorization centers in Senegal, the findings could be generalized to valorization structures in Senegal in general. The following table has been built according to these elements in order to match as much as possible the reality. Therefore the recommendations are adapted to the Senegalese specificities, which increase their applicability potential.

From a general point of view, elements that should be improved in order to strengthen a system are presented in Figure 21: Waste valorization system and its main variables (p.128). The related explanations provide accurate advices for improvement. Then the elements that have been judged as priority ones are listed in the following table.

	Strengthening and taking advantages from elements helpful to achieve the system's development	Limiting and overcoming the elements constraining the achievement of the system's development
Internal	Local systems' stakeholders should aim at maintaining system's strengths and building upon it for further development	Some elements internal to the system constrain its development and should therefore be overcome
	<ul style="list-style-type: none"> • Improving collection schemes by assuring good coordination among actors' activities and large spatial influence of every waste type collection. Transfer sites and inter-municipal arrangements are helpful • Maintaining a strict financial management within the system • Conducting regular assessments on valorization center's activities for transparency and increased acceptance • Insuring good communication among actors to guarantee cooperation and coordination, and stay constructive • Insuring a large governance based on inclusivity • Diversifying the center's activities by multiplying the types of waste valorized - or stocking when the adequate equipment is not available - 	<ul style="list-style-type: none"> • Increasing in parallel the quantity of plastic collected and the processing capacities • Overcoming communication difficulties and designating someone in charge of meetings' organization • Diversifying funding sources until the center becomes financially autonomous
External	Elements in the environment of the center should be exploited as opportunities for development	Negative elements external to the center are threats for the center's performances and should therefore be tackled (Independent of center's actions)
	<ul style="list-style-type: none"> • Developing partnerships with municipalities willing to exchange knowledge and experiences on valorization • Stimulating evolutions in waste perceptions with awareness programs (on waste sorting e.g.) • Diversifying the center's activities by diversifying the nature of partnerships - not only furnishing the buyers in valorized materials but also discharging producers their own waste. Industries are thereby relieved of their waste and gain an environmentally and socially friendly image upon the public -. 	<ul style="list-style-type: none"> • Creating an enabling political environment (cf. following section) • Creating an enabling economic environment (cf. following section)

The development of formal local valorization goes secondly through the multiplication of local systems across the country. When contemplating the current development state of the Senegalese valorization sector, it appears that consideration ought to be given to its large informal part. Integrating it would consist in structuring their activities and stimulating thus the appearance of new official valorization centers. Thereby it would accelerate decentralization - which is preferred since waste generation has sources everywhere -. Integration of informal workers starts firstly by encouraging and assisting the formation of waste workers' associations. Only then, collaboration can be established by firstly sub-contracting works – most often collection - with waste pickers. The last stage of the process of integration consists either in employing waste workers in valorization centers (public or private), or pursuing the sub-contract while assisting the change in status from association to small-enterprise. In the absence or relatively low participation of public authorities in Senegal, the integration of the informal sector into the private one is more likely to happen and preferred for the system efficiency.

Besides, the development of local initiatives should also be encouraged by the means of supporting programs. Raising awareness and giving the possibilities to concretize projects motivate people. Because financial resources are essential to implement initiatives, access to credit should be facilitated.

8.1.2.2. Recommendations for creating an enabling environment

- **The valorization network**

The sector requires a horizontal organization among its actors. A network should therefore be created, gathering all stakeholders of the Senegalese valorization sector. Valorization centers, local municipalities, potential buyers of valorized waste should be put in contact in order to create a large and dense network. Since collaboration is preferred to competition, the members of the network are accordingly expected to cooperate.

The national general network would be constituted of sub-networks, each corresponding to one waste type. According to the waste type's availability and requirements for its valorization, the sub-systems would be municipal, regional and national one. Waste whose availability at a municipal scale is low would be redirected towards regional or national one. Thereby valorization would be maximized while profitability of centers would be guaranteed. It is important that the network presents some financial advantages in order to convince and motivate stakeholders, and the State could be influential (cf. Section *Political recommendations as regards to the economic sphere*).

Because of the extensity of the network and the diversity of its members, a facilitator is required to structure and organize the network. It would assure the dynamism of the system by facilitating partnerships. SWM is considered as a public service due to the implications of waste on the economic, social and environmental spheres. Considering that, the central institution in charge of should be a public one. However, it has been observed that there is low trust from the Senegalese population in national institution which questions its recognition. Restoring trust appears therefore as a prerequisite.

The development perspectives of waste valorization sector in Senegal rely therefore in the combination of a more or less decentralized development of valorization structures, with local organizers and a centralized assisting structure.

- **Political recommendations as regards to the economic sphere**

The instability of prices for valorized materials impacts negatively on the centers' revenues, its activities and thus on the system's performances. Prices fluctuations should therefore be limited and even avoided, and specific economic tools are designed to cover prices' fluctuations. According to the model of "guaranteed prices", fictitious prices are fixed in consultation of stakeholders but not applied directly on the market. It aims at assuring minimum remunerations for producers in spite of market fluctuations, without constraining the market or worsening producers' competitive advantages (potentially caused by fix price on the market)¹⁰⁷. The State takes then in charge market prices' fluctuations. When market prices are lower than fictitious prices, the State covers the differences and pays it to centers; and when the market prices are higher than fictitious prices, the State recovers it and can thereby finance this system. It enables hence to protect local treatment centers and more largely local valorization systems, from market fluctuations and growing competition of external buyers.

Also the State can promote valorization activities by controlling imports. Norms should be established regarding the quantity and quality of imported products. For instance, the imports of plastic granules should be limited in order to protect local producers ; the import of low quality plastic bags difficult to valorize could be forbidden (cf. Box 16).

- **Legislative recommendations**

A legal frame presenting in a clear and accurate way the tasks assigned to waste actors would limit governance confusion.

Municipalities are in many cases confused by their role and do not have enough practical knowledge to apply concretely different types of waste valorization. The State is supposed to assist them in this process. Besides, municipalities should be supported through financial State's subsidies. Incentive tools might also be applied with higher amount provided to municipalities showing involvement in the development of waste valorization sector. However the final aim is to have autonomous municipalities which do not rely on public subsidies but rather on the mobilization of local resources, supposed to be provided by the tax TEOM. This tax has been created to fund SWM but it has an unclear role as regard to valorization since it concerns by definition merely waste collection¹⁰⁸. It appears therefore as crucial to redesign a tax that would encompass all SWM stages, including waste valorization. Another major difficulty in Senegal relies in the low tax recovery. Since its payment has already been made mandatory, its enforcement is therefore required with strict control, the aim being 100 per cent of tax recovery.

¹⁰⁷ <http://www.trackbusters.fr/definition-prix-garanti.html> [Accessed on 11th July, 2012]

¹⁰⁸ TEOM signifies originally "*Taxe d'Enlèvement des Ordures Ménagères*" which can be literally translated by "Tax for the Removal of Municipal Waste"

Also, responsibilities should be assigned to industrialists based on the concept of “the Extended Producer Responsibility”¹⁰⁹. According to this concept, the responsibility of the producer is extended to the post-consumer stage of a product’s life cycle. EPR seeks thereby to integrate other production process more environmentally and socially friendly. It can be applied as a policy instrument and OECD published in 2001 a Guidance Manual for Governments¹¹⁰ on its application. It provides the necessary information on associated issues, potential benefits and costs, a set of principles to guide policy makers and several policy instruments for implementing EPR (economic instruments e.g. advanced disposal fees, deposit-refund,i.e.).

To conclude to recommendations, changes needed are as endogenous as they are exogenous. Developing valorization in order to reach a sustainable SWM is therefore highly challenging, but also highly beneficial and should therefore become a priority for the Senegalese society.

The empirical findings are based on Senegalese data and are consequently best suitable to the Senegalese situation. It is then interesting to question the external validity of these recommendations. It links with looking at the applicability of the hypothetical good valorization governance in general.

Comparing the empirical findings with the theoretical ones enables to point the similarities and differences between Senegal and the general knowledge and international experiences. It is then explored whether the empirical findings have an external validity and where. The specificities of the Senegalese valorization sector are also revealed by the comparison which participates in detailing knowledge on SWM in developing countries. This comparison is conducted in the following part.

8.2.Discussion

The large literature available on SWM has revealed the extension of the academic knowledge existing on this topic. Comparison with the Senegalese situation has been made on the technics, the governance and the sustainability in SWM. By highlighting the Senegalese specificities, it reveals also large discrepancies between the theories and the practices applied in Senegal.

8.2.1. The technical backwardness in Senegal

Compared to the general technical knowledge related to waste management, Senegal presents a technical backwardness. SWM is inexistent in some places while it is failing or not complete in others. The lack of modern technics is observable in all SWM stages, which prevents the achievement of SWM’s objectives. It results often in waste accumulation in public spaces or inadequate disposal places. Nowadays there exist not complete management as described in theory encompassing collection, transport and treatment.

- Waste collection is not always organized, and if so, its performances are not automatically high.
- Waste transport meets some failures because of limited, constraining or inadequate transportation means, or failing coordination between collectors.
- Waste treatment is rarely or poorly organized.

¹⁰⁹<http://www.oecd.org/env/environmentalpolicytoolsandevaluation/extendedproducerresponsibility.htm> [Accessed on 20th July, 2012]

¹¹⁰ The Guidance manual is available on internet at the following address : http://www.oecd-ilibrary.org/environment/extended-producer-responsibility_9789264189867-en [Accessed on 20th July, 2012]

- Waste valorization is an embryonic stage. Its large presence in the informal sector has positive impacts since it increases the sector dynamism and multiplies its practices. However, it has also negative impacts by enabling merely basic technics with not-advanced technology.

The explanations behind the underdevelopment stage of valorization have been presented in Chapter 4 acknowledging institutional and legal, geographical-economic, financial, technical and social difficulties. These difficulties are in fact relatively universal and can therefore be considered as intrinsic to waste valorization. Yet it does not mean that they are insurmountable. On one hand there are premises of valorization development already observable in Senegal, revealed by the empirical findings of the research. The Senegalese valorization

sector does exist and is growing, with new technics developed by local workers in the SWM workers chain - engineers, collectors, i.e. -. Secondly, theoretical knowledge is large and instances found in the literature, such as the case of California described in Box 29, prove the existence of solutions to tackle the intrinsic valorization difficulties. Thanks to the literature review, it appears therefore clear that high quality valorization is technically possible. The discrepancy between practical applications in Senegal, and in developing countries in general, and the general knowledge and practices present in the literature reveals that international knowledge exchange is highly needed. Indeed, knowledge and technological transfers are likely to participate in the technical up-grading of the receiving country's valorization sector. Box 30 presents a program conducted between Vietnam and Senegal, which copes with transfer of waste valorization related knowledge and technology (BURGEAP, 2002). Such experiences are expected to enhance the quality of the valorization processes, stimulate and accelerate the development of the sector in Senegal. However consideration to local specificities and attempts to foresee potential harmful impacts of applying other technics are important when developing such exchanges.

Box 29 - The “Zero Waste Program” in California

Technics applied are advanced and direct the society towards a “Zero waste” stage where the amount of waste generated are low and waste disposed in landfilled nearly inexistent (Stave, 2008).

Box 30 - Transferring Vietnamese knowledge and practices to Senegal

In the early 00's, a program has been developed between Vietnam and Senegal where evaluations were conducted on the discrepancies between the respective sector's practices and technological platform, and on the possibilities to exchange knowledge and equipment. Large attention has been paid to the potential in metal valorization and possible exchanges on the correspondent practices. Transfer as regards to foundries' equipment and knowledge related have been organized, while assessing the hypothetical economic and social related impacts. The transfers' aim was to increase the efficiency of the foundries and enhance the quality of the valorized metal (BURGEAP, 2002).

8.2.2. Progressive shift from government towards governances

The comparison as regards to SWM governance exposes where Senegal stands compared to worldwide tendency. Reviewing the literature on Senegalese SWM governance has revealed that a progressive shift from government to governance is also happening, following therefore the common global trend. With the correspondent multiplication of actors, the private sector – with EIG and larger enterprises – and the civil society – with NGOs and grassroots organizations – are also included. The empirical findings have proved that Senegal does not make the exception. It presents a multiplication of its SWM's actors with a subsequent enlargement of responsibilities' distribution.

The literature review has also highlighted that SWM governance encompasses two forms of governance, differentiable and yet interconnected. SWM's actors are accordingly distributed among a group of actors acting in waste collection, transport and treatment, and a group of actors acting in waste valorization. The shift from government to governance concerns waste collection and treatment sector as well as waste valorization sector. The only difference relies in the motivation behind it: while the responsibility allocation has been progressively enlarged in waste collection and treatment because of the inefficiency of the public sector to handle this task, it has been enlarged in valorization sector because of the inactivity of the public sector. Dubbink describes the general overload of the States that have to handle a growing number of tasks (2003). The Senegalese State is also in this situation, and the failing or absent institutions have obliged the private sector and civil society to react. These situations are yet not specific to Senegal. As explained in the theoretical framework, the civil society and the private sector often get a growing role in service provision when the public sector is failing. Numerous instances presenting this pattern can be found, especially in developing countries.

Finally, the two governances in Senegalese SWM are dominated, as it is supposed to be theoretically, by the multiplicity of partnerships between their respective actors and external actors.

The following sections present more in detail the particularities of Senegalese valorization governance compared to the theoretical findings.

The large participation of the private sector, and especially in waste valorization

The growing participation of the private sector in SWM is also happening in Senegal. The private sector is getting a growing role in SWM, and especially in the valorization sector. This global trend is due to the economic potential relying in valorization and catching thus the attention of investors, and because private actors are the buyers of the valorized waste. In Senegal, the private sector's participation is indeed systematic in valorization related initiatives.

PPP as a promising solution and yet hardly applicable

Senegal gathers the three criterion mentioned by APROSEN and IAGU (2009) and Ahmed and Ali (2004) (cf. Section 2.2.3, p. 30) which proves the potential and relevance of developing PPP in developing countries for service provision, including SWM services. And with an increasing participation of the private sector, the PPP are supposedly also multiplying. In reality the Senegalese authorities showing low involvement in waste related issue which limits the possibilities to initiate PPP. Compared to the case study of Lebanon (Box 6, Section 2.3, p.38), the informal part in the Senegalese experience is larger and the involvement of municipalities is lower. Therefore PPP happens at a small extent, either by cooperating with EIG for waste collection, or with contracts with commercial and/or private investors. Also, PPP with the informal private sector is happening.

Cooperation with the informal sector and integration of the informal sector

Like in many developing countries, Senegal presents a large informal sector in SWM, and especially in waste valorization. Cooperation is therefore both relevant and inevitable, which has been confirmed for Senegal by the present research. Integrating informal workers improves their performances, enhance of their working conditions and rise their living standards (APROSEN & IAGU, 2009). All these aspects have been proved when analyzing the case studies in Kaolack and Thiès. Also, it appeared that public-informal private partnerships were less spread than formal private - informal private partnerships. While the PPP analyzed in the Senegalese case studies revealed to be relatively limited, the partnerships within the private sector and between the private sector and the civil society were dynamic. This trend is spread among developing countries considering the usual setback of the public sector.

However this process of cooperation and integration is not without difficulties and theories advocating communication's and coordination's problems when dealing with informal workers have been confirmed. Theories promoting integration of the informal sector while recognizing the existence of limits find thus also their relevance in Senegal.

Considerable effort for active community participation

The empirical findings reveal that the civil society is particularly dynamic in SWM in general, including in waste valorization. Accordingly NGOs are particularly present in Senegal and community participation highly encouraged. These characteristics are in fact common to developing countries where civil society involvement aims at counteracting institutional failures (Dorier-Apprill & Meynet, 2005). There is a large literature available on the relevance of community participation in service provision and the empirical findings have confirmed it. This approach is repeatedly used in Senegalese waste related programs and the results have often been positive. Like in the case studies reviewed in the literature review on community participation, the Senegalese experiences reveal willingness to initiate and strengthen community participation, and eventually bring it to citizen control. The application of these three points in Senegal is exposed in the Box 31, 32 and 33, and mirrors the theories on practices in community participation.

Box 31 - Initiating community participation in Senegal

Community participation has been initiated in the Senegalese case studies reviewed by bringing information to the population through communication channels organized mainly by NGOs. All the interviewees for the primary research acknowledge that increasing the understanding among the population maximizes the efficiency of the valorization system.

Box 33 - Citizen Control in Senegal

Citizen controlling SWM has never been total among the Senegalese case studies reviewed. However it has happened that some communities control entire sub-systems – of specific waste type collection, i.e.-. In cases like Kaolack or Thiès, the program is not only accepted by the inhabitants but also run by some of them, which participate in the durability of the system.

Box 32 - Strengthening community participation in Senegal

Large consideration is generally given to already existing CBO acting in waste related activities before the implementation of the programs. Their integration into the system strengthens their participation. Compare to the case study of Bamako where both financial and technical assistance was provided (Box 8, p.32), programs conducted in Senegal provide mostly technical assistance. Project's initiators often fear that assisting financially communities would lead to dependency and prevent accountability financially autonomy.

Promoting community participation has different goals according to if community participation is applied as an instrument in the program or as an aim; both situations are presented in Box 34. Community participation is considered as an instrument when it has a use in making SWM more efficient. It can also be considered as an objective in which waste management is an important instrument to achieve social development. The empirical findings

Box 34 - Different community participation initiation according to the programs' purpose, in Bamako (Mali) and Bangalore (India)

In a program developed in Bangalore (India) aiming at developing SWM, community participation was stimulated by different means in order to increase their cooperation with the services offered. On the other hand, a program developed in Bamako (Mali) applied methods directed to strengthen social relationships on all organizational levels. By doing so, the community-based organizations could be created as partners in waste management (Muller et al., 2002).

have revealed that waste related programs developed in Senegal have in the majority of the case encouraged community participation in order to reach the program's goal and sustain the processes.

Finally no misapplication of participatory approach has been observed among the Senegalese case studies reviewed. The initiators of project were aware of the local situation and people constraints, sometimes because they were themselves confronted to it before.

On the other hand, empirical findings have also confirmed the limits of community participation evocated in the theoretical framework. Because of the capacities of communities are also limited in Senegal, communities act in systems that are developed by the public sector, the private sector and/or NGOs. It explains therefore why community participation stays within a frame put in place and managed by other actors.

The main indirect limit of community participation in Senegal has been found in the behavior of the authorities. In numerous cases, community participation became a substitute for legitimate authorities and the authorities stood only spectator of these initiatives. Furthermore, it has been observed that municipalities do not know how to react and behave in front of involved community. Letting them handling partly SWM enables to create a sense of responsibility and to empower them. However, recognizing the civil society and the efficiency of their actions acknowledges to some extent their own incapability¹¹¹.

The large presence of NGOs and their essential contribution

As exposed in the theoretical framework, NGOs have a central role, by building the bridge between the main actors, determining or participating in the elaboration of program's guidelines. In Senegal, NGOs have played a fundamental role. They have motivated participation and paved the way for local initiatives recognition. The legitimacy of NGOs actions is recognized and relatively high considering the mistrust in the public sector. Until the State involves truly, this support will stay crucial for developing locally the sector. However assistance of NGOs at a national scale is questionable considering the negative drawbacks that such situation might lead to (cf. Box 10, p.35) but also because larger involvement from the Senegalese State would be preferred.

On the other side empirical findings have also confirmed the limits of NGOs' actions presented in the theoretical framework. The presence of NGOs in Senegal prevents to a certain extent the development of private local initiatives. They cannot compete with NGOs' valorization centers and their large financial resources, especially when these initiatives come from the informal sector. Temporary assistance is preferred when contemplating sustainability considering that intrinsic management is the final goal. However, responsibilities have rarely been transferred to Senegalese municipalities and in some cases upon grassroots organizations or private structures.

As a conclusion, the multiplicity of actors and an unclear tasks distribution appear from a first approach as the main limit in the Senegalese SWM. Large governance is indeed likely to create confusion in responsibility distribution (Dorier-Apprill & Meynet, 2005). This aspect questions therefore whether SWM should stay bounded to a public service managed essentially by public

¹¹¹ Representative of LVIA, 2012

sector as it used to be. However, analyzing separately the actual role of each actor in SWM in Senegal reveals that they all have limits. It confirms what the literature review have already highlighted as regard to the need for numerous and diversified actors in order to overcome the bounds of each. This aspect actually explains why there has been a progressive change towards larger governance.

Confusion and tension in SWM have yet been improved lately with the appearance of two governances within SWM. This trend is also happening in Senegal and reveals an evolution in the tasks allocation. It marks in fact a first level of tasks division within SWM among collection and treatment, and valorization. Although these sectors are interrelated, clear differentiation helps in the tasks fulfillment and therefore in sectors' performances.

Perspectives for Sustainability in Senegal

The Figure 7 (p.41), presenting the causes and consequences of mismanaged waste, gives a schematic representation of the actual general state of the Senegalese SWM. Apart from the causes presented on the figure, external factors relying in the social, political and economic spheres have plunged and maintained to a certain extent the system in the situation it stands now. Comparing the empirical findings on Senegalese SWM to the sustainable model conceptualized (p.53), put the light on the missing and existent.

On one hand, the present research has shown that the “Reuse” of waste was relatively spread in Senegal and became even the most developed one among the three components of ISWM. The basic aspects of the technics used, which can be easily applied by the numerous informal workers, explain this trend. Secondly the “Recycling” sphere is also relatively developed among the informal sector and is also getting a growing interest in the formal sector. As a result, a waste cycle is emerging in Senegal. Furthermore it has promising outlooks considering that “Reuse” and “Recycle” have a basic on which development perspectives could and should be built. Besides the technical aspects, these perspectives will be determined by valorization governance. However valorization is embedded in a larger system encompassing the other SWM stages and accordingly, valorization governance is also embedded into larger governance encompassing the entire SWM. Therefore valorization is dependent on the other variables present in its system and is subject to feedback loops (cf. Figure 20, p.117). Valorization cannot be developed in isolation and must consider the entire waste system for its development, including in governance.

Finally, achieving ISWM required also to “Reduce” waste and this stage is totally absent in Senegal, as the tremendous increase in waste generation proves it. People's behaviors and the legislation are good indicators of the state of waste prevention. In Senegal however, related awareness and regulation appear as non-existent. Consequently, the population does not receive particular incentive, industrialists implemented in Senegal are not constrained and the imports are not regulated. Also, some social behaviors in Senegal bring indirectly to consumption habits highly waste productive. The awareness is thus mainly happening in the academic field.

To conclude, the comparison of the empirical findings with the theoretical ones have firstly revealed that Senegal presents most of the characteristics common to a large number of developing countries - the extensiveness of informal sector, failing institutions in service provision, i.e.- . As a result, the external validity of the hypothetical model on valorization

governance is confirmed for developing countries. Since it is based on the Senegalese waste situation, the application of the model somewhere else would need some adaptations but its transplantation is surely possible in other developing countries since its main guidelines finds relevance in developing countries.

More generally, the comparison has enabled to finish the investigation on Senegalese SMW state and perspectives. The failing basic SWM, the clear underdevelopment of the waste cycle and the absence of waste prevention bring to light the large efforts still needed to reach sustainability. Good governance is not yet achieved neither in waste collection and treatment, nor in waste valorization but shows some promising evolutions. Technics applied are not sophisticated enough and technological improvement – with international transfer for instance – would help in overcoming this limit. Improving the performances of the two main components of SWM would direct it towards sustainability.

In most of the developing countries in the world, waste receives still too little attention in the formal sectors. Yet, more consideration would enable developing societies to experience progress in the economic, social and environmental spheres. On one hand, waste continues to be considered as something that should be discarded and rejected. However the possibilities to recover some value from waste before rejecting it are more and more contemplated. Crises bring changes and financial interests accelerate it. Thereby the shift that Senegal is currently living reflects a trend common to developing countries. It consists in enjoying economic advantages of waste considered then as local resources.

8.2.3. Enlargement of the research scope

It would have been interesting to enlarge the scope of the research by getting more insights from international valorization related initiatives. With the development of this sector all around the world, the initiatives multiply, offering thus a large range of inspiring schemes. Reviewing it would on one hand enable to develop the model developed in the present research and make it thereby more complete. In Belgium for instance, the cooperation between the authorities and local enterprises has enabled to open shops selling recycled products all produced in the region. These products are all presented in a guide made available for the consumer¹¹². In France, a network called “FEDEREC” gathers numerous actors of the recycling sector. Besides connecting them, the union facilitates the access to labels for the members. The FEDEREC’s label is given to members after evaluation and represents a first step towards ISO certification (ISO 9000 and ISO 14000). These labels prove the total transparency and reliability on production process of the certified industrialists as regard to social and environmental criteria¹¹³. Helping recycled products’ selling or the certification are means among others which participate in making a network more complete, highly beneficial for its members as well as for the rest of the society.

On the other hand, reviewing international valorization related experiences would enable to reference the existing isolated regional or national networks. Possibilities to gather them into a larger network could thereby be explored. It is assumed that international network would facilitate for instance technological and knowledge exchanges, especially needed in developing countries. Larger networks have been created but their influence stay so far relatively low. In Europe a network has been created called the “Association of Cities and Regions for Recycling

¹¹² The catalog of recycled products is made available on internet on <http://www.produitrecycle.info/> [accessed 20th June 2012]

¹¹³ <http://www.federec.org/presentation/federec/acteur-incontournable.html> [accessed 28th June 2012]

and Sustainable Resource Management (ACR+)” and the “Collaborative Working Group on Solid Waste Management in Low- and Middle-income Countries (the CWG)” gathers accordingly low- and middle-income countries. The United-Nations (2009) claim that such networks leads to growing dependence between cities and avoids harmful competition, which is highly beneficial. As a result, the benefits of networking (presented in Chapter 6, p.122), as well as the positive impacts of valorization, would be felt at an international scale. The feasibility and applicability of a network gathering the main actors at an international level would be interesting to explore therefore in the continuation of this research.

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Annex 1

List of interviews

Name	Function	Place and date	Contact	Quotation title
Kaolack				
Abdoulay Sy	Manager of the plastic valorization center PROPLAST Kaolack	24/04/2012	Phone number: +221 77 445 66 90	Manager of the center in Kaolack
Alioune Badara Ndiaye	Municipality councillor and President of the municipal commission responsible for the Environment of Kaolack	24/04/2012		Municipality councillor
Gertrude Rodriguez Ndong	Representative of CARITAS Kaolack	25/04/2012		Representative of CARITAS Kaolack
Marcel Gaétan Sagna	Assistance of the representative of Caritas Kaolack and representative of the neighborhood committee "Ndorong 1"	26/04/2012	Phone number: +221 77 659 92 00 e-mail: sagnamarcelg aetan@yahoo. fr	Assistance of the representative of Caritas Kaolack
Nayé Cissokho	Representative of the regional delegation of APROSEN in Kaolack	25/04/2012		Representative of APROSEN Kaolack
Ousmane Ndiaye	Representative of the neighborhood committee "Gawane"	26/04/2012	Phone number: +221 77 653 46 79	Representative of the neighborhood committee "Gawane"
Thiès				
Mouhamed Gueye	Representative of the NGO LVIA in Senegal	11/05/2012	Phone number: +221 33 635 16 09 e-mail: lviath@orange.sn	Representative of the NGO LVIA in Senegal
Germaine Faye	Production manager of the valorization plastic center PROPLAST Industrie SARL in Thiès	13/06/2012	Phone number: +221 77 186 75 76	Production manager of the center in Thiès
Saint-Louis				

Hadji Malick Diakhaté	Director of the municipal agency in charge of the urban developement of Saint-Louis	19/06/2012	Phone number: +221 77 977 07 53 e-mail: malickstm@h otmail.com	Director of Saint-Louis' urban developement agency
Dakar				
Daouda Gningue	Commercial agent of the valorization plastic center PROPLAST Industrie SARL in Thiès	10/05/2012	Phone number: +221 76 574 64 15 e-mail: dcproplast@g mail.com	Commercial agent of the center in Thiès
Thiès				
Macoumba Diagne	Director of the valorization plastic center PROPLAST Industrie SARL in Thiès	06/08/2012	e-mail: proplast.sarl @gmail.com	Director of the center in Thiès
Ousmane Niang	Representative of the Rosalux Institute	17/06/2012	e-mail: o.niang@rosa lux.sn	Representative of the Rosalux Institute

Annex 2

Interview Guide

The present interview guide is a sample of the interview guides formulated. It has been used during the interview with the valorization centers. Other interview guides have been formulated for the municipality, the grassroots organizations and the NGOs. The questions stood the same but were directed on different partners, in order to cover all the possible relations and/or partnerships.

Guide d'entretien auprès du centre de recyclage

Présentation personnelle

I. Présentation contextuelle du centre

1.1. Nuisance des déchets

1.2. Gestion des déchets

1.3. Avantages des activités du centre

II. Fonctionnement du centre

2.1. Fonctionnement technique du centre

2.2. Système financier du centre

III. Gouvernance du centre

3.1. Les acteurs

3.2. Les partenariats

3.2.1. Partenaires dans la gestion des déchets

3.2.2. Partenaires appuyant le centre

3.2.3. Partenaires économiques pour les débouchés des déchets traités

3.2.4. La place des communautés dans ces partenariats

3.3. Organisation et évolution des partenariats

IV. Développement du centre

4.1. Difficultés rencontrées par le centre

4.2. Opportunités de développement du centre

I. Présentation contextuelle du centre

1.1. Nuisance des déchets

- Quel est le montant des déchets produits dans la région ?
- Quelle est la part des déchets *plastiques / organiques / de métal ...etc.* ?
- Parmi ces déchets, quel montant atteint le centre de recyclage?
- Comment la perception par rapport aux déchets et leur valorisation évolue-elle ? (Prise de conscience environnementale ?)

1.2. Gestion des déchets

- Comment s'organise la collecte et le transport des déchets et qui est en a la charge? (*Définir clairement quel rôle a l'interviewé*)
- La collecte était-elle efficace selon vous?
- Comment les déchets étaient-ils traités avant l'implantation du centre ?
- Quel changement dans l'organisation de la gestion des déchets a amené l'implantation du centre ?
- Les principales difficultés dans la gestion des déchets sont des :
 - Difficultés financières
 - Difficultés techniques
 - Manque de coopération des populations
 - Manque d'entente et de coordination entre les acteurs

1.3. Avantages d'un système de traitement et/ou valorisation

- Quelles influences a selon vous un traitement et une valorisation efficace des déchets sur le reste du système de gestion des déchets ?
- Implications environnementales des activités du centre
- Implications socio-économiques des activités du centre

II. Fonctionnement du centre

2.1. Fonctionnement technique du centre

- Comment le centre fonctionne-t-il d'un point de vue technique?
- Aire couverte par l'activité?

Cela démontre l'intégration de la valorisation dans système de gestion des déchets

2.2. Système financier du centre

- Allocations financières
 - Des autorités locales
 - De l'Etat
 - Des ONG

- Cotisation pour le service auprès des habitants
 - Combien, et comment le montant a-t-il été établi?
 - Comment s'organise le recouvrement?

III. Gouvernance du centre

3.1. Les parties prenantes

- Qui a créé le centre?
- Qui en a la charge aujourd'hui ?
- Quelles sont les motivations du centre ?
- Qui sont les acteurs concernés actuellement dans les activités du centre?
- Y a-t-il des acteurs qui ont été impliqués mais ne le sont plus maintenant?
 - Pourquoi ne sont-ils plus impliqués aujourd'hui?

3.2. Partenaires dans la gestion des déchets

- Nature des partenaires
 - Avec le secteur public
 - Avec des OCBs
 - Avec des individus
- Organisation du partenariat
- Les avantages du partenariat
 - Quelles sont les avantages pour le centre ?
 - Le centre apprécie les avantages du secteur public (responsabilité sociale, conscience environnementale, connaissance locale et intérêt par la création d'emploi)
 - Avantages de collaborer avec ONGs
 - Avantages de collaborer avec OCBs
 - Quelles sont les avantages pour le système de gestion des déchets en général
- Quelles sont les difficultés rencontrées dans ce partenariat (coordination, i.e.) ?
- Quelles sont les perspectives envisagées pour ce partenariat ?
 - Dans quelle direction et pourquoi ?
- Quel est le degré de satisfaction du partenariat

3.3. Partenaires appuyant les activités du centre

- Nature des partenaires
 - ONG

- Autorités locales
 - Quelles sont leurs perspectives?
 - Encourager les initiatives locales pour renforcer les capacités des communautés
 - Développer un secteur de valorisation des déchets
 - Promouvoir la santé, la gestion de l'environnement, le développement d'infrastructures

- Investisseurs privés

- En quoi le(s) partenariat(s) consiste-t-il? (*Si plus d'1 partenariat, distinguer les actions en fonction des acteurs*)
 - Appui financier (pour amortir puis rentabiliser l'équipement, ex.)
 - Aide dans le management du centre
 - Appui technique
- Comment ce partenariat s'organise-t-il?
- Quel est le but de cet appui?
 - Initier le programme
 - Maintenir le programme
 - Aider à trouver des nouvelles opportunités pour le développement du centre
- Les opportunités
 - Est-ce que cet appui a aidé le centre à améliorer / développer ses activités?
 - Est-ce que cet appui a aidé le centre à élargir spatialement ses activités?
- Difficultés
 - L'appui n'est pas suffisant
 - L'appui n'est pas stable
 - L'appui n'est pas efficace (mal dirigé)
- Perspectives
 - Dans quelle direction et pourquoi ?
- Degré de satisfaction du partenariat

3.4. Partenaires économiques pour les débouchés des déchets traités

- Nature des partenaires
 - Secteur formel / entreprises privées

- Secteur informel
- Nature et organisation du partenariat
- Avantages du partenariat
 - Le centre apprécie les avantages du secteur privé ? (dynamisme, accès au capital, connaissances technologiques, efficacité dans la gestion, esprit entrepreneur, réponses aux besoins de la besoin mieux adaptées)
- Opportunités
 - Les partenaires économiques ont-ils aidé le centre à améliorer / développer ses activités?
 - Les partenaires économiques ont-ils aidé à l'élargissement spatial des activités ?
- Difficultés (dans les négociations, i.e.)
- Perspectives
 - Dans quelle direction et pourquoi ?
- Degré de satisfaction du partenariat

3.5. La place des communautés dans la gouvernance

- De quel type de “participation communautaire” s’agit-il?
 - Le centre est dirigé par une OCB
 - Cooperation avec des OCBs (groupements de femmes, GIE, groupement de jeunes...)
 - Combien d’OCBs?
 - Cooperation avec des individus
 - Quelle est la part de l’informel parmi ces coopérations?
- Rôle des OCBs ? (reflète leur niveau d’intégration)
 - L’OCB est l’initiateur du projet, participation active dans l’élaboration du projet (participation à des meetings, i.e.)
 - L’OCB n’a pas initié le projet mais a reçu la responsabilité de sa direction
 - Participation passive (sont informés, et formés, i.e.)
 - Participation au fonctionnement technique (en collectant et transportant les déchets, i.e.)
- Motivations pour ce partenariat
 - Pour les avantages de l’intégration des OCBs dans le système?

- Avantages économiques: les OCBs sont moins chères et/ou plus efficaces?
- Nécessité de mobiliser les ressources externes (savoirs techniques locales, compétences particulières, connaissances du milieu d’intervention., ex.)
- Avantages sociaux
 - Renforcer les capacités locales, en transférant les compétences
 - Pérenniser l’action : le système est alors mieux accepté (et donc intégré) par les populations?
- A cause des contraintes institutionnelles: obligation de coopérer avec structures locales
- Difficultés dans intégration des OCBs ?
 - Coordination des activités difficile (désarticulation entre les activités du centre et les dynamiques locales / l’organisation initial des OCBs avant l’arrivée du centre)
 - Manque de connaissance des OCBs sur la gestion et valorisation des déchets
 - Contraintes matérielles et technologiques
- Perspectives
 - Dans quelle direction et pourquoi ?
- Degré de satisfaction du partenariat

3.6. Organisation et évolution des partenariats

- Existence de “comités” pour rassembler tous les acteurs ?
 - Discuter des activités du centre
 - Discuter des partenariats en général (relations, stratégie, perspective de développement) et leur suivi
- Pas de comités mais juste des rendez-vous personnels
 - Pour travailler l’objet du partenariat
 - Pour discuter du partenariat lui-même (des relations, de la stratégie du partenariat) et leur suivi
- Les perceptions sur les partenariats
 - Quelle place à la négociation, concertation et collaboration pour définir les tâches de chacun et changement si nécessaire ?
 - Par rapport aux motivations initiales de la mise en place des partenariats, les relations souhaitées sont-elles devenues effectives ?

- Avec la collectivité locale
 - Avec les ONG
 - Avec les OCBs
 - Avec les entreprises privées
- Y a-t-il une compétition entre des acteurs
- D'un point de vue général, très satisfaisante (chacun rempli sa tâche & le centre peut profiter de la diversité de ses partenaires)
- Des déceptions par rapport à certains partenariats ?
- Comment le besoin pour des partenariats diversifiés est-il perçu?
 - Cela ne peut pas être évité mais doit rester limité
 - (devrait rester) surtout un service public
 - (devrait rester) surtout un service privé
 - Une balance parfait entre service public, privé et société civile
- Avantages des partenariats (le plus important?)
 - Amélioration des performances du secteur
 - Réduction et stabilisation des coûts du service
 - Protection environnementale améliorée
 - Accès au capital
- Comment les partenariats ont-ils évolué depuis leur mise en place ?
 - S'inscrivent-ils dans la durée ? ou changement fréquent des partenaires ?
 - S'inscrivent-ils dans la progressivité ? (l'organisation des partenariats a évolué et s'est améliorée depuis qu'ils ont été mis en place)
- Comment les partenariats sont susceptibles d'évoluer?
 - Naturellement
 - Grâce à l'aide d'une entité extérieure
 - Pour organiser les partenariats avec les communautés et les ONG (aprosen, ex.)
 - Pour organiser les partenariats avec le secteur privé / partenaires économiques

IV. Développement du centre

4.1. Difficultés du centre

- Difficultés internes

- Organisationnelles et de gestion
- Difficultés techniques
 - Risques en manipulant les déchets
 - Manque de connaissance et d'expérience
 - Manqué de technologie
 - Capacités du centre sont trop limitées
 - Productivité du centre trop limité
- Difficultés financières
 - Les activités sont-elles rentables?
 - Combien de temps cela a-t-il pris pour devenir rentable?
- Difficultés externes
 - L'instabilité institutionnelle et decentralization incomplète
 - Contraintes sociales (les perceptions sur les déchets, ou travailleurs, ex.)
 - Difficultés géographiques
 - Isolation géographico économique
 - Une contrainte car ça limite les débouchés économiques
 - Une opportunité car ça limite la compétition
 - Difficultés économiques
 - A cause de l'instabilité des prix (stockent-ils les produits recycles en fonction du cours des matières?)
 - Manque de débouchés économiques
- Observez-vous un cercle vicieux ?
- 4.2. Opportunités de développement du centre**
- Le développement du centre
 - Les activités du centre ont été améliorées / développées ?
 - Le centre a-t-il change de statut ? (de GIE à SARL, i.e.)
 - Combien de personnes travaillent dans le centre? (évolution dernièrement ?)
 - Elargissement spatial des activités?

- La région permet-elle un élargissement spatial des activités? (l'offre de déchets ou les débouchés économiques ne sont pas trop limités)
 - Les activités du centre ont-elles été élargies spatialement durant les dernières années ?
 - Une influence du centre peut-elle être perçue dans le reste de la région?
 - Dans le secteur informel, des associations se sont créées pour collecter, transporter ou recycler les déchets
 - Dans le secteur formel, des centres similaires se sont implantés ou sont en projet de développement
- Élément important pour le développement future du centre
 - Multiplier les partenaires
 - qui appuient le centre
 - pour des débouchés économiques
 - Encourager la participation communautaires
 - Meilleure intégration des OCBs (pour améliorer la collect, ex.)
 - Encourager les initiatives locales et leur coopération avec le centre
 - Etre intégré dans le service public? Reconnaissez-vous que la municipalité est responsable du développement locale ? ou c'est utopique ?
 - Développer l'éducation environnementale (plus de coopération des habitants pour trier les déchets, ex.)
 - Etablir un cadre juridique
 - Des outils économiques (taxes, augmenter le prix du plastique, ex.)

Annex 3

Gradations in the partnerships analysis

Gradation in the general analysis of the partnerships' quality in plastic valorization system

Criteria	Indicators	Evaluation
The program is in the line with global development policies	The program is based on partnerships	Positive: Partnerships are promoted in the program Mitigated: Partnerships are not clearly promoted in the program Negative: No attention is given to partnerships in the program
	Objectives of the partnership can be encompassed by national and/or international frame for development (MDGs, i.e.)	Positive: the program's objectives correspond to national and/or international development goals – quotation of which MDG the objectives correspond to - Mitigated: the association between program's objectives and development goals is unclear Negative: the program's objectives cannot be associated to any national and/or international development goal
Preliminary agreements on the goals and outcomes of the program	All the partnerships agree on common goal and expected outcomes when launching the program	Positive: The actors share a common goal and they fixed precise objectives when launching the program Mitigated: The actors share a common goal but no precise objective has been fixed when launching the program Negative: The actors did not share a common goal and no objective has been fixed when launching the program
Dialogue about the program	Meetings are organized for discussion	Positive: Meetings are regularly organized for discussion Mitigated: Meetings are only promptly organized for discussion Negative: No meetings is organized for discussion
	All the actors involved are present at these meetings	Positive: All the actors involved are present at these meetings Mitigated: Some of the actors involved are present at these meetings Negative: Outside the organizer of the meetings, nobody is present
Shared organization and management of the program	Responsibilities in the program are shared in legitimate way	Positive: Tasks are legitimately distributed among the actors according to their specificities Mitigated: Tasks are legitimately distributed but only limited number of actors Negative: Only one actor handles the tasks
Consideration of each other's constraints and difficulties	One's requirements are considered and integrated if necessary	Positive: All the requirements of all the participants are considered and integrated if necessary Mitigated: Some requirements of the participants are considered and integrated if necessary Negative: The requirements of the participants are not considered and thus not integrated

Gradation in the specific analysis on the relations' quality between the center and other actors

Criteria	Indicator	Evaluation
Reliability between the actors	The partnership was willing from both side and not imposed	Positive: The center and the other actor were willing to develop the partnership Mitigated: Only one of the partners was willing to develop the partnership Negative: The partnership has been imposed by an external actor
	Partners know well each other's activities	Positive: Both partners are transparent regarding their activities Mitigated: Occasional lacks of transparency on the actors' activities are deplored Negative: There is no transparency on the actors' activities
	Wished relations became effective	Positive: Relations that the actors wished to have become effective Mitigated: Relations that the actors wished to have did not become totally effective and there are some failures in the contacts Negative: The wished relations did not become effective
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Positive: Communication and negotiation are of good quality between the partners Mitigated: Communication and negotiation are only sometimes efficient Negative: Communication and negotiation are of bad quality between the partners
Respect of the procedures and agreements	Partners respect the procedures and agreement	Positive: Both partners respect the procedures and agreements Mitigated: Only one actor respects the procedures and agreements Negative: None of the partners respect the procedures and agreements
Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Positive: The partnership is relatively old and has met positive evolutions Mitigated: The partnership is relatively new and starts to meet Positive evolutions Negative: The partnership is relatively old but it has not met any evolution
	New projects are developed	Positive: The partners develop projects in cooperation and succeed in its realization Mitigated: The partners attempt to develop projects in cooperation but do not succeed in its realization Negative: No common project is developed by the partners
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Positive: Both partners have positive perceptions on the partnership and are optimist for its development the future Mitigated: Both partners tempered their satisfaction on the partnership and question its development in the future Negative: Both partners have negative perceptions on the partnership and are pessimist for its development in the future

Annex 4

Partnerships analysis: evaluation justification

General analysis of the partnerships' quality in plastic valorization system of Kaolack

Criteria	Indicators	Evaluation
The program is in the line with global development policies	The program is based on partnerships	Positive: The program has been elaborated in cooperation of several actors. It was clear since the beginning that the center would not run if isolated.
	Objectives of the partnership can be encompassed by national and/or international frame for development (MDGs, i.e.)	Positive: Developing plastic treatment is a project integrating in a program that aims to reducing insalubrity in Kaolack. It is expected to improve health situation, reduce poverty by creating jobs and enhance life conditions in general (MDG 1, 4,5 and 7)
Preliminary agreements on the goals and outcomes of the program	All the partnerships agree on common goal and expected outcomes when launching the program	Positive: The actors share a common goal (insalubrity reduction) where plastic revalorization has a major place. The outcome expected by the actors is efficient plastic management integrated in efficient SWM.
Dialogue about the program	Meetings are organized for discussion	Mitigated: Although all the actors recognized regular meetings' relevance, gatherings are yet not often organized. The main reason is the unclearness on who is supposed to organize these meetings. As the table presenting the roles showed it, the responsibility is merely taken by the NGO. It happens only occasionally since it was agreed that the municipality was in charge of the "Consulting frame" ¹¹⁴ which is currently not active. The majority of the actors recognized yet the necessity to revitalize this frame.
	All the actors involved are present at these meetings	Mitigated: Because of the unavailability of some actors (lack of time, other priorities, i.e.) there are difficulties to gather everybody. Most of the meetings happens thus between only few people in an informal way. Official consulting frame between Neighborhood committees and the center is particularly desired considering the influence that one has on the other's activities (Interview Caritas, 2012).
Shared organization and management of the program	Responsibilities in the program are shared in a legitimate way	Mitigated: Tasks are well distributed but merely among the private actors and the civil society. The public sector appears as too absent despite their legal responsibility
Consideration of each other's constrains and difficulties	One's requirements are considered and integrated if necessary	Mitigated: When exposed during the formal and informal meetings, ones' difficulties are considered. Because of insufficient meetings and occasional lack of transparency however, some difficulties can remain unknown.

¹¹⁴ Name given to the structure supposed to organize meetings ("*Cadre de concertation*")

Specific analysis on the relations' quality between the center in Kaolack and the NGO Caritas

Criteria	Indicator	Evaluation
Reliability between the actors	The partnership was willing from both side and not imposed	Positive: The center and the NGO were willing to develop the partnership since they both find interests in it
	Partners know well each other's activities	Mitigated. Occasional lacks of transparency on the center's activities are deplored.
	Wished relations became effective	Mitigated. The NGO would like to improve the communication especially on the occasional center's difficulties.
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Positive: Communication and negotiation are good between the partners
Respect of the procedures and agreements	Partners respect the procedures and agreement	Positive: No one has been disappointed by the other 's behavior
Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Positive: The partnership is established for several years and has met positive evolution.
	New projects are developed	Positive: The partnership works on the improvements of the current system. On the other side the NGO develops new programs where the center is included.
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Positive: Both partners are positive and optimistic for the future

Specific analysis on relations' quality between the center in Kaolack and the grassroots organizations

Criteria	Indicator	Evaluation
Reliability between the actors	The partnership was willing from both side and not imposed	Positive: The center and the grassroots organizations were willing to develop the partnership since they both find interests in it
	Partners know well each other's activities	Mitigated. On one side the partners are aware of each other activities since the grassroots organizations receive information on the center activities' and the center's manager used to be a grassroots organization's president. However occasional lacks of transparency from the center on its activities are deplored.
	Wished relations became effective	Mitigated. The grassroots organizations wish to be earlier informed on the fluctuations of the center's activities - due to variation on the plastic demand from the industrialists -.
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Positive: communication and negotiation are good between the partners. It has indeed help to elaborate a new financial system that facilitates the system functioning.
Respect of the procedures and agreements	Partners respect the procedures and agreement	Positive: Before the implementation of the new financial system, the center could not always respect the agreement. The center had occasionally delays in paying the collectors - due to the absence of the limited working capital - . The new financial system implies a renewal in the financial agreements that the center can now respect.
Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Positive: the partnership is established since the establishment of the center and it has met positive evolution.
	New projects are developed	Positive: The partnership works on the improvements of the current system. If the center diversifies its activities, the grassroots organizations will automatically be integrated in it. Multiplying the treatment types requires upstream sorting. Grassroots organizations have a major role in developing it.
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Positive and optimistic for the future. The partners are totally dependent on each other. Therefore both parts put effort in making it work.

Specific analysis on relations' quality between the center in Kaolack and the municipality

Criteria	Indicator	Evaluation
Reliability between the actors	The partnership was willing from both side and not imposed	Mitigated: the municipality has transferred the management of the center. The manager of the center has therefore to cooperate with the municipality. Then the SWM is a transferred responsibility – due to the decentralization process – which obliges to keep the municipality integrated in the system no matter what his participation is. The legal frame imposes cooperation.
	Partners know well each other's activities	Mitigated: Communication is low and nearly nonexistent. Only the strict minimum is shared.
	Wished relations became effective	Mitigated: According to the municipality, the center does not provide enough monitoring reports on its activities. On the other side, the center wishes to receive more support – technical and/ or financial – from the municipality.
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Mitigated: Negotiation is as limited as communication and cooperation are.
Respect of the procedures and agreements	Partners respect the procedures and agreement	Mitigated: the municipality did not always respect their commitments – recognized by the municipality – but the center does not give the expected feedbacks on its management and activities.
Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Mitigated: the partnership is established since the beginning but the relations deteriorate years after years. The center reproaches the instability of the municipality's representatives which prevent to build on the relation.
	New projects are developed	Negative: changes in this cooperation are hoped but nothing is concretely organized to improve this situation or to move on other projects.
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Mitigated: both sides perceive and complain about the very limited communication and cooperation of this partnership.

Specific analysis on relations' quality between the center in Kaolack and the industries

Criteria	Indicator	Evaluation
Reliability between the actors	The partnership was willing from both side and not imposed	Positive: The center and the industries were willing to develop the partnership since they both find interests in it
	Partners know well each other's activities	Positive: Industrialists need guarantees on the product before buying it. Their reliability on the product quality and thus on the center's activities is crucial for the center. Therefore the center actively and constantly works on that.
	Wished relations became effective	Positive: commercial relations are efficient
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Mitigated: Contracts have been signed by both sides but the center deplores some conditions. Industrialists put pressure on the center by imposing low prices and price fluctuations.
Respect of the procedures and agreements	Partners respect the procedures and agreement	Mitigated: Delays in payment from the industrial have sometimes been observed
Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Mitigated: Nearly all the contracts are established on long-term
	New projects are developed	Mitigated: A new contract has also been signed lately and the demand from the industrialists apparently increases. Yet, some actors question these commercial outlets. There is unclarity on this point.
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Positive: the relations between the center and the industrial are essentially commercial and satisfying.

General analysis of the partnerships' quality in plastic valorization system of Thiès

Criteria	Indicators	Evaluation
The program is in the line with global development policies	The program is based on partnerships	Positive: the program has been elaborated in cooperation of several actors. It was clear since the beginning that the center would not run if isolated.
	Objectives of the partnership can be encompassed by national and/or international frame for development (MDGs, i.e.)	Positive: developing plastic treatment was initially a project integrating in a program that aims to reducing insalubrity in Thiès. It is expected to improve health situation, reduce poverty by creating jobs and enhance life conditions in general (MDG 1, 4,5 and 7)
Preliminary agreements on the goals and outcomes of the program	All the partnerships agree on common goal and expected outcomes when launching the program	Positive: the actors share a common goal (insalubrity reduction) where plastic revalorization has a major place. The outcome expected by the actors is efficient plastic management integrated in efficient SWM.
Dialogue about the program	Meetings are organized for discussion	Positive: Meetings are organized promptly and the actors are satisfied of this organization
	All the actors involved are present at these meetings	Mitigated: meetings are essentially organized between the center and the grassroots organizations. When talking about waste collection, the absence of the municipality is noticed.
Shared organization and management of the program	Responsibilities in the program are shared in a legitimate way	Mitigated: Tasks are well distributed merely among the private actors and the civil society. The public sector appears as too absent despite their legal responsibility
Consideration of each other's constraints and difficulties	One's requirements are considered and integrated if necessary	Positive: When exposed during the formal and informal meetings, ones' difficulties are considered and adaptation is made.

Specific analysis on the relations' quality between the center in Thiès and the NGO LVIA

Criteria	Indicator	Evaluation
Reliability between the actors	The partnership was willing from both side and not imposed	Positive: The center and the NGO LVIA were willing to develop the partnership since they both find interests in it
	Partners know well each other's activities	Positive: Occasional lacks of transparency on the center's activities are deplored.
	Wished relations became effective	Positive. The NGO aimed in this project to create a center and enable it to become autonomous.
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Positive: communication and negotiation are good between the partners
Respect of the procedures and agreements	Partners respect the procedures and agreement	Positive: no one has been disappointed by the other 's behavior
Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Positive: the partnership is established for several years and has met positive evolution.
	New projects are developed	Positive: The partnership works on the improvements of the current system. On the other side the NGO develops new programs where the center is included.
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Positive and optimistic for the future

Specific analysis on relations' quality between the center in Thiès and the grassroots organizations

Criteria	Indicator	Evaluation
Reliability between the actors	The partnership was willing from both side and not imposed	Positive: The center and the grassroots organizations were willing to develop the partnership since they both find interests in it
	Partners know well each other's activities	Positive: the meetings organized promptly with the director of neighborhood committees enables good communication on each other's opinions.
	Wished relations became effective	Positive: both sides accomplish satisfactorily their tasks
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Positive: communication and negotiation are good between the partners.
Respect of the procedures and agreements	Partners respect the procedures and agreement	Positive: the respect of the agreement has enabled to implement a new effective spatial organization.
Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Positive: the partnership is established since the establishment of the center and it has met positive evolution.
	New projects are developed	Positive: The partnership works on the improvements of the current system. The projected installation of new transfer sites will be made in close cooperation with neighborhood committees
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Positive and optimistic for the future. The partners are totally dependent on each other. Therefore both parts put effort in making it work.

Specific analysis on relations' quality between the center in Thiès and the industries

Criteria	Indicator	Evaluation
Reliability between the actors	The partnership was willing from both side and not imposed	Positive: The center and the industries were willing to develop the partnership since they both find interests in it
	Partners know well each other's activities	Positive: Industrialists need guarantees on the product before buying it. Their reliability on the product quality and thus on the center's activities is crucial for the center. Therefore the center tries to be as transparent as possible.
	Wished relations became effective	Mitigated: Not all wished relations became effective since industrialists keep in mind profitability and can retrieve easily when they perceive risks.
Negotiation on procedures and agreements	Partners negotiate together procedures and agreements	Mitigated: Contracts have been signed by both sides but the center deplores some conditions. Industrialists put pressure on the center by imposing low prices and price fluctuations.
Respect of the procedures and agreements	Partners respect the procedures and agreement	Mitigated: Some industrialists pretended to buy the outcome and did not respect that (especially at the creation of the center) (LVIA, 2006)
Long-lasting and constructivist relations	Partnership is established for a long time and has met some improvements	Positive: good communication with the main partners enables improvements in the partnerships' perceptions and its outcomes.
	New projects are developed	Positive: some projects are developed in cooperation with industrialists
Satisfaction from both side on the partnerships	The perception on the partnership's relevance and performances is positive	Positive: the relations between the center and the industrial are essentially commercial and satisfying.