

A NEW SUSTAINABLE DEVELOPMENT MODEL: A CASE STUDY OF SOLID WASTE
MANAGEMENT PRACTICES IN CURITIBA, BRAZIL

By

SHANI ELISE KRULJAC

A THESIS PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS IN URBAN AND REGIONAL PLANNING

UNIVERSITY OF FLORIDA

2012

© 2012 Shani Elise Kruljac

To the millions of waste pickers all around the world whose work continues to be underappreciated and undervalued

ACKNOWLEDGMENTS

First I would like to thank my friends and family for putting up with me while I made this project into something bigger than it needed to be. I especially thank my mom for her support both emotionally and financially, my daughter, Sydney, for enduring all of the Subway and spaghetti meals without much complaining, and Michael for being the yin to my yang, and making my life a whole lot easier. Thank you also to the Urban and Regional Planning Department staff and faculty who helped in this process, particularly Ella Littles for patiently assisting me through registration over and over again and Dr. Chris Silver for serving on my committee. I would also like to acknowledge the Center for Latin American Studies for granting me funding through the FLAS program, so that I could study Portuguese, as well as the Hinkley Center for Hazardous and Solid Waste Management, for hiring me as an intern and exposing me to the wonderful world of waste management. Finally, I would like to express my gratitude to Dr. Joseli Macedo, my committee chair, for steering me toward learning Portuguese and experiencing all things Brazil. Your patience, guidance, and faith in me to pursue this topic are what made it possible. I will be forever grateful.

TABLE OF CONTENTS

ACKNOWLEDGMENTS.....	4
LIST OF TABLES.....	7
LIST OF FIGURES.....	8
LIST OF ABBREVIATIONS.....	9
ABSTRACT	11
CHAPTER	
1 INTRODUCTION	13
2 LITERATURE REVIEW	15
Origins of Sustainable Development.....	15
Sustainable Development in the Context of Urban Planning Theory	17
Sustainable Development in the Context of International Development	21
Sustainable Development and the United Nations	21
Agenda 21 and the Establishment of Sustainable Development Indicators	23
Solid Waste Management in the Context of Sustainable Development	26
SWM Structures and Institutions: Comparing Industrialized and Developing Countries.....	31
SWM in Developing Countries: Informal Waste-Picking Sector.....	35
Governance Structures	40
3 METHODOLOGY	43
Using a Case Study	43
Implementing the Curitiba Case Study.....	45
4 CASE STUDY	49
Setting the Stage: Application of International Sustainability Principles at the National and State and Local Levels	49
Local Agenda 21 Implementation: State of Paraná, BR	50
Local Agenda 21 Implementation: Curitiba, Paraná, BR	51
Introduction to Curitiba.....	51
Model Sustainable City?.....	52
History of Curitiba.....	54
Curitiba's Solid Waste Management Programs	56
The 'Garbage that is not 'Garbage' Program.....	58
The 'Garbage Purchase' Program.....	59
The 'Green Exchange' Program	60
Curitiba's Informal Waste Collection Sector	62

5	APPLYING THE SUSTAINABILITY MODEL TO CURITIBA'S SOLID WASTE MANAGEMENT PROGRAMS	66
	Curitiba's Solid Waste Program: Problems and Criticisms.....	66
	Governance: The Missing Link in Sustainable Development?	68
6	SUITABILITY OF GOVERNANCE AS AN INTEGRAL PART OF THE SUSTAINABLE DEVELOPMENT MODEL	73
	Potential Solutions: Public-Private Partnerships	73
	Defining PPPs	73
	Conditions for Successful PPPs	74
	Application of PPPs to Curitiba.....	76
	Conclusion	80
	Beyond Curitiba—Applicability of Sustainable Development Model Elsewhere.....	82
	Beyond Curitiba—Opportunities for Continued Research.....	83
	LIST OF REFERENCES	85
	BIOGRAPHICAL SKETCH.....	92

LIST OF TABLES

<u>Table</u>		<u>page</u>
2-1	Agenda 21 Chapter 21-Solid Waste Management Objectives.....	29
2-2	Summary of Millennium Development Goals' links to solid waste management.....	30
2-3	World Bank statistics on worldwide collection and disposal rates	32
2-4	Income and SWM costs in developed and developing countries.....	32
3-1	Elements for analyzing sustainability of Curitiba's solid waste programs	48
4-2	Summary of waste collected in Curitiba	57

LIST OF FIGURES

<u>Figure</u>	<u>page</u>
2-1 Munasinghe's original sustainability triangle.	17
2-2 The Planner's Triangle.	18
2-3 Ebenezer Howard's Three Magnets diagram.....	20
4-1 Geographic location—Curitiba, capital of Paraná, Brazil.....	53
4-2 Summary of the Garbage That is Not Garbage and the Green Exchange and Garbage Purchase programs	62
6-1 Sustainability rectangle: A new model for sustainable development.	83

LIST OF ABBREVIATIONS

CAICO	Center for Support of Community Integration of (Vila Torres) (<i>Centro de Apoio à Integração Comunitária (da Vila Torres)</i>)
CBO	Community-Based Organization
CBO-94	Brazilian Classification of Occupations (<i>Classificação Brasileira de Ocupações</i>)
COMEC	Coordination of the Curitiba Metropolitan Region (<i>Coordenação da Região Metropolitana de Curitiba</i>)
CSD	(UN Economic and Social Council) Commission on Sustainable Development
CWG	Collaborative Working Group on Solid Waste Management in Low- and Middle-income Countries
FNLC	National Waste Citizen Forum (<i>Fórum Nacional Lixo e Cidadania</i>)
GHG	Greenhouse Gas
IBGE	Brazilian Institute of Geography and Statistics (<i>Instituto Brasileiro de Geografia e Estatística</i>)
IPD	Paraná Development Institute (Instituto Paraná Desenvolvimento)
MDG	Millennium Development Goals
MNCR	Movimento Nacional dos Catadores de Materiais Recicláveis
MSW	Municipal Solid Waste
NGO	Non-Government Organization
NIMBY	Not in My Backyard
ORBIS	Indicators of Sustainability, Regional Base Observatory (Observatório Regional Base de Indicadores de Sustentabilidade)
PPP	Public-Private Partnership
RPAA	Regional Planning Association of America
SIPAR	Integrated System for Processing and Reuse of Waste (<i>Sistema Integrado de Processamento e Aproveitamento de Resíduos</i>)

SWM	Solid Waste Management
UN	United Nations
UNEP	United Nations Environmental Program
USEPA	United States Environmental Protection Agency
WEIGO	Women in Informal Employment: Globalizing and Organizing
WTE	Waste to Energy Facility

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Arts in Urban and Regional Planning

A NEW SUSTAINABLE DEVELOPMENT MODEL: A CASE STUDY OF SOLID WASTE
MANAGEMENT PRACTICES IN CURITIBA, BRAZIL

By

Shani Elise Kruljac

December 2012

Chair: Joseli Macedo

Major: Urban and Regional Planning

This thesis argues the need for a governance dimension in the sustainability model, taking into account implementation strategies, monitoring and institutional controls. This focus heavily relies on integrated public-private partnerships and deliberative democracy approaches in order to achieve sustainability within the solid waste management sector. National and local policies in Brazil are analyzed, primarily focusing on the inclusion of informal waste collection into municipal solid waste management schemes. The city of Curitiba, in the state of Paraná, which is world-renowned for its innovative sustainable development policies, is used to frame and illustrate the case. The analysis is done through a case study approach. The results of this study indicate that the public-private partnerships being created within Curitiba's solid waste programs are helping the city move closer to true sustainability, at least where solid waste management is concerned. However, the remainder of the city's green initiatives such as the city's rapid bus system that have helped Curitiba become a "model sustainable city" are falling short of their sustainability goals. The findings of this

study can be applied to these other policy areas so that Curitiba can regain its stature as a green city.

CHAPTER 1 INTRODUCTION

Hailed as an environmentally sustainable “model city,” (CNN, 2010; Gnatek, 2003; and Sustainable Cities, n.d.) Curitiba, in the state of Paraná, Brazil has been extensively studied by urban planners since the 1970s (Irazábal, 2005; Macedo, 2004; Moore, 2007; Rabinovitch, 1992). Professionals and academics within the urban planning field often have strong opinions—whether it is in support of (Rabinovitch, 1992; Vassoler, 2003), or criticizing (Halais, 2012; Irazábal, 2005; Macedo, 2004;)—the merit of Curitiba’s green city status. At a recent talk given by Jaime Lerner, the long-term Curitiba mayor notorious for his city marketing, the audience of urban planners and architects could be seen scoffing as Lerner shamelessly praised his hometown’s sustainability programs (personal observation, January 28, 2009¹). Despite this cynicism, many cities around the world look to various Curitiba initiatives as models to be emulated. The city’s solid waste management program is one such initiative that has been praised and touted as an example of sustainable solid waste management. Concepts of sustainability, however, denote the balance of social, environmental and economic concerns. The wide presence of waste pickers and the obvious use of local rivers as waste dumps would seem to contradict the sustainability principles that Curitiba claims to embody.

This thesis analyzes the extent to which Curitiba’s solid waste management program fits with prevailing sustainable development theory. In doing so, the need for

¹ Observation by author at the 58th Annual Conference of the Center for Latin American Studies: “The Urban Divide in Latin America: Strategies and Challenges for Social Inclusion,” where Jaime Lerner gave the opening keynote address. Conference was held in Gainesville, Florida, January 28, 2009.

another prong within the sustainability model is proposed, one that encompasses a governance dimension, taking into account implementation strategies, monitoring and institutional controls. This model heavily relies on integrated public-private partnerships and deliberative democracy approaches in order to achieve sustainability. Policies put in place by Brazil, who is becoming a leader in the developing world for facilitating citizen involvement and public-private partnerships within the solid waste management realm, are presented. In particular, the experience of Curitiba is used to assess how the city fits the new sustainability model. Specifically, their solid waste management initiatives—which Curitiba touts as some of its greatest accomplishments—are used to frame and illustrate the case.

Field observations and interviews by the author with Curitiba officials, staff and citizens during the summer of 2008 form the core of the empirical evidence for this paper, which commences with a review of sustainability theories as they relate to solid waste management and governance schemes. The literature review provides a background of sustainable development in the context of urban planning theory as a whole and in the context of solid waste management. A large part of this discussion also looks at international development centering on the sustainability movement spurred by the United Nations and the various summits and documents to come out of this organization.

The thesis concludes with recommendations on how to apply the new sustainability model in other developing countries. Specifically, it gives suggestions as to how other cities and countries can work towards sustainable solid waste management, using the new model.

CHAPTER 2 LITERATURE REVIEW

The literature review for this thesis includes a background on the evolution of sustainable development theory in urban and regional planning, as well as within international urban planning. Solid waste management is also explored in the context of sustainable development with a special emphasis on solid waste management practices in developing countries. Finally, the idea of governance theory is also investigated. These concepts form the foundation for the case study.

Origins of Sustainable Development

By now the ubiquitous sustainability triangle has infiltrated every Urban Planning Theory class and every planning conference across the world, yet its place within urban and regional planning theories and strategies still remains elusive. The concept of sustainability has been described as too holistic and vague and therefore vulnerable to criticism (Campbell, 1996; Hall, 2002; Hanna, 2005). Nonetheless, sustainable development has become the mantra among many in the urban planning field.

Although yet to be named, the idea of sustainable development began to take shape with the 1972 United Nations (UN) Conference on the Human Environment, held in Stockholm, Sweden. The Stockholm Conference was the first major conference on international environmental issues and laid the groundwork for subsequent world environmental meetings. It was not until twenty years later, in 1992, that Dr. Mohan Munasinghe unveiled the now famous “sustainable development triangle” (Figure 2-1), at the UN Conference on Environment and Development at Rio de Janeiro, Brazil (Munasinghe, 1992). Also known as the Earth Summit, this latter conference launched the international comprehensive plan, Agenda 21, the blueprint for sustainability. With

its identifiable goals and objectives, Agenda 21 was instrumental in furthering the sustainability agenda. By 2002, the idea of sustainable development had gained momentum, as evidenced by the title of that year's UN environmental meeting: The World Summit on Sustainable Development.

As Munasinghe's triangle indicates, sustainable development attempts to balance economy, society, and the environment (Munasinghe, 1992). These broad categories encompass such issues as water quality, poverty, job creation and resource conservation, with some issues confined to a specific dimension, or 'point' of the triangle, and others holistically overlapping within the triangle. One important issue that is often overlooked in the discussion of sustainable development is that of municipal solid waste management. Yet solid waste management is pervasive in all the sustainable development objectives: its management, or lack thereof, can have major implications for the health of the environment, economy and society. Applying the sustainability triangle to solid waste management provides an interesting case study on how well the model works in demonstrating sustainable development within urban planning. Yousif and Scott (2007) evaluated solid waste management and suggest that a governmental/administrative dimension is an important aspect in achieving sustainability in solid waste management. This fourth dimension may have implications for other fields of urban planning also. Further discussion linking solid waste to sustainable development theory will be explored below. But first, sustainable development will be defined in the context of urban planning and then within the international realm of the United Nations.

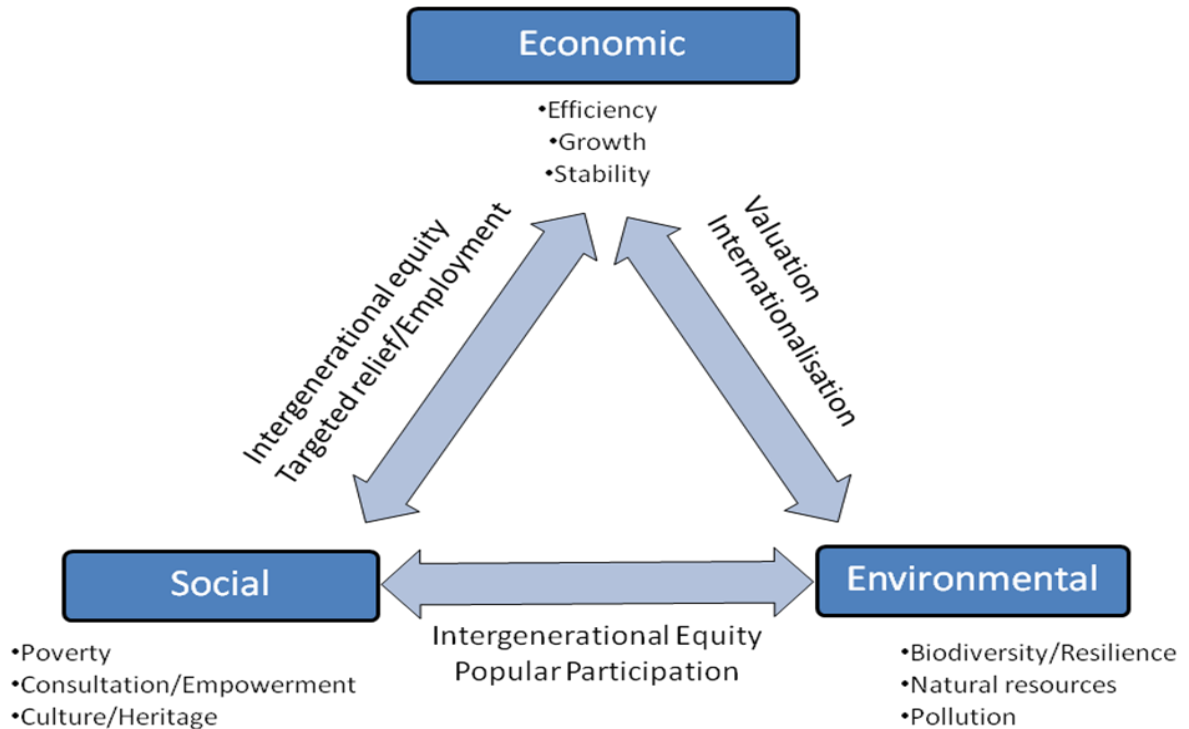


Figure 2-1. Munasinghe's original sustainability triangle, by Munasinghe (1992), adapted by author.

Sustainable Development in the Context of Urban Planning Theory

Contemporary planning literature attempts to define sustainable development and outline ways it can be implemented. Campbell's (1996) adoption of Munasinghe's triangle model (Figure 2-2), often referred to as the 3 Es (for equity, environment and economy), or the three-legged stool (Moore, 2007) reiterates the necessary ingredients for achieving the elusive sustainable development goal. Campbell contends that once balance is obtained between the economy, the environment and social equity, sustainable development is possible, at least in the abstract. Conflict arises, however, between the three priorities making implementation difficult (Campbell, 1996).

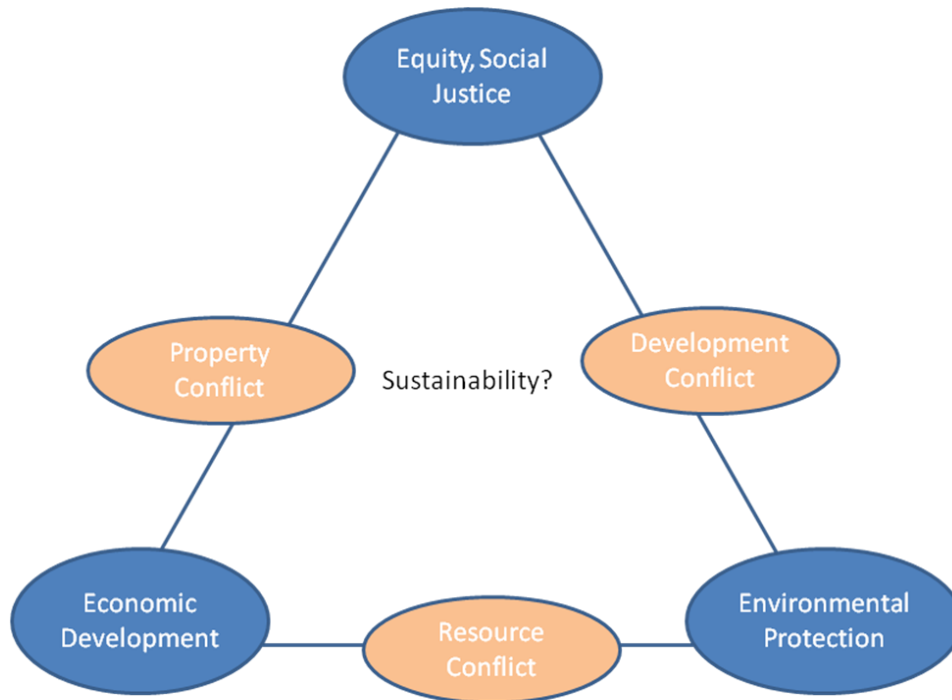


Figure 2-2. The Planner's Triangle, by Campbell (1996), adapted by the author.

Another application of the sustainability model elaborates the theory further by identifying six common themes: i). harmony with nature; ii). livable built environments; iii). place-based economy; iv). equity; v). polluters pay; and vi). responsible regionalism (Berke and Conroy, 2000). The way to achieve this balance, according to this viewpoint, is through communication, negotiation, and compromise.

With sustainable development comes a new focus on not just the creation and development of cities, but the long-term *viability* of cities. Making cities more livable is an important strategy within the movement, as well as promoting equity of urban populations. Indeed, as demonstrated below, many 20th century planning theories focused on the sustainability of cities. Although these ideas are labeled differently and manifested in various forms as compared to the current sustainable development model, sustainability tenets are intertwined within historical theories and strategies of urban planning.

Arguably, Ebenezer Howard's Three Magnet diagram (Figure 2-3) which depicts the ideal community as one that melds together the social (Cooperation, Things to Do), economic (High Wages, Flow of Capital) and environmental (Pure Air and Water, Good Drainage) factors, can be viewed as a pre-cursor for sustainable development. Howard's solution for reaching this ideal was to move *out* of the city and into areas of limited development bounded by a greenbelt. He envisioned the Town-Country interface, known as garden cities, which is represented by the third magnet. The Garden City was characterized by local management, self-government and cooperative solutions empowered by small-scale enterprises (Campbell and Fainstein, 2007; Hall, 2002).

Lewis Mumford and fellow Regional Planning Association of America (RPAA) colleagues—most notably Clarence Stein, Benton MacKaye and Stuart Chase—fought for integration of the environment and the economy. Although this movement also focused on decentralization, the economist of the group, Chase, especially pushed for a society where conservation was at the forefront, influencing a regional economy, rather than allowing pure capitalism to dominate the way in which a society developed and functioned (Hall, 2002). They envisioned a self-sustaining economy, one where families could live off the land and off the resources that are indicative of their region, therefore eliminating the inefficiencies of shipping resources and supplies across regions (Hall, 2002). Surely, had the term sustainable development been around in the early 1900s, the RPAA would have adopted it.

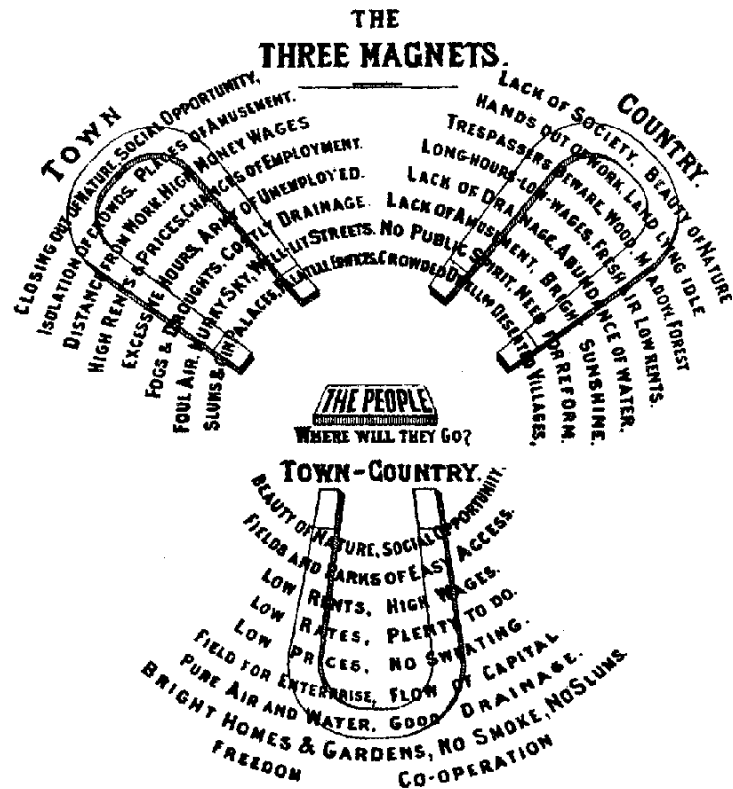


Figure 2-3. Ebenezer Howard's Three Magnets diagram from *To-morrow: A Peaceful Path to Real Reform* (Hall, 2002).

Le Corbusier's Radiant City can also be viewed as a predecessor to sustainable development. His egalitarian views on society influenced his ideas about architecture and urban planning: he believed in efficiency and fairness and he did not distinguish between rich and poor. He envisioned a "vertical garden city," one in which residents would enter via a large park, and one where all city dwellers could find hope, relaxation, sun, and greenery (Fishman, 1977; Jacobs, 2003).

Jacobs (2003), another 20th century urban planning theorist, criticized Howard and Mumford's "orthodox city planning theory" and other "decentrists" as promoting "city-destroying ideas" (p.70) and instead advocated for a greater understanding of the city, not in terms of what ought to be, but what is. She sought to embrace the city as "a

most intricate and close-grained diversity of uses that give each other constant mutual support, both economically and socially” (Jacobs, 2003, p. 67).

As the above historical accounts show, it appears that, to use Hall’s (2003) words, that planners have “reinvented the wheel” (p. 415) when it comes to the search for sustainability. And similar to today’s critique of sustainable development, contemporaries of these urbanists criticized their ideas as being too utopian (Fishman, 2003; Hall, 2002). Nonetheless, Hall (2002) claims “it was a good wheel, one worth reinventing” (p. 415).

Sustainable Development in the Context of International Development

Sustainable Development and the United Nations

Knowledge of the structural and institutional framework of the United Nations (UN) Environmental Program (UNEP), considered the “voice of the environment” for the UN, is important in understanding the role sustainable development plays on the world stage. The evolution of the UNEP began in 1972 at the UN Conference on the Human Environment held in Stockholm, Sweden. The UNEP was first codified by the adoption of Resolution 2997 on December 15, 1972. This resolution established the 58-seat Governing Council and created the UNEP Secretariat with its headquarters in Nairobi, Kenya. The resolution also set up a voluntary Environment Fund to finance the UNEP. Since that time, a plethora of international environmental conferences and gatherings have taken place, most famously the Montreal Protocol in 1987, which initiated the Intergovernmental Panel on Climate Change and the Rio Earth Summit in 1992. These summits resulted in the adoption of Agenda 21, which ultimately established a roadmap for sustainable development.

Agenda 21 has special importance to the UNEP. Before this time, UNEP's mission was one of strict environmental concerns. They concentrated on such issues as biodiversity, desertification, climate change, and hazardous waste management. Although the UNEP conceptually understood that the environment was intrinsically intertwined with social and economic issues, the UN had no clear policy framework for synthesizing the three concepts. The adoption of Agenda 21, with its identifiable goals and objectives, gave the UNEP more clout, and most importantly, more momentum in promoting the environmental aspect of sustainable development. Agenda 21 is discussed in more detail below.

The UN General Assembly's Millennium Summit in September 2000 further advanced the tenets of sustainable development. Out of this meeting came the *Millennium Declaration* which outlined eight quantifiable goals and objectives, now called the Millennium Development Goals. These broad goals are considered internationally agreed upon, and set a timetable of achievement at 2015. The goals are as follows:

1. Eradicating extreme poverty and hunger
2. Achieving universal primary education
3. Promoting gender equality and empowering women
4. Reducing child mortality rates
5. Improving maternal health
6. Combating HIV/AIDS, malaria, and other diseases
7. Ensuring environmental sustainability
8. Developing a global partnership for development

Not only was environmental sustainability identified as one of the eight primary objectives, but sound environmental principles underlie nearly all other goals charted within the Millennium Declaration. Then in 2002, the World Summit on Sustainable

Development Plan of Implementation again focused on the importance of effective environmental management as a means of achieving human development. Finally, in 2005, the UNEP Governing Council approved the Bali Strategic Plan, which mandates the UNEP to implement capacity building and technology support in developing nations. The 2005 World Summit also pushed for greater coordination and rigorous pursuit of scientific knowledge when addressing the world's development needs.

Agenda 21 and the Establishment of Sustainable Development Indicators

Analyzing how Agenda 21 is implemented at the international, national and local levels demonstrates ways in which the UNEP and its sister organization, the UN Commission for Sustainable Development, are normatively establishing a worldwide sustainable development agenda. Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the UN system, governments and major groups in every area in which humans impact the environment (UNEP, n.d.). The initiative lays out a global action plan to address poverty, human health, consumption patterns, demographic dynamics, and a host of environmental concerns such as biodiversity, clean water and solid waste issues (Pattenden, n.d.). The plan was adopted by 179 countries at the June 1992 Earth Summit.

In order to ensure effective implementation of Agenda 21, the Commission on Sustainable Development (CSD) was created in December 1992. The CSD is considered a 'functional commission' of the UN Economic and Social Council (CSD, n.d.). The CSD was initially tasked with monitoring and reporting on implementation of Agenda 21, as well as all the Earth Summit initiatives agreed upon by participating nations. Since that time, the CSD has inherited other responsibilities related to sustainable development.

During a five-year review of the Earth Summit's progress undertaken at the 1997 UN General Assembly meeting in special session (referred to as Earth Summit + 5), the Program for the Further Implementation of Agenda 21 was adopted by resolution. This resolution was a muddy compromise of the 2,500 government delegates to continue to support Agenda 21 implementation. Unsatisfied with the outcome, General Assembly President Razali pushed for non-governmental organizations (NGO) to "go back to the grassroots and pressure Governments for 'more sincere' implementation of the Rio accords, because 'our words have not been matched by deeds'" (UN, 1997). One positive aspect of the Earth Summit + 5, however, was the first-time involvement of representatives from the "major groups" defined in Agenda 21, Chapter 23 -- including NGOs working on behalf of environment and development, women, indigenous people, farmers, trade unions, scientists, local government officials, the private sector and youth.

The next major phase of implementation was the World Summit on Sustainable Development or the Rio Earth Summit + 10, held in Johannesburg, South Africa, in September 2002. This summit resulted in the Johannesburg Plan of Implementation, which sought actual targets and timetables rather than simple statements of intent. Another outcome of the summit was the formation of 220 Type 2 agreements, which are essentially public-private partnership agreements. With these agreements nearly \$235 million in resources were pledged (Sibley, 2007). The increase in activity as it relates to civil society surrounding the World Summit on Sustainable Development is quite apparent: a plethora of webpages and online discussion forums related to the preparation, participation and follow-up of the summit grew exponentially as compared

to previous world meetings. The prevalence of the Type 2 negotiations were a direct result of this activity and demonstrated the momentum NGOs and the business industry had gained in their international environmental affairs participation.

Following the Summit on Sustainable Development, the CSD decided that its scope of work from 2003 forward, would be organized on the basis of seven two-year cycles, with each cycle focusing on selected thematic 'clusters' of issues. For example, for years 2004-2005 the CSD concentrated on water, sanitation and human settlements; years 2010-2011 focused on transport, chemicals, waste management, mining and sustainable consumption and production patterns.

Both Agenda 21 and the Johannesburg Plan of Implementation give direction for implementation of their mandates and include capacity-building, education and awareness, finance, indicators, national sustainable development and, science and technology strategies. All of these approaches are pursued cross-sectionally throughout the entire UN system, as a major goal of Agenda 21 is to infiltrate sustainability into every aspect of decision-making. An impressive array of databases exist, such as the CSD Partnership Database, which lists detailed information on nearly 350 partnerships, as well as links to NGOs, and other online forums to assist in implementing the principles of Agenda 21.

Perhaps the most effective implementation tool, however, is the set of indicators developed by the CSD in 1995, revised in 2001 and then again in 2008. These indicators provide a framework of measurement and monitoring that can be adapted and applied to national sets of indicators. There are currently over 45 CSD-registered Partnerships on Indicators (CSD, n.d.), which outline specific measurements for areas

of interest ranging from energy issues like the Indicators for Sustainable Energy Development, which uses the indicator framework already established to further elaborate on energy concerns, or the Children Environmental Health Indicators, coordinated by the World Health Organization, which monitors worldwide progress in children's health.

Solid Waste Management in the Context of Sustainable Development

One of the most pressing problems facing cities in developing countries is the management of solid waste. Solid waste in this context refers to all domestic or residential garbage and non-hazardous waste, such as commercial and institutional waste and construction debris. Currently, about 1.3 billion tons² of solid waste per year is generated in cities all around the world at a rate of 1.2 kg per person per day, but this rate is expected to increase to 1.42 kg/capita/day by 2025 resulting in 2.2 billion tons of trash being generated. (Hoornweg and Bhada-Tata, 2012). Just ten years ago there were 2.9 billion urban residents worldwide who generated about 0.64 kg of municipal solid waste (MSW) per person per day (0.68 billion tons per year). The rate of MSW generated is superseding even the high rate of urbanization, a statistic that is particularly alarming since an estimated 20-50% of municipal budgets in cities in developing countries are already going towards solid waste management (SWM) (Cointreau, 1994; Medina, 2005). In fact, SWM usually constitutes the single largest budget item for cities in lower income countries (Ahmed and Ali, 2004, Hoornweg and Bhada-Tata, 2012). Still, refuse collection remains inequitable, inefficient and ineffective

² Most of the world measures weight of garbage by metric tons (or tonnes), which equals 1000 kg, which is equal to 2,204 lbs. There are 2000 lbs in 1 ton; therefore, 1 tonne equals 1.102 tons.

in the Global South. Open dumpsites, where waste is discarded in an empty field or pit, are a common occurrence in many of these areas. Not only are open dumpsites unsightly, they also pose serious health and environmental threats. Paradoxically, these dump sites also provide much needed income for local garbage-pickers, known as *catadores* in Brazil, and various other names in other countries, who wade through the mounds of trash to collect recyclables to sell or trade. There is a growing debate as to the role of the waste-pickers in an around dumpsites, many of whom are children.

Another global concern tied to solid waste is that of global warming. Solid waste is a large source of methane, a greenhouse gas (GHG) that is 21 times more powerful than carbon monoxide (CO₂), the standard by which GHG is measured. Methane is generated from solid waste decomposing in landfills and open dumps, as well as waste that is composted or digested aerobic or anaerobically. Or, if waste is incinerated CO₂ is often a byproduct. Additionally, the CO₂ emissions generated from garbage trucks picking up waste also contributes to the sector's GHG emissions.

Chapter 21 of Agenda 21, Environmentally Sound Management of Solid Waste and Sewage-Related Issues, outlines the international goals and objectives as they relate to sustainable SWM and Agenda 21. Section 21.4 of Chapter 21 states:

Environmentally sound waste management must go beyond the mere safe disposal or recovery of wastes that generated and seek to address the root cause of the problem by attempting to change unsustainable patterns of production and consumption. This implies the application of the integrated life cycle management concept, which presents a unique opportunity to reconcile development with environmental protection. (UN, 1992; Section 21.4)

The framework for action follows the solid waste hierarchy and focuses on four waste-related program areas: (a) Minimizing wastes; (b) Maximizing environmentally sound waste reuse and recycling; (c) Promoting environmentally sound waste disposal and

treatment; (d) Extending waste service coverage. Table 2-1 summarizes the actions and objectives of Agenda 21 as it relates to SWM.

The CSD's thematic cluster concentrations for 2010-2011 included waste management and sustainable consumption and production patterns, addressing the environmental and health threats improper SWM poses. The effort also addressed the social ills associated with improper solid waste management, which needs to be overcome in order for cities to achieve sustainability. It is too soon to know if metrics showed any gains on the initiative over the 2010-2011 period. As the international sustainability demonstrates, it is appropriate that sustainability is measured in the context of solid waste management policies and practices.

Although SWM is not mentioned explicitly in the Millennium Development Goals (MDG) and Targets, striving for sustainable solid waste management can help developing countries meet many of the MDG objectives. In a recent publication by the Collaborative Working Group on Solid Waste Management in Low-and-Middle-Income Countries (CWG) the authors argue that there is a deep connection between SWM and sustainability, and thus striving for sustainable SWM facilitates governments' efforts to meet the MGD. (Gonzenback, Coad, Gupta and Hecke, 2007). As Gonzenback et al.(2007) point out, ineffective SWM can cause negative aesthetic, health and environmental effects, each having its own associated negative economic impact. Furthermore, focus is beginning to shift from capital investment and technology to alternative types of MSW provided by the private sector, community groups and the informal sector (Gonzenback et al., 2007), further integrating the social aspect of SWM

with the technical side. Table 2.2 summarizes the relationships between sustainable SWM principles and each MGD as presented by Gonzenback et al.

Table 2-1. Agenda 21 Chapter 21-Solid Waste Management Objectives

Agenda 21 Actions	Objectives
<p style="text-align: center;">A. Minimizing Wastes</p>	<p>(a) Stabilize or reduce the production of waste destined for final disposal</p> <p>(b) Strengthen the procedures for assessing waste quantity and composition changes for the purpose of formulating operational waste minimization policies</p>
<p style="text-align: center;">B. Maximizing Environmentally Sound Waste Reuse and Recycling</p>	<p>(a) Strengthen and increase national waste reuse and recycling systems</p> <p>(b) Create a model internal waste reuse and recycling program for waste streams within the UN system</p> <p>(c) Make available information, techniques and appropriate policy instruments to encourage and make operational waste reuse and recycling schemes</p>
<p style="text-align: center;">C. Promoting Environmentally Sound Waste Disposal and Treatment</p>	<p>(a) Treat and safely dispose of progressively increasing proportion of generated wastes</p>
<p style="text-align: center;">D. Extending Waste Service Coverage</p>	<p>(a) Provide health-protecting, environmentally safe waste collection and disposal services to all people.</p>

Table 2-2. Summary of Millennium Development Goals' links to solid waste management (Adapted by author from Gonzenback et al, 2007).

MDG	SWM Link
Goal 1: Eradicate extreme poverty and hunger	Provide opportunities for employment in street sweeping and waste collection, as well as recycling of useful materials Improve status of waste pickers
Goal 2: Achieve universal primary education	Improve working productivity and earning power so there is less need for child labor Facilitate children of waste pickers learning by establishing day care for children or making schooling times compatible with waste workers' schedules
Goal 3: Promote gender equality and empower women	Ensure women are consulted during decision-making process concerning SWM Facilitate waste-picker coops organized and managed by women
Goal 4: Reduce child mortality	Improve SWM collection service to prevent spread of contaminants that might cause gastro-intestinal diseases Upgrade disposal sites from open dumps to sanitary landfills
Goal 5: Improve maternal health	Provide maternal health education and information for women working with waste Provide a simple insurance scheme for women waste workers that allows pregnant mothers to avoid strenuous work in the last months of pregnancies and the first months of their babies' lives
Goal 6: Combat HIV/AIDS, malaria and other diseases	Develop safe methods for disposing of infectious wastes from hospitals and clinics Keep solid waste out of drains and prevent collection of rain water in order to limit the incidence of mosquito-born diseases
Goal 7: Ensure environmental sustainability	Access to sanitary landfill should be acquired so as to limit pollution and nuisance Provide waste collection services to all parts of the city Promote recycling
Goal 8: Develop a Global Partnership for Development	Strive to design tasks and working conditions that allow work to be done with dignity and pride SWM experiences and lessons learned should be shared in local, state, national and international communications

SWM Structures and Institutions: Comparing Industrialized and Developing Countries

One of the earliest documented organized urban SWM programs took place in New York City in the early 1890s (Berthier, 2003), under the direction of Sanitation Commissioner, George Waring. With the population of New York almost doubling every decade from 1800 to 1880, issues of human waste disposal were in dire need of attention and reform. Waring created a program for waste recovery, street cleaning and public health improvements within the streets of New York, which served as a SWM model widely implemented in other American cities (Berthier, 2003). Since that time, especially over the last three decades, SWM in developed countries has evolved into a sophisticated system of collection and treatment that has significantly reduced the negative impacts to human health and the environment. The implementation of SWM programs in developed countries has been studied for several decades, but research has primarily focused on the operational aspects, such as the collection, transportation and disposal and/or processing of garbage and recyclables. Thus, there is an abundance of literature related to the technical side of solid waste management but, as is demonstrated below, this knowledge and research is not always applicable to developing countries.

In many ways, cities in developing countries are facing the same problems New York encountered during the rapid urbanization of the 19th century. According to a World Bank study (UN, 2010) on the collection and disposal of solid waste around the world, high-income developed countries collect and properly dispose of 100% of their solid waste generated, while middle-income and low-income developing countries only properly dispose of 30% and 5% of their waste, respectively (Table 2-3). However,

when viewed as a percentage of personal income (per capita costs), SWM costs for lower and middle income countries are higher than those in developed countries (Cointreau, 2006, Hoornweg and Bhada-Tata, 2012, Medina, 2005). Table 2-4 shows cost ranges for solid waste collection, transport and sanitary landfill in relation to GNP income. Due to inadequate waste collection services, municipalities in developing countries also incur costs related to litter collection and cleaning up the accumulation of waste in empty lots and streets. These costs can be a significant aspect of the overall SWM budget in developing countries, but constitute very little of the expenses associated with SWM in industrialized countries.

Table 2-3. World Bank statistics on worldwide collection and disposal rates (Adapted by author from Cointreau, 2006)

Status	Percent of Waste Collected	Percent of Waste Properly Disposed
High-Income Developed Countries	100%	100%
Middle-Income Developing Countries	60%	30%
Low-Income Developing Countries	40%	5%

Table 2-4. Income and SWM costs in developed and developing countries (Adapted by author from Cointreau, 2006)

	Average Waste Generation	Average Income from GNP ¹	SWM Costs	Total Costs per Capita	Cost as % of Income
High-Income Developed Countries	0.6 ton/capita/year	\$22,000/capita/year	\$90-\$190/ton	\$60-\$114/capita/year	0.2-0.5%
Middle-Income Developing Countries	0.3 ton/capita/year	\$2,400/capita/year	\$38-\$100/ton	\$12-\$30/capita/year	0.5-1.3%
Low-Income Developing Countries	0.2 ton/capita/year	\$370/capita/year	\$13-\$48/ton	\$3-\$10/capita/year	0.7-2.6%

1. Income is based upon 1992 Gross National Product data from the World Development Report 1994 published by the World Bank; \$ equals US dollars

There are a number of factors that contribute to this discrepancy. First, cities of developing countries are experiencing rapid urban growth, which is predominately taking place in the form of informal squatter settlements around the outskirts of the urban core. These new urban settlements are commonly located in environmentally precarious, hard to access locations, oftentimes in wetlands, rivers, flood-prone areas or in locations with steep slopes. The unplanned, narrowly winding streets makes it difficult for municipal waste collection vehicles to provide waste collection to these communities (Medina, 2005). It is within these conditions that many informal waste collection activities are initiated. With the prevalence of formal, organized waste collection in developed countries, waste pickers are unheard of at the end disposal sites (i.e. landfills or incinerators) and are very rare in the streets and neighborhoods of cities of the developed world. In fact, SWM managers in cities of industrialized countries were historically instructed to “exclude them [the scavengers] from the recovery processes” in order to allow for the most efficient mechanization possible (qtd. in Berthier, 2003, p. 194).

The presence of waste pickers is inextricably linked to job opportunities available in a city, and thus further explains the prevalence of this activity in developing countries. But industrialized countries are not completely insulated from this phenomenon, as the recent worldwide economic downturn has demonstrated: an increase in metal theft is on the rise in the U.S. and although it usually pertains to metal stripped from infrastructure like playground equipment and manholes, some cities are also experiencing the illicit removal of recyclable material from curbside recycling bins and foreclosed houses. This increase in scavengers in wealthier cities has spurred municipalities and states in the

U.S. to pass ordinances preventing the “theft” of metals in their municipalities. For example, in San Francisco, California, city residents’ recycling bins are raided for recyclables by scavengers during the night, before city-contracted recycling trucks can arrive to pick up the materials. This loss of recyclable income has resulted in about a \$5 million loss over the course of the year, a deficit that will be made up with increased garbage collection fees in subsequent years (Tyler, 2011). Clearly, the structures and institutions that are in place in the developed countries’ SWM systems make it difficult to accommodate a thriving informal waste picker sector.

Secondly, industrialized countries have an abundance of capital and have high labor costs, while the opposite is true of developing countries: they have ample unskilled and cheap labor, as well as very little resources for implementing elaborate SWM systems (Medina, 2005). It stands to reason that industrialized countries have developed SWM systems that are capital intensive in order to save labor costs, while the same approach is not suitable for SWM programs in developing countries (Medina, 2005).

Another difference influencing the SWM needs of the developed as opposed to the developing world is the quantity and type of waste generated. Solid waste data confirms that the wealthier a nation, the more waste that is generated (Medina, 2005, Cointreau, 2006). For example, the per capita waste disposal per day for residents in the United States was 4.4 pounds in 2010 (USEPA, 2011), while the per capita waste generation rate in Brazil is 1.6 kg/day, which is equivalent to 3.5 lbs/person/day¹

¹ Per capita waste generation rate for Brazil is based upon 2001 data from the Pan American Health Organization, which is the most recent waste generation data available. The per capita waste generation data is reported in kg/capita/day, but was converted to lbs per day by the author (1 kg = 2.2 lbs).

(Hoorweg and Bhada-Tata, 2012). Additionally, waste composition also tends to differ according to the wealth of a nation. Since residents of lower income countries are more inclined to consume more fresh fruits, fresh vegetables and homemade food products, their waste tends to contain a significant amount of organic material and a lot less packaging material as compared to the waste stream of industrialized countries (Cointreau, 2006; Hoorweg and Bhada-Tata, 2012; Medina, 2005). SWM strategies differ according to what is in the waste stream. In developed countries, burning waste for energy (waste to energy facility, or WTE) is a SWM option that is becoming increasingly popular. This technology does not translate well in a developing country, however, where a waste stream heavy on organics results in a low calorific value waste, which is unsuitable for burning in a WTE.

As Medina (2005) argues, due to the vastly different conditions influencing the SWM needs of industrialized nations as compared to those of developing countries:

Low-income communities need an approach nearly the opposite of conventional solutions: affordable solutions that work well in a Third World context, that create jobs, that protect the environment, that promote community participation, that encourage and support the entrepreneurial spirit in the community, and that consider the contribution that informal refuse collectors and waste pickers make. (p.5)

SWM in Developing Countries: Informal Waste-Picking Sector

The informal economy is characterized by small-scale, labor-intensive, low technology work that, for the most part, is unregulated (Ahmed and Ali, 2004; Wilson, Velis and Cheesman, 2006). Summarized by Spies and Wehenpohl (2006), the International Labor Organization emphasizes the following when characterizing the informal sector:

- Existence of low entry barriers
- Utilization of local resources

- Predominance of family business and child labor
- Domination of small-scale enterprises
- Use of labor-intensive and adapted technology
- Training for skills required takes place outside of the formal school system
- Utilizing unregulated and competitive markets

In the framework of SWM, the informal economic sector refers to the work performed by waste pickers or scavengers. As Medina (2005) points out, waste scavengers have existed for thousands of years going back to when humans scavenged leftovers from metallurgy activities. What has changed, however, is the magnitude and visibility of today's waste pickers, due to rapid urbanization and the increase in disposed materials from food and product packaging (Constance, 2004).

Poor living conditions that include lack of infrastructure and urban services such as potable water and sewage treatment, as well as a lack of social safety nets has resulted in many waste pickers being marginalized and thus subject to harassment by those in power or by society in general (Wilson et al., 2006). Waste pickers are also vulnerable to significant occupational risks due to handling raw and decomposing waste, emissions from that waste, and the equipment (or lack thereof) that is used for work (Cointreau, 2006; Gutberlet, 2008). Waste pickers are also subject to environmental health risks associated with lack of pollution control and overall safety of SWM facilities (Cointreau, 2006).

Despite these challenges, there are advantages associated with an informal economy. A typical informal worker can be characterized as having "extreme flexibility to quickly and appropriately react to changing framework conditions and to understand such disruptions as challenges" as well as having a "high degree of creativity, an impressive potential for improvisation and the related specific potential for innovation"

(Spies and Wehenpohl, 2006). Studies have indicated that these characteristics are part of what attracts people to waste scavenging and related activities, and contrary to conventional belief, waste pickers are not always the poorest of the poor (Medina, 2000, 2005). In fact, some waste pickers at the Beijing dump reportedly earned more than university professors (Medina, 2005). Some studies have even indicated that many waste pickers do not want to be formalized; they like the freedom of being their own boss and deciding when and how much to work (Medina, 2005). Additionally, many waste pickers would not be able to find work in the formal sector due to low education levels (Medina, 2005).

Waste pickers are estimated to make up to 2% of the population of developing countries' cities (Medina, 2000). Reliable statistics on the number of waste pickers is not readily available; Brazil is the only country that keeps official statistical data on waste pickers. The National Movement of Recyclable Materials Waste Pickers estimate that more than 500,000 people earn a living from collecting and selling recyclables in Brazilian cities (as cited in Fergutz, Dias and Mitlin, 2011). The work of waste pickers takes on a wide array of forms and at various points in the waste cycle. In general, waste activities can be categorized as follows:

- Itinerant waste collectors—Waste collectors go door to door in residential or commercial neighborhoods and purchase separated recyclables from the residents or business owners, which they in turn take to a dealer to sell. The waste collectors utilize carts, pulled by animals or bicycles, or even by hand to collect these wastes in these type of systems.
- Waste collection crews—Mixed waste is collected in open trucks or compactor trucks and the collection crews sort out the recyclables during the collection route and then later sell the materials on their way to the landfill or transfer station.

- Street waste picking—Recyclable material is recovered from mixed waste and litter thrown on the streets or waste thrown in other public areas like parks, rivers and vacant lots used as illegal dumps.
- Waste picking from dumps or landfills—Here many people live and work sorting out the recyclables before the burial of waste (Gutberlet, 2008; Medina, 2005; Wilson et al., 2006).

One of the most indicative problems facing solid waste workers in the informal sector is the existence of intermediaries, or middlemen. Middlemen purchase recyclables from the waste pickers and then sell them to brokers at a much higher price, up to four times the price that they paid. An estimate by the Association of Paper, Cardboard, and Recyclable Materials Waste Pickers from Belo Horizonte (in the state of Minas Gerais, Brazil) claims waste pickers only get paid one-third of what they would have received had they worked in the formal sector (Fergutz et al., 2011). The middlemen achieve such control over the market because they have the means to transport the recyclables to market, whereas the waste pickers oftentimes do not. Furthermore, the middlemen frequently are the suppliers of collection carts, as well as food and shelter, or sometimes even alcohol (Fergutz, et al., 2011). The relationship between middlemen and waste pickers is quite similar to a procurer and his prostitutes: the procurer takes a cut of the worker's income in return for physical protection and for providing or enforcing exclusive rights to 'turf' where their workers can operate with less competition.

A very effective strategy in combating the intermediary problem is to form waste picker cooperatives in order to circumvent the middlemen and thus increase wages. A cooperative (co-op) is an organized group of waste pickers who form micro-enterprises and partnerships with government and private entities for collecting and selling

recyclable materials. By taking advantage of the pooled resources and the economy of scale cooperatives provide, waste pickers belonging to these groups have increased their earnings and security. Members of *Cooperative Recuperar*, located in Medellin, Columbia, and one of the oldest and most organized waste picker co-ops in Latin America, reportedly earn 1.5 times the minimum wage, while members of *Coopamare*, one of the most successful waste picker co-ops in Brazil, claim to earn twice the minimum wage in Brazil (Medina, 2005). Additionally, co-op workers report a higher quality of life including higher self-esteem (Medina, 2005).

Another important development in improving the livelihoods of waste pickers is the organization of waste pickers' associations, a form of labor union for the industry. It is through these associations that waste pickers have made progress towards improving their social standing. Again, Brazil has been a leader in efforts to organize waste pickers in order to improve their station in society and increase their livelihood. One of most notable feats accomplished was the recognition of waste picking in the Brazilian Classification of Occupations (*Classificação Brasileira de Ocupações*, CBO-94) in 2002. CBO-94 provides a common basis for labor classifications, used for collecting and analyzing labor statistics in Brazil. Since its addition to CBO-94, the waste picker category has been included in important data collection efforts in Brazil, including the National Research by Household Sample (*Pesquisa Nacional por Amostra de Domicílios*, PNAD), conducted by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*, IBGE), the primary collection of social and economic data for the country (WIEGO, n.d.). Since SWM activities already constitute such a large part of city budgets; few municipalities can afford to expand their

SWM activities beyond what they are already providing. This recognition, along with the political pressures the waste picker groups are providing, is resulting in some countries and cities finally acknowledging the waste pickers integral role to their SWM schemes.

Although some waste pickers are being recognized as valuable contributors to sustainability in developing country cities, very few people can deny that having a large proportion of citizens working in a dump or landfill, or collecting waste in the streets is very undesirable, especially if adequate safety precautions are not taken. Many times, health and safety concerns are the main motivation for municipalities banning waste pickers from their solid waste facilities. A fine line exists between denying waste pickers of their livelihoods and having a moral, social obligation to protect the most vulnerable populations from the ills associated with handling society's waste. The key in balancing this fine line is to open up communications and form partnerships with the waste pickers and the municipalities they are indirectly serving. This arrangement provides the best chance that waste pickers can continue to make a living for themselves in a less dangerous environment. The recognition that waste pickers provide an economic and environmental good is the premise in which some of the most successful SWM partnerships have developed. Many of these partnerships were initiated by local or national NGOs and community based organizations (CBO), and often benefit from the facilitation and monetary help from international donor agencies (Wilson et al., 2006).

Governance Structures

In addition to the traditional tenants of sustainable development, attention is being turned to governance structures, which encompasses a wide variety of theories and explanations, all falling under the nebulous description of "good governance," or simply governance. But what is governance? The UN Center for Human Settlements

defines good urban governance as a way “by which the common good is increased, with the common good being all things which make up a decent quality of life and good society” (qtd. in Vassoler, 2007, p. 8). More generally, governance is a “mode of social coordination” (Kemp, Parto and Gibson, 2005, p. 17) that is different than “governing” which is top-down and used to control or manage society (Kemp et al., 2005).

Governance structures depend upon deliberation and negotiation among participants who all have access to knowledge in the decision-making process. Many governments couch this process in terms of building social stock or civic capacity among their residents.

The process of implementing governance strategies in developing countries has proven difficult, especially with the poor who “shape the form and function of cities outside the formal structures of the states” (Irazábal, 2004, p. 2). In most developing countries’ cities, a large portion of the economy, including housing and transportation, take place informally, outside of the formal institutions (Irazábal, 2004). Failure to understand and incorporate such a large segment of the population into the policies and strategies for development results in a dysfunctional governance system.

Public-private partnerships (PPPs), NGOs and CBOs are also playing a pivotal role in providing inclusion and participation in urban planning. An entire new sub-field related to this area is emerging and is an important factor in implementing alternative institutional controls (as opposed to top-down regulatory controls).

This literature review has provided the groundwork necessary for linking the relationships between sustainable development, solid waste management and governance structures. The foundation provided in the literature review will be

expanded upon to further explore the interconnectedness of these various theories in the context of Curitiba, Brazil. The methodology for this investigation is included in Chapter 3.

CHAPTER 3 METHODOLOGY

One of the guiding questions for this study is what roles do governance structures play in the prevailing sustainable development model advocated by urban and regional planning professionals? The chosen methodology for this thesis is based upon an exploratory case study analysis, as outlined by Yin (2003). This section describes the methodology used to explore the relationship between governance structures and sustainable development, using solid waste management practices in Curitiba, Brazil to contextualize the argument.

Using a Case Study

The use of an explanatory case study (Yin, 2003) is helpful in assessing the suitability of including governance, along with equity, environment and economic aspects, as a necessary element for successful sustainable development. Specifically, applying the sustainability model to a city that has been declared one of the most sustainable cities in the world provides an opportunity to explore the strengths and weaknesses of the existing paradigm as well as test the suitability of adding another major element to the model.

More generally, a case study is an “empirical inquiry that: 1) investigates a contemporary phenomenon within its real-life context; especially when 2) the boundaries between phenomenon and context are not clearly evident” (Yin, 2003, p. 13). Case studies provide researchers with the opportunity to “explain the causal links in real-life interventions” for which survey or experimentation cannot alone explain, and to “describe an intervention and the real life context” of an event or phenomenon. (Yin, 2003, p. 15). Additionally, case studies can “illustrate certain topics” through a

descriptive account, as well as, “explore those situations in which the intervention being evaluated has no clear, single set of outcomes” (Yin, 2003, p. 15).

In the case of this research, fieldwork was initiated in order to study the sustainable solid waste management practices of Curitiba; while there, I recognized the prevalence of the informal sector’s role in achieving sustainable solid waste management and the opportunities public-private partnerships provided in this realm. Therefore, in this case study, sustainable development implementation is the contemporary phenomenon of interest, while Curitiba’s solid waste management policies and practices represent the real-life context in which sustainability is assessed.

Curitiba’s prominent sustainability status presents an ideal city to study sustainable development theory.

The research methodology follows as a single case study research design, using the four stages as defined by Yin (2003):

- Design the case study.
- Conduct the case study.
- Analyze the evidence.
- Interpret findings to develop conclusions, recommendations and implications.

Field research, providing opportunity for first-hand observation and access to interviews, lectures and literature not available elsewhere, took place in Brazil from May to June 2008, through a University of Florida study abroad program with the.

Government publications, files and data pertaining to solid waste management and sustainable development in Brazil were obtained and analyzed. The IBGE was the main source of social and economic data information on Brazil. Through a literature review, I investigated historical and contemporary sustainable development theory in the context

of urban and regional planning, international development, solid waste management and governance. It provided an understanding of the underlying issues and highlighted the relevance of sustainable solid waste management in the debate on how to assess sustainability progress.

Implementing the Curitiba Case Study

The majority of findings in this study are based upon the literature review, supplemented by the field notes prepared during a visit to Curitiba in the summer of 2008. I spent several weeks in Curitiba during May and June of 2008 as part of a graduate school study-abroad program designed to expose students to urban and regional planning issues within the context of a Latin American country. Students were introduced to concepts of urban planning and design in Brazil, in general, and more specifically, in Curitiba. Students were required to choose an individual research topic upon which to write a paper and present to the class. The goal of my initial case study was to understand Curitiba's sustainable solid waste planning initiatives and analyze how these programs could be replicated in other developing countries.

Although there was not a defined approach to gathering information for the initial case study, the research involved both formal and informal discussions with local residents, leaders, government officials and government employees. My questions focused on the current state of the solid waste programs, implementation strategies for these programs, education and outreach strategies and the roles that the informal waste collectors play in the city's programs. Experiencing Curitiba in person allowed for better understanding of the solid waste programs and the residents who were benefitting from such initiatives—information critical to this study.

The fieldwork, as well as additional readings and lectures assigned during the initial site visit, constitutes the first part of the methodology. This section of the methodology involves exploring Curitiba in its present condition, paying special attention to the claims of government officials or the literature in terms of sustainability achievements as opposed to what was observed in the streets and through interaction with Curitiba residents and officials. Observing the dichotomy of proclamations declaring Curitiba a model sustainable city and those who argue against this notion provides additional scholarship to the case study. Objectively comparing these claims to situations and events witnessed first-hand contributed significantly to the research questions pursued in this study.

The next section of the methodology, based on fieldwork but completed retrospectively, as well as additional research conducted after the fact, considers the sustainable development characteristics observed in Curitiba within the specific context of solid waste management. Table 3-1 describes how the three elements of sustainable development—based upon the sustainable development triangle models described by Munasinghe and Campbell—are incorporated within Curitiba's solid waste program. A fourth element, centered on governance, is also established so as to ascertain the relevance of governance to sustainable development theory. Due to the interrelated characteristic of the sustainability principles outlined earlier, several of the elements, such as stakeholder involvement and education, overlap in different categories. This categorizing exercise served as a checklist for analyzing how well Curitiba fits the sustainability triangle paradigm.

The methodology, as described, provides a way to qualitatively assess the sustainable development elements within Curitiba's solid waste programs, and is intended to facilitate a discussion of the relationship between the traditional three sustainability principles—social, economic and environmental balance—with a new element, governance, as defined by the literature. To ensure the results of this study advances urban sustainability research, an understanding of Curitiba's development history more generally, and its solid waste programs specifically, is necessary.

Chapter 4 describes this historical context for the policies and programs that have emerged, as well as their evolution and status today. The methodology described here is then applied to Curitiba, by examining the solid waste policies and program implementation, as well as social constructs observed to be in place. Additionally, other authors' analyses on Curitiba's sustainability and governance aspects, or lack thereof, are taken into account and categorized in the same manner. These elements are examined in relation to the traditional principles of sustainable development, as well as the proposed new good governance element in order to assess the appropriateness of assigning a larger role to governance in sustainable development theory.

Table 3-1 Elements for analyzing sustainability of Curitiba's solid waste programs

Sustainability Element	In the Context of Solid Waste Management
Social Indicators	<ul style="list-style-type: none"> • Access to jobs and education • Adequate measures employed to protect human health associated with waste management activities • Level of involvement with labor unions, co-ops and waste associations
<ul style="list-style-type: none"> • Access to jobs • Access to education • Collective bargaining abilities • Protection of health • Stakeholder involvement and public participation 	
Environmental Indicators	<ul style="list-style-type: none"> • Adequate technology employed for protection of resources, e.g. lined sanitary landfill • Limit greenhouse gas emissions from landfills and waste management activities • Recycling • Waste minimization/waste diversion activities
<ul style="list-style-type: none"> • Protection of natural resources—air, water and land • Conservation of natural resources • Education and awareness 	
Economic Indicators	<ul style="list-style-type: none"> • Markets for recycled material—both collection and production • Percent of economy spent on solid waste management activities • Percent of GNP derived from waste management activities, e.g. recycling, energy from waste • Employing innovative technologies for solid waste management, e.g. waste to energy or anaerobic digestion • Opportunities exist for small and micro enterprises related to SWM
<ul style="list-style-type: none"> • Production • Consumption • Distribution • Innovation • Integration of formal and informal sectors of economy 	
Good Governance Indicators	<ul style="list-style-type: none"> • Effective and safe removal of garbage from all neighborhoods and businesses • Acknowledgement of waste pickers' work/ "Right to the City" philosophy • Evidence of public-private partnerships and waste picker cooperatives • Equitable and clear regulations, licensing arrangements, procurement procedures and sanctions
<ul style="list-style-type: none"> • Trust in government • Facilitation of stakeholder involvement • Political accountability • Transparency • Activism from civil society 	

CHAPTER 4 CASE STUDY

Understanding the evolution of international, national and local policies that shaped Curitiba is important to the case study application. This section begins by applying international sustainability principles at all levels of government. Then, a more in-depth description of Curitiba and its policies—specifically those related to SWM—is provided.

Setting the Stage: Application of International Sustainability Principles at the National and State and Local Levels

The history and development of Agenda 21, arguably the most significant normative influence on international sustainability, was previously discussed in the literature review. The following paragraphs present implementation of Agenda 21 at the national, state and local levels. National Agenda 21 Implementation: Brazil

Starting with the Rio Earth Summit, Brazil has long had a connection to the Agenda 21 process. Being a developing country, Brazil also provides valuable case-studies on how sustainability is being implemented at the local level. Negotiations for the development of the Brazilian Agenda 21 began in 1995 with the establishment of the Commission for Sustainable Development Policies and Brazilian Agenda 21 taking place in 1997. The Federal Ministry of Environment implemented the official National Sustainable Development Strategy in 2002. The main objectives of the Brazilian Agenda 21 center around social inclusion for a solidarity society, strategies for urban and rural sustainability, protection of natural resources, and governability and ethics for the promotion of sustainability (Stratos, 2004).

In 2002, the federal government incorporated the Brazilian Agenda 21 into its Multi-Year Plan (PPA 2004-2007), with the overarching goals of 1) social inclusion and

reduction of social inequalities; 2) environmentally-sustainable economic growth generating employment and income, and reducing regional inequalities; and 3) promotion and expansion of citizen empowerment and strengthening of democracy (European Commission, 2007). Of the funding allocated for the PPA, 60% is going towards social inclusion, 36% towards environmental initiatives, and 4% is going towards strengthening democracy (European Commission, 2007).

Finally, Brazil has gone to great lengths to promote sustainable development through multiple websites and publications such as the Step by Step towards a Local Agenda 21. The manual explains how to start a Local Agenda 21, primarily focused on the principles of democracy and broad-based participation (Earth Charter, n.d.).

Local Agenda 21 Implementation: State of Paraná, BR

The implementation of Agenda 21 at the state level is coordinated through the Paraná state environmental agency (*Secretaria do Meio Ambiente*) in partnership with the Paraná Development Institute (*Instituto Paraná Desenvolvimento*, or IPD). The IPD has developed the Indicators of Sustainability, Regional Base Observatory (*Observatório Regional Base de Indicadores de Sustentabilidade*), a set of sustainable development indicators for the state of Paraná, BR. The organization is also in the process of developing Corporate Sustainability Indicators. The Institute has produced numerous studies as well as developed Geographical Information System models for assisting businesses and government entities in evaluating their sustainable development impacts (ORBIS, n.d.). The Institute has facilitated regional discussions involving over 5,000 participants in eight cities within Paraná; the IPD also publishes periodic newsletters and maintains an extensive website (ORBIS, n.d.).

Local Agenda 21 Implementation: Curitiba, Paraná, BR

For Local Agenda 21 implementation purposes, Paraná is divided into 17 regions, so as to localize the sustainability effort even further. Since Curitiba is dubbed as one of the “most sustainable cities in the world,” it was a natural fit that the 2003 International Conference on Sustainable Development and Quality of Life Indicators was held there, helping to prod the State towards its local sustainability effort. Curitiba administers its local Agenda 21 through the city’s environmental agency (*Secretaria do Meio Ambiente*), with emphasis on citizen participation, environmental monitoring and developing strategies for environmental conservation.

Introduction to Curitiba

Curitiba is the capital city of the state of Paraná, located in the southern region of Brazil (Figure 4-1). Founded in 1693, Curitiba is characterized by the many European immigrants drawn to the area in the 18th and 19th centuries for its mining, timber growing and agricultural activities. The remnants of the massive immigrant influx into the city are still evident today with various ethnic festivities, cultural events and cuisine that characterize the region.

Starting in the 1970s, Curitiba began to experience rapid urbanization, growing from 600,000 people to nearly 1.1 million in just one decade (Macedo, 2004). Curitiba now has a population of 1.8 million inhabitants (IBGE, 2012), and is the eighth largest city in Brazil, while the state of Paraná is the sixth largest in the nation with a population of 10.4 million. The state has an area of nearly 200,000 square kilometers (km²), while Curitiba occupies an area of 435 km², with a population density of four thousand people per km². Curitiba also claims to provide 64.5 km² green space per resident (Chen, 2012).

Paraná is among the most affluent states in the nation. Curitiba boasts an unemployment rate of just 2.5%, less than half of Brazil's average unemployment rate of 5.5%. Thanks to aggressive marketing efforts, Curitiba has experienced industrial development and growth and now is attracting a number of international companies to the metropolitan area, including Exxon Mobil Corporation and the Swedish appliance maker Electrolux, known for its green products (Chen, 2012; *Prefeitura da Curitiba*, n.d.).

Model Sustainable City?

Curitiba has received numerous recognitions and accolades for its sustainability efforts (Globe Award, 2010; Grist Magazine, Inc., 2007; and World Habitat Awards, n.d.). Yet, in recent years, the city administration has been criticized increasingly for failing to meet some of its claims. According to Macedo (2004), the city has been developed “as if it were an island” creating a starkly different quality of life in neighboring communities, thus underscoring Curitiba’s lack of regional planning (p. 548). And the city’s integrated bus system—a key initiative in bringing Curitiba worldwide recognition for sustainability—appears to be nearing capacity (Halais, 2012). Evidence of Curitiba falling short of its sustainable model city status is abundant. As one New York Times Magazine (Lubow, 2007) article points out, not only is Curitiba dealing with debris littering the area’s rivers, but also massive amounts of raw sewage polluting the waterways. Curitiba's traditionally impressive garbage recycling rate has been declining over the last six or seven years, and the only landfill in the municipal region reached full capacity and closed in November 2010, with a long-term solution still



GOVERNO DO ESTADO DO PARANÁ
SECRETARIA ESPECIAL PARA ASSUNTOS DA R. M. C.
COORDENAÇÃO DA REGIÃO METROPOLITANA DE CURITIBA

Região Metropolitana de Curitiba

Figure 4-1. Geographic location—Curitiba, Capital of Paraná, Brazil: Source: COMEC and the State of Paraná

unresolved. In addition, a substantial number of *favelas*, informal settlements within and around the city, have developed providing a place to live and work for the increasing number of poor people. The development of favelas, and the informal economic sectors they harbor, poses a significant challenge in achieving equity among Curitiba's citizens. This picture is hardly one of a model sustainable city.

History of Curitiba

Government decentralization initiated by restructuring under a neoliberal agenda and formalized by the Constitution in 1988, has put the city of Curitiba directly in charge of public services such as education, health, and environmental issues (Prud'homme, 1995). In addition, human development and other welfare concerns, such as providing free public libraries throughout all areas of the city, fall under their jurisdiction, a role that most municipalities struggle to embrace although Curitiba has managed to do better than most. Rising popular demands and expectations have put severe pressure on local governments in Brazil to provide public services such as easy access to potable water and universal garbage collection, services once considered luxuries to its citizens, but that are now viewed as basic rights (Prud'homme, 1995).

Formulated in a new comprehensive solid waste management plan (*Plano de Gestão Integrada de Resíduos Sólidos*) finalized in October 2010, Curitiba has built upon past innovative solutions—such as revamping their aggressive recycling campaign and recognizing waste pickers—for dealing with the municipal solid waste problem. Still, the city has a long road ahead in addressing the extensive informal sector of waste pickers who are poor, disenfranchised and seemingly without a chance of rising out of poverty. Additionally, trash can still be found strewn about the city's waterways, particularly in poorer areas of the city.

Before going into greater detail about Curitiba's garbage programs, however, it is important to understand the history and politics of the city's urban development. The most recognized and celebrated figure associated with the city's development is its three-time mayor, Jaime Lerner. Appointed mayor for two terms under the dictatorship regime (1971-74, 1979-83) and then democratically elected for his 1989-92 term, he and his administration developed several innovative environmental initiatives including the integrated transportation system, as well as social services and environmental education programs aimed at low-income areas. As with many Latin American cities, Curitiba experienced tremendous population growth in the latter half of the 20th century. The population doubled between 1970 and 1991 to reach about 1.3 million inhabitants (Macedo, 2004). Over the next five years, between 1991 and 1996, Curitiba had an even faster growth rate (2.34%) than Brazil's two biggest cities, São Paulo and Rio de Janeiro (Macedo, 2000). Of course, most of this growth occurred due to migration of the rural population who settled along the periphery of the city, ultimately giving rise to illegal squatter settlements, or favelas, and thus increasing the rate of urban poverty. By the early 1990s, it was estimated that about 10 to 15% of Curitiba's total population lived in favelas (Macedo, 2000). As of 2002, an estimated 58,530 favela households in Curitiba were occupying over 300 settlement areas (Macedo, 2004). The most recent IBGE data from 2010 indicates that 163,301 inhabitants live in sub-standard housing in Curitiba (Portal OMD, 2009).

In addition to the legality issues hindering basic survival of favela residents, establishing adequate infrastructure or municipal services is near impossible since many of these settlements are in unsuitable areas such as wetlands or other

environmentally sensitive areas. Therefore, waste (including human excrements and garbage) collects in open dumpsites, vacant lots and rivers thus threatening the local water supply and posing a health risk to all those who come in contact with these areas. An attempt at regularization of these settlements began in 1982 with the goals of implementing basic infrastructure (water, electricity and sewage), and providing public services like schools and healthcare (Dziallo, 2006). Most settlements, however, still lacked basic solid waste management, due primarily to the fact that the city had yet to implement a comprehensive solid waste management plan, even within the urban core. Formulated in a comprehensive solid waste management plan, Curitiba has devised innovative solutions – such as a prioritized recycling campaign and refuse collection programs – for dealing with the municipal solid waste problem (Monteiro et al., 2001).

Curitiba's Solid Waste Management Programs

In 1989, the city developed a comprehensive plan for treating urban solid waste. The plan included recycling plants, compost factories and sanitary landfills, which entailed the use of clay and plastic liners to prevent contamination (Bava and Mullahy, 1995). Under this plan, two innovative programs, the 'Garbage that is Not Garbage' (*Lixo que não é Lixo*) and 'Garbage Purchase' (*Compra do Lixo*) programs, were launched during Jaime Lerner's third administration.

In 2010 Brazil passed the national solid waste policy plan, a law that aims to decrease the total volume of waste produced nationally and increase the sustainability of solid waste management from the local level to the national level. The law encourages public-private partnerships in the management of SWM and provides specific directions for social inclusion. The plan also requires states and municipalities to develop solid waste management plans before receiving federal funds for solid waste

projects. In response to this legislation, Curitiba developed a new Integrated Solid Waste Management Plan (*Plano de Gestão Integrada de Resíduos Sólidos*) in 2010. Alongside the management plan, Curitiba also initiated the Integrated System for Processing and Reuse of Waste (*Sistema Integrado de Processamento e Aproveitamento de Resíduos*, SIPAR) in 2010, which integrates waste reduction, reuse and recycling and adequate treatment and disposal of waste that is not utilized. Current statistics related to solid waste collected in Curitiba's solid waste program are included below.

Table 4-2. Summary of waste collected in Curitiba (Adapted by author from Prefeitura de Curitiba, 2010)

Type of Waste Collected	Amount Collected (Tons/Day)
Conventional MSW	1,472.70 tons
Source-separated recyclables (city-collected)	89.16 tons
Source-separated recyclables (informal sector-collected)	445.00 tons
Vegetative waste	70.83 tons
Waste related to city street cleaning, river cleanings, etc.	266.37 tons
Total	2,560.06 tons

SIPAR also utilizes composting as a treatment for organic waste within the waste stream, an activity that has shown little success in developing countries around the world, due to inadequate technologies and poor implementation (Hoornweg, Thomas and Otten, 1999). This waste treatment method holds much promise for future solid waste management programs in developing countries, however, especially because of

the high organic content of waste (the input to the process) in these countries and the need for quality soil (the output from the process). It will be interesting to see if Curitiba's composting program will be successful, as this is another area in which it can serve as a positive case study for cities in the developing world. The details of these programs are discussed below.

The 'Garbage that is not 'Garbage' Program

The 'Garbage that is not Garbage' program was a citywide initiative developed to encourage recycling (Paes, Silva, Ribas and Calvallari, 2008). Under the 1989 comprehensive waste management plan, city officials projected that they would lessen the amount of garbage going into the landfill from 700 tons a day to 147 tons, representing a 79% diversion rate. This goal was extremely ambitious: the average diversion rate in the US, for example, is only 45%. In addition to the infrastructure component of the program, the city also incorporated an educational element, in order to encourage residents to recycle and to inform them about the importance of separating organic from inorganic garbage at home. In 1990, the program gained worldwide recognition by the United Nations Environmental Program (Rabinovitch, 1992).

Though, as was already noted, the recycling rate began decreasing in the early 2000s. The Garbage That is Not Garbage program went from collecting 14,872 tons a year in 2001 to 7,662 yearly tons in 2005 (Paes et al., 2008; Prefeitura do Curitiba, 2010). But with a newly revamped education and outreach program, recycling rates are again on the rise (the city reports 22,420 tons collected in the Garbage That is Not Garbage program in 2009), showing the effectiveness and importance of concerted education efforts (Figure 4-2). Unfortunately, as pointed out by Rosemari Malinowski, an

education and outreach specialist with Curitiba's Environmental Education Department (*Secretaria Municipal do Meio Ambiente Centro de Educação Ambiental*), the effects of this effort are primarily seen only among the urban poor; upper and middle class neighborhoods have significantly lower recycling rates (personal communication, June 2, 2008). Perhaps this disparity can be explained, as suggested by Malinkowski, by the fact that separating trash is stigmatized as an activity of the poor.

The 'Garbage Purchase' Program

The first step in the regularization process of the informal settlements is to provide basic solid waste management and sanitation services to the city's periphery. However negotiating large vehicles, for example garbage trucks, can prove difficult in these informal settlements. Thus, the city crafted a program that would utilize the residents to carry their own recyclables to a common collection point within, or at least closer to regularized areas. To assist in this endeavor, the 'Garbage Purchase' program was developed. Created in 1989 in conjunction with the city-wide 'Garbage that is not Garbage' recycling program, the 'Garbage Purchase' program was implemented to provide basic garbage collection to areas that demonstrated: a). excess of waste deposited in open pits or river valleys; b). high incidence of diseases and other sanitary health issues, and c). a lack of basic sanitation (Prefeitura de Curitiba, n.d.). Before participating in the program, each favela is required to create a Neighborhood Association (*Associação de Moradores*) where the City of Curitiba and the Association sign an agreement holding the community responsible for distributing trash bags to participating families (Dziallo, 2006). The Association is also responsible for coordinating and facilitating residents' delivery of trash to particular drop off spots.

Approximately every 15 days a municipal garbage truck arrives to collect the bags of garbage in exchange for food (Prefeitura de Curitiba, 2010).

When it was discovered that local farmers had a surplus of food going to waste due to low market demand and that the bus tokens were being sold in the “black market,” the Curitiba innovators found their solution. Instead of giving bus tokens for trash, they began purchasing the surplus food from the farmers thus exchanging trash for a box of locally grown food. In addition to receiving food, the Neighborhood Associations also receive 10% of the ‘value’ of a bag of trash to go into a bank account. The Associations can then use the money for needed community services within their neighborhoods (Prefeitura de Curitiba, 2010). Benefits from this program are multifaceted. Not only are residents of the favelas receiving healthy food, but the local farmers are also assisted by the city purchasing food that would normally be an economic loss. The ‘Garbage Purchase’ program is meant to be an intermediary program; residents only participate during the regularization process of their favela, during which roads are being paved and the basic public services developed and implemented. After this goal is achieved, residents of the newly regularized neighborhood can begin to participate in the ‘Green Exchange’ program (Dziallo, 2006). Upon observations during June 2008, however, some of the Green Exchanges appeared to be in regularized, middle-class neighborhoods.

The ‘Green Exchange’ Program

In 1991, the Green Exchange (*Câmbio Verde*) program was created as a supplemental program to encourage regularized, low-income areas (either former favelas or other poor areas) to recycle. This is another example of municipal officials' attempts to influence the behavior of lower-income citizens and mold them into

environmental citizens. By 1992, fifty-two communities were involved with more than 22,000 families participating (Rabinovitch, 1992). The program worked quite similarly to the ‘Garbage Purchase’ program in that participants must have an established Neighborhood Association and formally agree to the terms of participation. The main differences between the two programs are the informal settlement's sanitary conditions, the family income requirements, and the type of waste collected. In order to participate in this program the area must have a higher standard basic solid waste management in place (Dziallo, 2006). Residents are given a certain amount of seasonable items, usually foods—although odd items such as Christmas trees and Easter eggs have been used—in exchange for recyclable goods collected. Pick up points are located where excessive trash has been documented—usually near rivers and creeks—thus preventing garbage from entering water sources (Rabinovitch, 1992).

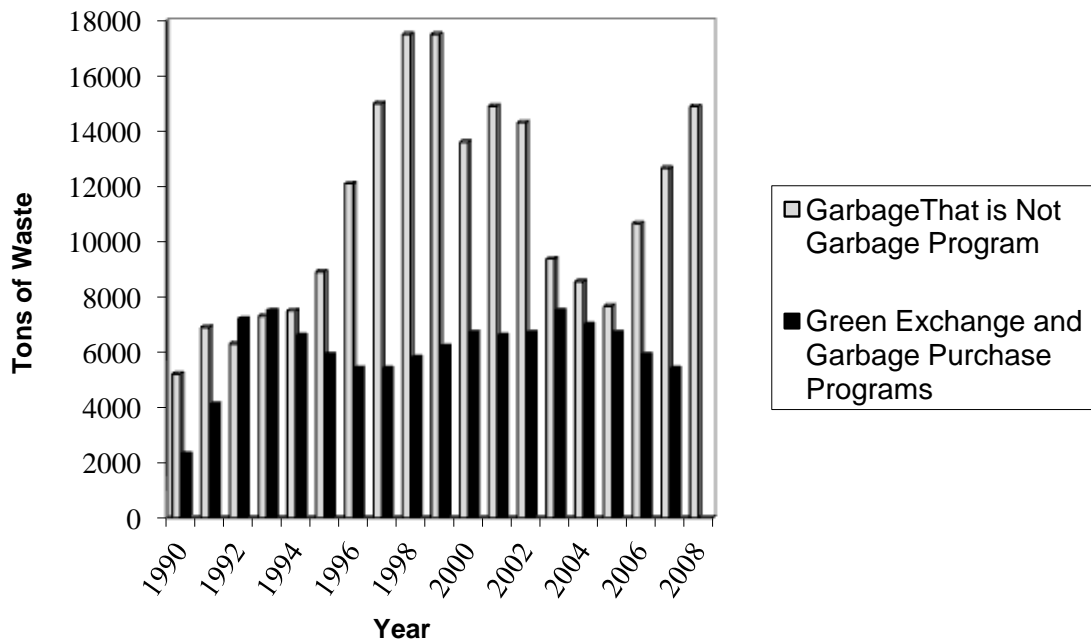


Figure 4-2. Summary of the Garbage That is Not Garbage and the Green Exchange and Garbage Purchase programs (Source: Secretaria Municipal do Meio Ambiente, Curitiba 2007; Prefeitura de Curitiba, 2010).

Curitiba's Informal Waste Collection Sector

The government of Curitiba estimates that on any given day around 3,300 catadores work in the city collecting recyclables (Prefeitura de Curitiba, 2010; A. Souza, personal conversation, June 2, 2008), although other estimates put the number of waste pickers between 4,000 and 10,000 (Martins dos Anjos, 2008, Cunha, 2008). In a 1999 study conducted by Curitiba's Municipal Secretary of the Environment-Department of Public Cleanliness (Departamento de Limpeza Pública da Secretaria Municipal de Meio Ambiente), along with Municipal Secretary of Health (Secretaria Municipal de Saúde) 2,769 registered catadores were asked about their profession. The study found that 21% of the catadores interviewed live in *depósitos*, the sheds where they deposit their collected recyclables for storage and sale (Prefeitura Municipal de Curitiba, 2010). Based upon this study, the municipality estimates that 60% of the catadores in the metropolitan area of Curitiba utilized *depósitos* as their primary place of residence (Prefeitura Municipal de Curitiba, 2010). Primarily run by the "middlemen" associated with informal recycling business; these undocumented, mostly illegal, sheds consist of cubby-like living areas partitioned off with pieces of wood. One former *depósito* owner claims to have housed 20 catadores at his shed before he left the recycling business (Fernandez, 2007).

The study also found that 44% of those interviewed do not own their own cart for collecting recyclables. This makes the catadores dependent upon the *depósitos* and middlemen for renting carts in order for them to do their work (Prefeitura Municipal de Curitiba, 2010). The city recently announced the investment and disbursement of 504 electric carts and 500 conventional carts to catadores for the purpose of collecting recyclables (Jubanski and Henrique, 2012). The project is made possible by an

agreement with the municipality and the National Bank for Economic and Social Development, (*Banco Nacional de Desenvolvimento Economico e Social* or BNDES).

Strong and effective waste picker associations around the country have paved the way for Curitiba's own increase in waste picker associations. The national group Waste and Citizenship Forum (*Fórum Nacional Lixo e Cidadania*, FNLC) has come together to improve the socio-environmental standards through the participation of waste pickers associations and through the implementation of integrated waste management systems at the local level (Dias, 2006). One of their focuses is on the elimination of children waste pickers and thus they organized a national campaign called 'No More Children in the Dump' (*Criança no Lixo, Nunca Mais*) in 1999 as a way to draw attention to this issue to the general population. They received unprecedented media coverage and resulted in over 100 mayors signing a Letter of Commitment to adhere to the 'No More Children in the Dump Campaign,' after which they received a kit outlining ways to assist waste pickers in their municipalities (Dias, 2006). This movement later led to the federal government implementing the highly successful *Bolsa Família* program, which provides supplemental money to families who agree to send their children to school rather than have them work (Dias, 2006). As a result of these campaigns, an estimated 46,742 children nationwide no longer work in dumps (Dias, 2006).

A waste pickers' association of Belo Horizonte, the capital of the state of Minas Gerais, Brazil, is one of the most active and effective associations in Brazil. Developed with the help of funding from United Nations International Children's Emergency Fund (UNICEF) and has since become a model for how local government can incorporate

waste pickers into their recycling programs. The Municipal Waste and Citizenship Forum of Belo Horizonte (*Fórum Municipal Lixo e Cidadania de Belo Horizonte*) holds monthly meetings, bringing together both catadores and public officials to establish policies and organize funding for waste picking activities in Belo Horizonte. A National Training Program has also been created in order to coordinate the various sectors involved in waste management and provide training about other aspects of the industry. This program is envisioned to serve as a kind of incubator for development of micro-enterprises by former informal-sector waste pickers (Dias, 2006). A local Municipal Waste and Citizen Forum is also established in Curitiba and follows the same tenants as the national organization.

CoopZumbi is an example of a successful waste picker coop operating in Curitiba. The co-op started in 2005 and involved 15 pickers who had an average monthly income of R\$ 220.00¹. Since that time, the coop has expanded to over 60 catadores who now earn on average \$R 550.00 a month (Tamashiro, 2008). Today the Municipality of Curitiba, in partnership with *Aliança Empreendedora*, an NGO serving as an incubator for encouraging micro-enterprises within low-income communities in Curitiba, is implementing a series of similar co-ops throughout the city. The program, ECO City (*ECO Cidadão*), plans to establish 25 “recycling parks” in low income areas of the city that have high concentrations of waste pickers, in hopes of displacing some of the depósitos in the region (Tamashiro, 2008, A. Souza, personal conversation, June 2, 2008). Currently the city has established 13 parks, all which contain an area for

¹ 1 In 2012, the Brazilian real (\$R) = 0.4924 US dollars (US\$)

separating and preparing the recyclables for sale, toilets, and a cafeteria for the participants (Jubanski and Henrique, 2012).

Curitiba has implemented a number of innovative SWM programs that appear to be on the path to sustainability. But, the existence of poverty and environmental degradation within the city demonstrates that Curitiba is still struggling to meet sustainability goals and declarations of being a green city. Chapter 5 applies the sustainability model to Curitiba's policies and programs in order to assess the true sustainability of the city.

CHAPTER 5 APPLYING THE SUSTAINABILITY MODEL TO CURITIBA'S SOLID WASTE MANAGEMENT PROGRAMS

Chapter 5 I apply the tenants of the sustainability triangle—economic development, environmental protection and equity—to Curitiba's solid waste program in order to assess its long-term sustainability. I add another dimension—governance—to the program to test the assertion that governance is a necessary part of achieving sustainable development.

Curitiba's Solid Waste Program: Problems and Criticisms

Although Curitiba's solid waste management programs have been praised, even modeled after, since their inception in the late 1980s, they are receiving a fair share of criticism as of late. Local NGOs have hotly contested the numbers the government claims to be recycling. One environmental activist estimates that only 3% of the city's garbage is recycled (Irazábal, 2005, p. 109). Teresa Urban, an environmental activist based in Curitiba echoes Macedo's (2004) sentiments concerning the claim by Curitiba to be a sustainable city: 'everything done in this city in the area of the environment is much more a marketing policy than an environmental policy' (qtd in Irazábal, 2005, p. 109). Irazábal argues that Curitiba is 'perpetuating the paternalistic and populist approach that is so prevalent in Latin American leadership practices' (2005, p.109). Urban's research further shows that 'the level of poverty of the participating sectors of society ... is so high that they hardly produce recyclable garbage' (Irazábal, 2005, p. 110). Nonetheless, Curitiba's policies and framework are innovative and push for sustainability more than most cities in the Global South, and in many cases are more progressive than policies in cities of industrialized nations. The problem however lies in

the inefficiencies or failures of these policies to achieve their intended goals. How can Curitiba's policies translate into effective action and promote social equity?

The most difficult aspect of achieving sustainability in Curitiba—as in the world over—is realizing social equity. This inequity stems not necessarily from a conscious effort to exclude certain populations, but from the existing institutions and structures in place within a society. In an attempt to facilitate income distribution, some communities are subscribing to the ideas of Lefèbvre, specifically the Right to the City concept. Lefèbvre argues that even within democratized nations there is still a lacking in political rights, specifically the right to the city which consists of the “right of all city dwellers to fully enjoy urban life with all of its services and advantages—the right to habitation—as well as taking a direct part in the management of cities—the right to participation” (Fernandez, 2007 p. 208). In 2001, Brazil officially recognized the Right to the City as a collective right established by the City Statute, the main legal framework governing urban planning and management. The law outlines the legal-political role of municipalities in the formulation of urban planning policies, in addition to acknowledging the social function of the city or the need for cities to “democratize the local decision-making process and thus legitimize a new socially oriented urban-legal order” (Fernandez, 2007, p. 213).

This social inclusion component has had a profound effect on the decision-making process. Since 2001, Brazil has made impressive progress in the participation rates of all citizens, including those residing and working in the informal sector of society. In terms of the informal waste management sector, the effect of the Right to City are undeniable: formalized in 1999, the grassroots group National Movement of

Recyclable Materials Collectors (*Movimento Nacional dos Catadores de Materiais Recicláveis*, MNCR) has gained momentum since they held their first national congress in 2001, which had more than 1,700 recyclers in attendance. Now there are more than 400 associations and cooperatives associated with the MNCR in Brazil; 52 are in Paraná and at least 9 such organizations exist in Curitiba (CMI Brasil, 2006). Goals of the MNCR include providing a forum for recyclers to exchange experiences and to frame a political agenda for activism. The group also emphasizes regionalism, in terms of establishing recycling networks at a state-level so as to better facilitate and plan collaborative actions (Gutberlet, 2008).

Governance: The Missing Link in Sustainable Development?

As previously discussed, prevailing sustainability theories advocate for some kind of compromising and negotiating to achieve social, environmental and economic balance. These formulas, however, do not apply to Curitiba: when the initial urban development plan was launched in the 1960s, an authoritarian government dictated Brazil. Therefore, the majority of the planning initiatives implemented involved little input by the affected parties, a pattern the federal government is going to great lengths to change via legislation mandating public involvement.

Irazábal's (2005) analysis of Curitiba's sustainability success suggests the city's accomplishments are attributed to three major influences: the support from the power elite, existence of local media who championed the cause, and finally, the witness of small, material gains by lower-income populations. Rabinovitch calls the gains "action scripts," which he uses to describe short-term projects that allow for "immediate feedback" that can then be used as the foundation of the next project (as cited in Moore, 2007, p.113). Another analysis asserts that it is good governance that sets Curitiba

apart from other cities. That is, the presence of political commitment, organizational capabilities, and policy consistency at the local level is what facilitates Curitiba's success (Vassoler, 2003). Vassoler (2003) uses the self-reinforcing aspect of the path-dependence model, to explain the persistence of effective governance in Curitiba. Initially, successful programs that resulted in real improvements in infrastructure and public services were put into place by strong leadership. She argues that electoral campaigns became more meaningful, serving as platform for discussing urban issues among citizens. Feeling the benefits of implemented programs, public involvement becomes more prevalent, thus positively reinforcing the governance activities (Vassoler, 2003). Moore, 2007 explains this phenomenon another way: he contends that "if the regime of sustainability is, by design or by accident, starting its citizens down the road toward a strong, rather than weak model of citizenship, sustainability is *becoming true*" (p. 111, emphasis in original). Moore (2007) also contends that many of these "action scripts" are "paternal" in nature meaning the programs were designed by "technocrats to alter social behavior" (p.85). Still, as McKibben argues, the reason that this regime works is because it is "effective paternalism," meaning it actually achieves sustainability objectives (qtd in Moore, 2007, p. 85). Therefore, according to Moore, North American and European observers are willing to overlook the "undemocratic means" of Curitiba's sustainability regime because it is "getting the job done" (p.85). If these factors are indeed instrumental in Curitiba obtaining measures of sustainability success, to which pillar of the sustainability model do they belong? The aspects described above appear to stray from the prevailing sustainability model since governing structures are not accounted for in the sustainability triangle. An argument can be made that Curitiba has

been successful in implementing their policies throughout the 1970s and 80s, but since the mid-1990s the city's history of exclusionary participation “has begun to delegitimize the planning process of decision-making and implementation” (Irazábal, 2005, p.85). Nonetheless, in this case, it is the *process* of governance that can help solve the current problems in Curitiba and a new focus on citizen participation can go far in remedying the current situation (Irazábal, 2005). The strength of a city's economy, the responsiveness of its governing institutions, and the well-being of its citizens is highly correlated with the strength of social networks and participatory groups working to achieve their identified goals (Irazábal, 2005).

Other examinations of Curitiba's sustainability achievements are more critical: “despite [its reputation of being a development model] Curitiba's approach to urbanism is largely a result of political measures taken, not only to give the impression of development, but also to advance political and economic agenda through urban development” (Macedo 2004, p. 548). In this case, a new focus on regional planning initiatives is needed in order to meet the needs of Curitiba's inevitable growth. Macedo (2004) points out that the planning initiatives implemented in the city over the past decades are more successful when “municipal administrators and politicians work together with planning professionals and there is consensus between technical solutions and the political will to implement them” (p. 548). Furthermore, she contends that as long as Curitiba is “surrounded by poverty” and “until there are no families settling in riparian areas within the water supply watersheds” Curitiba cannot claim to be a model sustainable city (Macedo, 2004, p. 548).

Although promoting social stock and public participation is the prevailing trend among scholars and policy-makers, there is evidence that decentralization in developing countries is falling short of the goals of participatory governing. Andrews and de Vries (2007) claim World Bank projects “demonstrate that decentralization in developing countries complicates policy processes, makes the implementation problematic, and fails to make citizens' empowerment a reality” (p. 436).

Andrews and de Vries may argue that the demise of Curitiba's green programs is precisely due to the decentralization process that has taken place in Brazil over the past 10-15 years. Curitiba seems perfectly situated to support Andrews' and de Vries' thesis: the heyday of Curitiba's success was under the 'benevolent dictatorship' of the 1960s and 70s, a time when mayor/architect/urban planner Jaime Lerner could push through his prerogatives with the blessing of the State, a time when public participation was nil. Can the governance theory augment the sustainable development model as a way to create livable, sustainable, and socially equitable communities? Or, is Curitiba's situation unable to be replicated or sustained under the new decentralization and democratization structures now in place? While the cited authors all invoke a structuralist viewpoint and imply Curitiba's history is the main influence to its current day politics and governance, they would disagree as to how Curitiba can maintain or recapture its spot as one of the greenest cities in the world. While Andrews and de Vries would most likely write off Curitiba as doomed to become a typical, dysfunctional 3rd-world city under the current decentralization scheme, the other authors might point to potential opportunities that public participation and public private partnerships (PPP)

can provide in furthering Curitiba's goal of achieving an economical, social and environmental balance. Chapter 6 explores the potential PPP opportunities.

CHAPTER 6 SUITABILITY OF GOVERNANCE AS AN INTEGRAL PART OF THE SUSTAINABLE DEVELOPMENT MODEL

Thus far, Curitiba's successes and failures in achieving sustainability have been presented and analyzed. This section suggests a possible solution for addressing Curitiba's shortfalls by exploring how Curitiba's solid waste management can evolve into a system centered upon PPPs. PPPs are explained in the context of current theory and the case study of Curitiba is applied to the proposed arrangement.

Potential Solutions: Public-Private Partnerships

A viable solution for tackling the complex problems facing Curitiba and other cities of developing countries is to move towards privatization or semi-privatization of waste management with government transitioning into a regulatory role. Since the decentralization of Latin America, local governments have been trying to emulate developed countries' solid waste management styles, which are predominantly controlled by local municipalities. This concept does not, and cannot work in developing countries. They do not have the resources and many times lack the technical know-how to take on such tasks, as is evidenced by the massive amount of garbage seen in most cities in the developing world. Therefore, forming PPPs—with NGOs or CBOs as mediators—provides a viable solution to tackling some of the problems associated with solid waste management. This can be further maximized if there is a deliberative democracy structure in place.

Defining PPPs

In this analysis, it is important to outline the players and their roles in the solid waste arena. Some have already been introduced in the description of Curitiba's

programs. First, there are public sector agencies, which generally mean the municipalities, operating under strict laws and guidelines, which for the most part, are inflexible (Ahmed and Ali, 2004). Municipalities have strong labor unions, but are notorious for low productivity, inadequate supervision and inadequate or inappropriate equipment. This sector is also vulnerable to political influence, contributing to the culture of distrust so prevalent in Latin America.

Secondly, there is the private industry that depends on demand for service, the ability to pay, and regulations (Ahmed and Ali, 2004). Private industry is made up of the formal and/or informal sectors. The term “informal sector” is used to describe economic activities that are non-permanent, outside the scope of governmental regulations and performed by individual or small-scale establishments. The private industry can be categorized many different ways: as waste pickers, waste buyers, and small scale recycling industry, large-scale recycling industry, CBOs, NGOs and micro-enterprises, which are small-scale, for-profit business operations. Persons within the private industry tend to be innovative entrepreneurs who find or create a niche to buy or sell a product (Ahmed and Ali, 2004).

Thus, PPPs can offer the best of both worlds: Ahmed and Ali (2004) describe PPPs as alternatives to full privatization, offering a hybrid of the private sector's “dynamism, access to finance, knowledge of technologies, managerial efficiency, and entrepreneurial spirit” with the “social responsibility, environmental awareness, local knowledge and job generation concerns” of the public sector (p. 470).

Conditions for Successful PPPs

In many cities in the developing world, privatization is an unfavorable option due to failures contributed by poor implementation. If governments are transparent and

actively facilitate public involvement, PPPs can be an acceptable compromise to all interested parties. Ahmed and Ali (2004) outline the conditions required for successful

PPPs:

- i. A positive culture that encourages leadership and citizen participation and is related to the long-term development concerns of a community
- ii. A realistic commonly accepted vision among the public, private and community members that is based on the area's strengths and weaknesses, as well as a good understanding of the potential for the community.
- iii. A participatory ethic in concerned organisations (such as NGOs and CBOs) that can blend the self-interests of the private sector, with the broader interests of the community, and
- iv. Continuity of policy, yet the ability to adapt to changing circumstances, while at the same time reducing uncertainty for businesses and individuals who want to take economic risks.

The danger in applying PPPs to developing countries, however, is the necessity to include the informal sector when creating these partnerships. To overlook these vibrant and necessary informal sectors so prevalent in all developing countries would be disastrous. Municipalities need to embrace the skills and efficiencies this sector provides and incorporate it into the formalized economic sector. A “sustainable livelihood’ approach could help facilitate such PPPs. The framework for this approach focuses on people’s assets rather than their needs (Gutberlet 2008). Strategies are then assessed, integrating capital—whether it is human, physical, social, natural or financial—in order to address wellbeing at both the community and the individual level. This approach also highlights the often overlooked fact that the public sector is reliant on the private sector for assistance in garbage collection. In order for the idea of sustainable livelihood to exist, new partnerships need to take hold. Gutberlet (2008) claims these will only take place when the political and social context of waste

management is addressed, and proposes the conceptual keystones to be a mover towards governance and deliberative democracy within a social and solidary economy. Therefore the success of potential PPPs relating to solid waste management hinges on how well these economies are absorbed into the system. The most effective way to ensure this economic sector's participation is through a facilitative approach, again enlisting the participation of community groups and organizations that are supportive of these partnerships.

Application of PPPs to Curitiba

Applying Ahmed and Ali's successful conditions for PPPs to Curitiba reveals that the city can potentially move closer towards its goal of sustainability. The most important factor in a PPP's success is a demand from the public that cannot be met by the public sector. Curitiba obviously meets these criteria when it comes to the municipality's solid waste management record. City officials estimate that catadores collect an average of 135 kgs of recyclables each day (Martins dos Anjos, 2008) amounting to 92% of the recyclables (Cunha, 2008). Additionally, catadores are thought to collect 20-35% of the total refuse within the city, indicating the dependency of the municipality on their services (Cunha, 2008; Prefeitura de Curitiba, 2010). Curitiba has embraced this fact by funding and building a multitude of waste-sorting sheds in many of the city's favelas as well as providing gloves and other safety equipment for the waste pickers. This much public investment into the occupational needs of waste pickers helps legitimize their contribution to the city's waste management system.

Secondly, does Curitiba foster a positive culture for citizen leadership and participation? While the city gives an outward appearance of citizen empowerment and participation, several *curitibanos* (natives of Curitiba), including Macedo and Urban,

previously cited in this paper, would argue otherwise. But, it is hard to find a city in a developing country anywhere in the world that has been more innovative, or that has given more attention to their poor as the city of Curitiba. So, the most likely answer to this question is yes. Evidence of the effects of public participation in the new solid waste management scheme for the city is discussed below.

The city is beginning to see grassroots movements fostering individual and community-wide sustainability objectives as laid out in Agenda 21. Using Agenda 21 principles and strategies as a springboard for sustainability is demonstrated in the case of Vila Torres, a small 30-year old squatter community on the outskirts of Curitiba. Although originally occupied illegally, the community has been recently regularized, meaning the municipality of Curitiba has invested in developing roads and sewage infrastructure for the community. Since the regularization process, as expressed by City of Curitiba councilwoman Roseli Isidoro and community activist Ezequiel Bibiano, the community feels as if it has 'been forgotten' (E. Bibiano and R. Isidoro, personal communication, June 12, 2008). In 2007, the community decided to take action and initiated its own Local Agenda 21 via the Foundation for Community Integration (*Centro de Apoio à Integração Comunitária, CAICO*). CAICO's main objective is to create consciousness and promote social assistance, volunteer work and preserve the environment in a sustainable way. They have partnered with the local universities and NGOs to institute several small-scale projects within their community such as individual water purification systems. With this particular project, not only did they provide the purification systems, but they also trained local residents on how to install, and repair

them, so as to provide a trade for those who might not otherwise have viable means for supporting themselves.

Third, do Curitiba citizens and government actors have a realistic vision of the city's strengths and weaknesses? As Irazábal points out, Curitiba has gone to great lengths to market themselves as a global ecologically sustainable city. Some people even contend that common citizens are afraid to speak out as to what's *wrong* with their city because they are constantly being told how wonderful it is (private conversation with J. Macedo, November 2007). Until Curitiba is willing to acknowledge that they have problems that need to be addressed, it will be difficult for them to move forward and find solutions. On the other hand, Curitiba has acknowledged the importance of the informal sector's role in their solid waste management scheme and is now taking steps to improve the working conditions of the catadores. The city's investment in recycling infrastructure in the form of the recycling parks and collection carts for the catadores provide examples of how the City is responding to problems identified in the 1999 study on the informal waste sector in Curitiba.

Fourth, are there NGOs and CBOs willing to come to the table and negotiate PPPs? All indicators seem to answer yes to this question. In Brazil there are national, state and local NGOs and CBOs, including the national, state and local branches of the MNCR, who are fighting for the rights of those involved in the informal waste management sector, so much so that they are becoming a leader in not only Latin America, but for all of the developing world.

Does Curitiba have continuity of policy that has the ability to adapt to change? This issue may be the core of what is preventing Curitiba from continuing on its march

to sustainable development. With Lerner, the city benefitted from having a long-standing mayor who was able to create, and then follow through, on urban planning initiatives. Even in the years when he was not mayor, with the exception of the years 1983-1988, those who were in office were still of the same political party and thus sympathetic to the policies and sustainability platform Lerner promoted. Increased frustrations with the persistent social problems however, are resulting in a call for change. The 2012 mayoral election was the first time since 1988 that a member of the Lerner cadre was not elected mayor. Furthermore, as Macedo (2004) pointed out, the tendency for Curitiba to plan inside of a bubble, not accounting for tremendous future growth, has created significant problems and will continue to do so until officials decide to take a regional approach to planning.

One of the first moves towards regionalization involves the future of solid waste management in the city. Curitiba is now in a critical moment: with the only municipal landfill now closed, the city must send its garbage to two private landfills in the metropolitan area, while officials attempt to plan for what to do next with the city's waste. The planning process heavily involves an increasingly educated and involved public. The outcome of such a process has allowed for NIMBY-ism ("Not In My BackYard") to take hold in a way that previously only citizens of developed countries have practiced. Although the city is determined to implement a sustainable, integrated solid waste management system with very little waste left after treatment, there is still a need for a landfill, which despite their best efforts is still being contested. Additionally, the increasingly empowered waste pickers are working to ensure their rightful place in the integrated system; the municipality is having a difficult time settling on a plan. The

outcome of the plan will speak volumes as to how serious the city is about incorporating the needs of the waste pickers and recyclers as well as how committed they are to being a leader in sustainable solid waste management.

A new area of waste management being explored by Curitiba is the idea of recycling organics. With high-valued commodities such as metals and hard plastic dominating the recyclers' collection routes, many waste pickers are not capitalizing on the value of this waste resource (Yousif and Scott, 2007). Although there is local knowledge as to the benefits of composting, little knowledge exists at this level about larger scale organics management. With the city's focus on reducing its waste stream, venturing into beneficial use for organics may present opportunities for private industries searching for a return on investment (such as harvesting biogas from anaerobic digestion of waste) while providing additional valuable commodities for waste collection by the informal sector.

Conclusion

The research conducted for this analysis has brought me back full circle: I began this journey with the idea that Curitiba could provide examples of sustainability policies and programs that could be emulated elsewhere. That exploration led me to become disillusioned by the apparent lack of long-term sustainability in Curitiba that I witnessed during my time there in 2008. Although the programs were in existence and represented all the right sustainability objectives, the city was still faltering. This realization ultimately guided my question of what is missing? How can Curitiba regain or hold onto their sustainability status? I embarked upon the rest of the research in an attempt to answer this question. I hypothesized that it is governance—particularly promoting dialog among

the public and private sectors leading to PPPs—that is the missing link in achieving sustainability.

It has now been four years since I was in Curitiba. Since that time it appears they are continuing to lose ground on the sustainability front: their famous bus system is continuing to lose ridership, losing 14 million riders in the past four years while simultaneously increasing the number of personal vehicles on the road (Halais, 2012, J. Macedo, personal conversation, August 2012). Curitiba has the highest ratio of automobiles per inhabitant out of all the state capitals in Brazil (Halais, 2012). Additionally, due to the city's failure to integrate its suburbs into a functional regional plan, the city's famous plethora of public parks, green spaces and pedestrian-friendly streets are not easily accessible to the growing number of suburban, and usually lower-income, residents (Halais, 2012).

But still, this case study shows that Curitiba—with guidance provided by the national social inclusion policies and the National Solid Waste Plan—is shifting gears in an attempt to rectify the stumbling blocks they have encountered in their quest for sustainable SWM. The city's aggressive promotion of recycling and their innovative solid waste policies in place since the early 1990s—the Garbage That is Not Garbage program and the Garbage Exchange programs—met some of the environmental, social and economic sustainability goals and have rightly served as models for other municipalities in developing countries across the world. As the sustainable solid waste program began to look *unsustainable*, the municipality has responded with a new wave of education and outreach activities and is very effectively utilizing the PPP model to continue forward to true sustainability. The acknowledgement of the catadores and

proliferation of waste picker groups and cooperatives throughout the city is improving the livelihoods of this vulnerable population in a real, measurable way.

Lessons learned in the solid waste sector's experience with PPPs can be extrapolated to other areas of concerns within Curitiba's sustainability agenda. For example, transportation policies and structures can be explored to assess the relationship between the municipality and the private transportation stakeholders including individual car owners, taxi drivers, and so forth. Grassroots groups concerned with alternative transportation networks, such as bicycle trails and safe pedestrian walkways could also be encompassed in the planning and implementation of improved plans and policies as it relates to a sustainable transportation network. Exploring the role of state, federal and international NGOs in this context would also give interesting insight.

Beyond Curitiba—Applicability of Sustainable Development Model Elsewhere

Implications for governance are that sustainable development is never complete; it is always an open-ended process. Instigating goals and policies that address the traditional economic, social and environmental pillars of sustainable development is not enough as was evidenced by Curitiba's aggressive sustainability agenda that is beginning to crumble. But it is through a governance framework, especially one that accommodates PPPs, that societies have the best chance of achieving some measure of success when pursuing sustainable development principles. It is also here that planners will be the most useful in supporting the sustainable development movement. Campbell (1996) asserts that an "obvious start would be for community development planners and environmental planners to collaborate more" with a possible joint task

being “to expand current public-private partnership efforts to improve environmental health in the inner city” (p. 309). As Hanna (2005) reiterates: “As purveyors of knowledge, planners have the greatest potential to act as advocates for open and inclusive community processes” (p.29). He goes on to say that planners must balance their roles as unbiased professionals and advocates for social and environmental justice (Hanna 2005).

In order for PPPs to be successful, it is imperative to have adequate governance structures in place. Without this element included within the sustainability model, environmental, social and economic goals will not be realized, and sustainable development, will in fact have the same fate as the other “urban utopias.” Therefore, I propose the sustainability triangle morph into a sustainability rectangle, so as to encompass this important aspect of sustainable development (Figure 4-1).

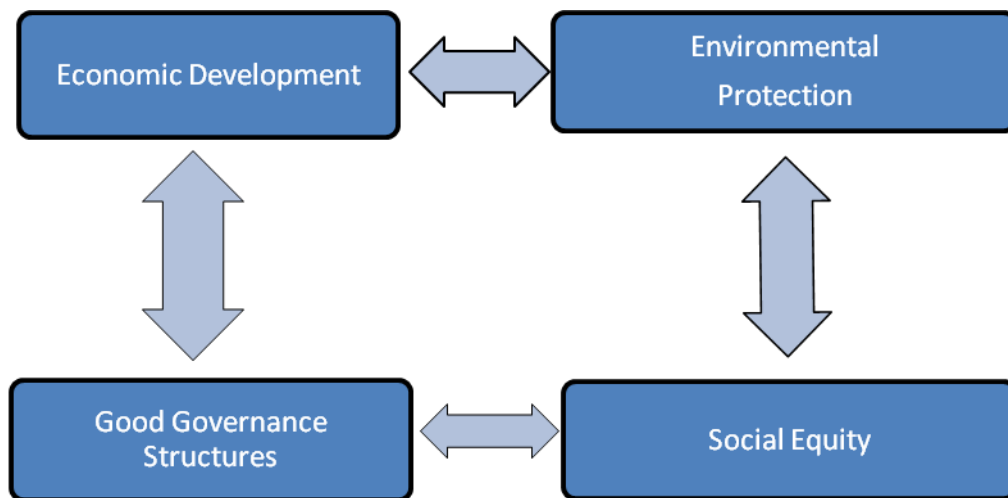


Figure 6-1. Sustainability rectangle: A new model for sustainable development.

Beyond Curitiba—Opportunities for Continued Research

While this case study has expanded upon the relationship between governance and the traditional pillars of sustainable development in the context of SWM, case

studies focusing on different aspects of sustainability are needed, such as the transportation example explained above. Exploring other geographical areas would also prove useful as culture has a significant effect on community interactions, and thus governance, in a public arena. What works in Brazil may not be applicable to Sierra Leone or India.

Assessing and analyzing adequate governance structures remains challenging. Although Agenda 21 and the MDGs provide frameworks for benchmarking and goal-setting in this realm, successful urban governance hinges on the peculiarities of specific communities. There is no single solution that can be applied universally. Having a series of case studies outlining best practices of cities that have experienced measures of sustainability success can provide insight into ways in which accomplishments can be quantified.

LIST OF REFERENCES

- Ahmed, S. A. and Ali, M. (2004). Partnerships for solid waste management in developing countries: Linking theories to realities. *Habitat International* 28(3), pp. 467-479.
- Ahmed, S.A. and Ali, M. (2006). People as partners: Facilitating people's participation in public-private partnerships for solid waste management. *Habitat International* 30(4), pp. 781-796.
- Andrews, C. W. and de Vries, M. S. (2007). High expectations, varying outcomes: Decentralization and participation in Brazil, Japan, Russia and Sweden. *International Review of Administrative Sciences* 73(3), pp. 424-451.
- Bava, S. C. and Mullahy, L. (1995). Making cities livable: Local initiatives in solid waste and public transportation management in Brazil. In C. A. Reilly (Ed.), *New Paths to Democratic Development in Latin America: The Rise of NGO-Municipal Collaboration* (pp. 99-117). Boulder: Lynne Rienner Publishers Inc.
- Berke, P. R. and Conroy, M. M. (2000). Are we planning for sustainable development?: An evaluation of 30 comprehensive plans. *Journal of the American Planning Association* 66(1), pp. 21-33.
- Berthier, H.C. (2003). Garbage work and society. *Resources, Conservation and Recycling* 39(3), pp.193-210.
- Brazilian Institute for Geography and Statistics (IBGE). (2012). Demographic Census 2010. Retrieved on September 30, 2012 from <http://www.ibge.gov.br>.
- Campbell, S. (1996) 'Green cities, growing cities, just cities?: Urban planning and the contradictions of sustainable development. *Journal of the American Planning Association* 62(3) pp. 296-312.
- Campbell, S. and Fainstein, S.S. (2003). *Reading in planning theory* (2nd Ed). Cambridge, MA: Blackwell Publishers.
- Chen. J. (2012). Curitiba: Brazil's easiest city to live in. *CommonWealth Magazine*, 502. (Sabatier, L., Trans.) Retrieved on September 30, 2012 from: <http://english.cw.com.tw/article.do?action=show&id=13717&offset=0>.
- Cointreau-Levine, S. (1994). *Private sector participation in municipal solid waste services in developing countries* (Urban management program discussion paper; UMPP no. 13). Washington, DC: The World Bank.

- Cointreau S. (2006). *Occupational and environmental health issues of solid waste management: Special emphasis on middle-and lower-income countries*. Washington, DC: The International Bank for Reconstruction and Development/The World Bank.
- CMI Brasil. (2006). *MNCR quer catadores/as operando um novo sistema de Reciclagem*. Retrieved on October 1, 2012 from: <http://www.midiaindependente.org/pt/blue/2006/05/353806.shtml>.
- CNN. (2010). *A model of urban planning*. Reported by Richard Quest. November 2010. Online video retrieved on January 20, 2012 from: <http://edition.cnn.com/video/?/video/business/2010/11/29/fc.curitiba.sustainable.city.cnn>
- CSD-Partners for Sustainable Development. (n.d.) Retrieved on April 2009 from: <http://webapps01.un.org/dsd/partnerships/public>.
- Cunha, D. (2008). Curitiba aposta na inclusão de catadores para reciclar 35% de seu Lixo total. *Revista Sustentabilidade*. Retrieved on January 16, 2008 from: <http://www.revistasustentabilidade.com.br>.
- Dias, S. M. (2006). *Waste and Citizen Forum—Achievements and limitations*. (Solid Waste, Health and the Millennium Development Goals, CWG-WASH Workshop Proceedings, Kolkata, India, February 1-5, 2006).
- Dziallo, R. (2006). *A critical analysis of the 'Green Exchange' program in Curitiba, Brazil*. (Unpublished paper from the University of Florida, Urban Planning in Brazil Study Abroad Program). Gainesville, FL: University of Florida.
- Earth Charter. (n.d.) *Experience of the Brazilian Ministry of the Environment in using the Earth Charter*. Retrieved on April 2009 at: http://www.earthcharterinaction.org/2007/02/experience_of_the_brazilian_mi.html.
- European Commission. 2007. *Brazil: Country strategy paper*. Retrieved on April 2009 from: http://ec.europa.eu/external_relations/brazil/csp/07_13_en.pdf.
- Fergutz, O., S. Dias and D. Mitlin. (2001). Developing urban waste management in Brazil with waste picker organizations. *Environment and Urbanization* 23(2), pp. 597-608.
- Fernandes, E. (2007). Constructing the 'Right to the City' in Brazil. *Social Legal Studies* 16(2). 201-219.
- Fernandes, J. (2007). Estima-se que 21% dos catadores morem em depósitos de lixo. *Gazeta Do Povo*. Retrieved on September 30, 2012 from: <http://www.gazetadopovo.com.br/vidaacidania/conteudo.phtml?id=719416>.

- Fishman, R. (1977). Urban utopias: Ebenezer Howard, Frank Lloyd Wright and Le Corbusier. In S. Cambell & S. Fainstein (Eds), *Reading in planning theory* (2nd Ed) (pp. 21-60). Cambridge, MA: Blackwell Publishers.
- Globe Award (2010) *The Brazilian city Curitiba awarded the Globe Sustainable City Award 2010*. Retrieved on January 20, 2012 from: <http://globeaward.org/winner-city-2010>.
- Gnatek, T. (2003). *PBS: Frontline World Project: BRAZIL-Curitiba's Urban Experiment*. Retrieved on January 23, 2012 from: <http://www.pbs.org/frontlineworld/fellows/brazil1203>.
- Gonzenback, B., Coad, A., Gupta, S. and Hecke, J. (2007). *Solid Waste Management and the Millennium Development Goals: Links That Inspire Action*. (CWG Publication Series No 3). St. Gallen, CH: CWG:Collaborative Working Group on Solid Waste Management in Low-and Medium-income Countries.
- Grist Magazine, Inc. (2007) *15 Green Cities*. Retrieved on January 23, 2012 from: <http://grist.org/cities/cities3>.
- Gutberlet, J. (2008). *Recovering Resources—Recycling Citizenship: Urban Poverty Reduction in Latin America*. Burlington: Ashgate.
- Halais, F. (2012). Has South America's most sustainable city lost its edge? *The Atlantic*. Retrieved on September 30, 2012 from : <http://www.theatlanticcities.com/commute/2012/06/has-south-americas-most-sustainable-city-lost-its-edge/2195>.
- Hall, P. (2002). *Cities of tomorrow* (3rd Ed). New York: Blackwell Publishers.
- Hanna, K.S. (2005). Planning for sustainability: Experiences in two contrasting communities. *Journal of the American Planning Association* 71(1), pp.27-40.
- Hoornweg D., Thomas, L and Otten, L. (1999). *Composting and its applicability in developing country,es*. (Working paper series). Washington, D.C.: the World Bank .
- Hoornweg, D. and P. Bhada-Tata (2012). *What a waste: a global review of solid waste management*. (Urban development series; knowledge papers no. 15.) Washington D.C.: the World Bank. Retrieved on September 1, 2012 from: <http://document.worldbank.org/curated/en/2012/03/16537275/waste-global-review-solid-waste-management>.
- Howard, E. (1898). *To-morrow: A peaceful path to real reform*. London: Swan Sonnecnchein.

- Irazábal, C. (2004). *Models of urban governance and planning in Latin America and the United States: Associationism, regime theory, and communicative action*. (Presented at the International Planning History Society Conference, "Planning Models and the Culture of Cities," Barcelona, Spain, July 14-18, 2004).
- Irazábal, C. (2005). *City making and urban governance in the Americas: Curitiba and Portland*. London: Ashgate.
- Jacobs, J. (1961). The death and life of great American cities. In S. Cambell & S. Fainstein (Eds), *Reading in Planning Theory* (2nd Ed) (pp. 61-74). Cambridge, MA: Blackwell Publishers.
- Jubanski, E. and B. Henrique (2012). Catadores de produtos recicláveis de Curitiba vão receber carrinhos elétricos até setembro. *Banda B*. Retrieved on September 30, 2012 from: <http://bandab.pron.com.br/jornalismo/catadores-de-produtos-reciclaveis-de-curitiba-va-receber-carrinhos-eletricos-ate-setembro-38795>.
- Lubow, A. (2007) *Recycle City—The Road to Curitiba*. Retrieved on January 16, 2008 from: <http://www.nytimes.com/2007/05/20/magazine/20Curitiba>.
- Macedo, J. (2000). *Land use policies and urbanization of informal settlements: Planning initiatives for environmental protection areas in Curitiba, Brazil*. (Doctoral dissertation). Retrieved on October 26, 2012 from University of Florida Etd: Theses & dissertations database at <http://uf.catalog.fcla>.
- Macedo, J. (2004). City Profile: Curitiba. *Cities* 21(6), pp. 537-549.
- Martins dos Anjos, G. (2008). Gerência de Limpeza, Departamento de Limpeza Pública, Secretaria Municipal do Meio Ambiente, (Presentation to University of Florida students, Curitiba, PR, Brazil, May 30, 2008).
- Medina, M. (2000). Scavenger cooperatives in Asia and Latin America. *Resources, Conservation and Recycling* 31(1), pp. 51-69.
- Medina, M. (2005). *Waste Picker Cooperatives in Developing Countries*. (Paper presented at the Women in Informal Employment: Globalizing and Organizing (WIEGO)/Cornell/SEWA Conference on Membership-Based Organizations of the Poor, Ahmedabad, India, January 2005).
- Moore, S. (2007). *Alternative Routes to the Sustainable City*. Lanham, MD: Lexington Books.
- Munasinghe, M. (1992). Environmental Economics and Sustainable Development, Paper presented at the UN Earth Summit, Rio de Janeiro, and reprinted by the World Bank, Washington D.C.

- ORBIS: Indicadores de Sustentabilidade. (n.d.) Retrieved on April 2009 from:
<http://www.orbis.org.br>.
- Paes, N., Silva, L., Ribas, G. and Calvallari, B. (2008). *Gerenciamento dos resíduos sólidos urbanos no município de Curitiba*. Prefeitura Municipal de Curitiba. Secretaria Municipal do meio Ambiente, Departamento de Limpeza Pública.
- Pattenden, Mary. (n.d.). *Global Implementation of Local Agenda 21*. Retrieved on April 2009 from: http://www.cityshelter.org/13_mobil/04tend.htm.
- Portal ODM: Acompanhamento Municipal dos Objetivos de Desenvolvimento do Milênio. (2009). Database. Retrieved on October 28, 2012 from www.portalodm.com.br.
- Prefeitura de Curitiba. (2010). *Plano de Gestão Integrada de Resíduos Sólidos*. Municipality of Curitiba.
- Prefeitura de Curitiba (n.d.-a) Portal da Prefeitura de Curitiba: *Região Metropolitana*. Retrieved on September 30, 2012 from: <http://www.curitiba.pr.gov.br/conteudo/regiao-metropolitana-de-curitiba/186>
- Prefeitura de Curitiba (n.d.-b). Portal da Prefeitura de Curitiba: *Secretaria Municipal do Meio Ambiente- Programa Compra de Lixo*. Retrieved on October 28, 2012 from: <http://www.curitiba.pr.gov.br/conteudo/compra-de-lixo-smma-secretaria-municipal-do-meio-ambiente/343>
- Prud'homme, R. (1995). The dangers of decentralization. *World Bank Research Observer* 10(2), pp. 201-220.
- Rabinovitch, J. (1992). Curitiba: Towards sustainable urban development. *Environment and Urbanization* 4(2), pp. 62–73.
- Sibley, A. (2007). World Summit on Sustainable Development (WSSD), Johannesburg, South Africa in *The Encyclopedia of Earth*. [First published in the Encyclopedia of Earth May 7, 2007; Last revised October 29, 2007;]. Retrieved on April 2009 from: [http://www.eoearth.org/article/World_Summit_on_Sustainable_Development_\(WSSD\),_Johannesburg,_South_Africa](http://www.eoearth.org/article/World_Summit_on_Sustainable_Development_(WSSD),_Johannesburg,_South_Africa).
- Spies, S. and Wehenpohl, G. (2006). *The informal sector in solid waste management—Efficient part of a system or marginal and disturbing way of survival for the poor?* (Collaborative Working Group (CWG) on Solid Waste Management in Low-and Middle-Income Countries; Selected Papers Presented at the Solid Waste, Health and the Millennium Development Goals Workshop at Kolkata, India, February 1-5, by CWG on Solid Waste Management in Low-and Middle-Income Countries).

- Stratos, Inc. (2004). Brazil case study: Analysis of national strategies for sustainable development in *National Strategies for Sustainable Development: Challenges, Approaches, and Innovations Based on a 19-country Analysis*. Retrieved on April 2009 from: http://www.iisd.org/pdf/2004/measure_sdsip_brazil.pdf.
- Sustainable Cities. (n.d.) *Curitiba: The Green Capital*. Retrieved on January 23, 2012 from: <http://sustainablecities.dk/en/city-projects/cases/curitiba-the-green-capital>.
- Tamashiro, E. (2007). A model of organization, development and economic inclusion of recyclable materials pickers. *Change Makers*. Blog retrieved on September 30, 2012 from: <http://www.changemakers.com/es/competition/freedom/entries/model-organization-development-and-economic-inclusion>
- Tyler, C. (2011). Scavengers cash in on illegal recycling around SF. *San Francisco News*. (ABC7News, 9 Feb. 2011). Retrieved on September 9, 2012 from: http://abclocal.go.com/kgo/story?section=news/local/san_francisco&id=7949895
- UN (1992). *Earth Summit-Agenda 21: The United Nations Programme of Action from Rio*. (UN Conference on Environment and Development (UNCED): June 3-14, 1992). Retrieved on February 16, 2009 from: http://www.un.org/esa/dsd/agenda21/res_agenda21_21.shtml
- UN. United Nations Department of Economic and Social Affairs: Division for Sustainable Development. (n.d.) Retrieved on April 2009 from: http://www.un.org/esa/dsd/csd/csd_multyearprogwork.shtml.
- UN. Environment Program (n.d.) Retrieved on February 11, 2009 from: www.unep.org.
- UN. Earth Summit + 5 Round-up Press Release (1997). Published by the United Nations Department of Public Information - DPI/1916/SD. Retrieved on April 2009 from: <http://www.un.org/ecosocdev/geninfo/sustdev/es5final.htm>.
- UN. (2008). *World Urbanization Prospects: The 2007 Revision Population Database*. Retrieved on November 9, 2011 from: <http://www.esa.un.org/unup>.
- UN. (2010). *Review of the implementation of Agenda 21 and the Johannesburg Plan of Implementation: waste management—Report to the Secretary General*. (Commission on Sustainable Development: Eighteenth session).
- USEPA. (2011). *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*. Retrieved on November 7, 2011 from: <http://www.epa.gov/osw/nonhaz/municipal/pubs/msw2009-fs.pdf>

- Vassoler, I. (2003). *Urban visions: Lessons in governance from two Brazilian cities*. (In MACLAS: Journal Essays, vol. XVII: Selected papers presented at the 24th annual conference of the Middle American Council for Latin American Studies at Kutztown University, February 21-22, 2003). Kutztown, PA: Kutztown University- Middle Atlantic Council for Latin American Studies.
- Vassoler, I. (2007). *Urban Brazil: Visions, Afflictions, and Governance Lessons*. Amherst: Cambria Press.
- WIEGO. (n.d.) *Informal Workers in Focus: Waste Pickers in Brazil*. Retrieved on October 26, 2012 from: <http://wiego.org/sites/wiego.org/files/resources/files/Fact-Sheet-Waste-pickers-Brazil.pdf>.
- Wilson, D., Velis, C. and Cheeseman, C. (2006). Role of informal sector recycling in waste management in developing countries. *Habitat International* 30(4), pp. 797-808.
- World Habitat Awards. (n.d.) *Previous Winners and Finalists: Urban Management in Curitiba-Building Full Citizenship*. Retrieved on January 24, 2012 from: <http://worldhabitatawards.org/winners-and-finalists/project-details.cfm?!ang=00&theProjectID=58>.
- Yin, R.K. 2003. *Case Study Research: Design and Methods* (3rd ed.) Thousand Oaks, CA: Sage Publications, Inc.
- Yousif, D. and Scott, S.D. (2007). Governing solid waste management in Mazatenano, Guatemala: Problems and prospects. *International Development Planning Review* 29(4), pp. 433-450.

BIOGRAPHICAL SKETCH

Shani Kruljac received her undergraduate degree, a B.A. in Environmental Science, from the University of Florida in 1999. Upon graduation, she volunteered one year with AmeriCorps Vista, and then worked in water issues, first as a watershed management coordinator with the Soil and Water Conservation Districts of Etowah and St. Clair Counties, Alabama, and then as the Lakes Program Coordinator with the City of Lakeland, Florida. She returned to the University of Florida in 2006 to study Urban and Regional Planning and Latin American Studies. While pursuing her master's degree, she received two Foreign Language and Areas Studies (FLAS) Fellowships to study Portuguese—one in June 2007 to attend Middlebury College's summer language program at the Portuguese School, and the other to continue her Portuguese studies during the 2007-2008 academic year at the University of Florida. She also worked as an intern during this time with the University of Florida College of Engineering's Hinkley Center for Solid and Hazardous Waste Management, where she coordinated a study looking at regional solid waste management practices in several north central Florida counties. Shani received her Master of Arts in Urban and Regional Planning with a Certificate in Latin American Studies in 2012 and now works as an environmental consultant specializing in solid waste management issues.