Handling Solid and Hazardous Waste by Waste Pickers:

A Case Study of Phnom Penh, Cambodia

by

Gina Chhun

A Thesis Presented in Partial Fulfillment of the Requirements for the Degree Master of Science in Technology

Approved November 2010 by the Graduate Supervisory Committee:

Mary Jane Parmentier, Chair
Gary Grossman
Chuthatip Maneepong

ARIZONA STATE UNIVERSITY

May 2012
ABSTRACT

The handling of waste encompasses the following processes: recycling, collection, treatment, and disposal. It is crucial to provide a cost-effective waste management system that improves public health and reduces environmental risks. In developing countries, proper handling of solid and hazardous wastes remain severely limited in urban cities if the industries and hospitals producing it do not take responsibility. Recycling and reusing of 12% of total waste in Phnom Penh is an active industry in Cambodia, driven by an informal network of waste pickers, collectors, and buyers.

This thesis examines the environmental situation of solid and hazardous wastes in Phnom Penh. The socio-economic background of waste pickers and their current practices for handling solid and hazardous wastes will be mainly discussed in order to understand health and sanitation impacts and risks for disposal of solid and hazardous waste by these informal waste pickers. Surveys and interviews with the following sources are conducted: waste pickers, community members, observation at local dumpsites, governmental officials, and other non-government organization agencies in Phnom Penh, Cambodia.

This thesis reports the external and internal factors that hinder safety and cost-effective management for disposal of solid and hazardous wastes. Multiple literature reviews are assessed in regards to the health effects, economic, and social impacts in developing countries. Evidentially, after attending several training and environmental awareness-raising programs, waste pickers expressed concerns about their health and the environment. Instead of receiving support,
waste pickers are under economic pressure to use improper tools for waste picking, to stop working, get access to health care/service, to change their career, and prevent contact to limit serious communicable diseases and disability.

As a result, the government and other related government agencies have made an effort to establish sanitation handling, treatment, and disposal systems by closing the old dumpsite. Due to limited entrepreneurship and business experience after training, most waste pickers cannot initiate micro business or find new jobs and then resume their waste picking. In conclusion, this thesis proposed that there are alternative technologies and management methods that will allow waste pickers to maintain employment while minimizing hazardous waste. Some examples of alternatives for waste pickers are establishing a material recovery center and alternative higher income occupation.
DEDICATION

For my parents and family, who inspired and taught me to see.

And for the people of Cambodia
ACKNOWLEDGMENTS

This thesis would not have been possible without the generous help and support of a number of individuals. Dr. Mary Jane Parmentier, my thesis committee chair, Faculty of the Global Technology and Development (GTD) program and Senior Lecturer in the School of Letters and Sciences at Arizona State University for her thorough comments and suggestions and kind understanding that have assisted me with my study. Dr. Gary Grossman, my thesis committee member, Faculty Chair of the Global Technology and Development (GTD) program and Associate Professor in the School of Letters and Sciences at Arizona State University with his insightful comments and encouragement about my proposal and thesis. Dr. Chuthatip Maneepong, my thesis committee member, Visiting Assistant Professor in School of Politics and Global Studies, Arizona State University has been a great source of support and encouragement. I am deeply grateful to her helpful guidance, comments, enthusiasm and insightful discussions at the various stages of my thesis as well as editing of my thesis.

The survey research in Phnom Penh, Cambodia would not have happened without the help of Mr. Mathew Suthea Kun, Senior Technology Specialist in the Planning and Development Department, City of Phoenix for his assistance in translating my survey and interview questionnaires to Khmer language. I also appreciate his time in helping locate the Community Sanitation and Recycling Organization (CSARO) and the waste development community. I very much appreciate the discussion and advice from Mr. Heng Yon Kora, Program Director,
of Community Sanitation and Recycling Organization. I wish to thank the CSARO staff for their kind support and assistance in organizing the waste pickers for us to conduct interviews.

My appreciation is extended to Dr. Monique Chhun and Dr. Garrett Lum for assisting with final editing of this thesis. Their encouragement and support are greatly appreciated. They helped me throughout my studies. Further thanks to officials of Office for Ministry of Environment and Department of Environment in Phnom Penh Municipality for their time and support in supplying the facts needed for my survey and for their influential connections to significant information and access to data. I would like to extend my sincere appreciation to my student assistants, Srey Leak Kun for her great assistance in collecting data in the field and her translation of Khmer documents and Sophany Kun for her assistant in the interviews.

Lastly, I would like to thank my parents (Andy Thai Chhun and Kim Seng Neav) who inspired and taught me to see the world and to my sisters (Terri and Monique), my brothers (Thy, John, and Chris), my brother-in-laws (Kevin and Garrett), my nephews (Anthony, Ronny, George, Kaleb, Marty, Mike, Ryker), my niece Lily, and my husband Mathew and my sons Dean and Aaron for their understanding, support, and encouragement while completing my study. I dedicate this thesis to them.
# TABLE OF CONTENTS

| LIST OF TABLES | xi |
| LIST OF FIGURES | xii |
| LIST OF DIAGRAMS | xiii |
| LIST OF PHOTOS | xiv |
| LIST OF MAPS | xv |

## CHAPTER

1. INTRODUCTION .......................................................................................................................... 1
   1.1 Purpose .......................................................................................................................... 2
   1.2 Objectives ...................................................................................................................... 2
   1.3 Statement of Problem ................................................................................................. 3
   1.4 Significant of Problem ............................................................................................... 5

2. LITERATURE REVIEW .................................................................................................................. 7
   2.1 Current Waste Management in Developing Countries ........................................... 7
   2.2 Role of waste pickers ................................................................................................. 9
   2.3 Factors contributing or hindering sanitation handling of hazardous waste by waste pickers from international experiences .......................................................................................................................... 12
   2.3.1 External Factors – At the implementation level ................................................. 12
   2.3.1.1 Coordination between public/private, NGO and community in supporting was pickers’ occupation ................................................................. 12
<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3.1.2 Garbage segregation at source</td>
<td>15</td>
</tr>
<tr>
<td>2.3.2 External Factors – At the policy level</td>
<td>18</td>
</tr>
<tr>
<td>2.3.2.1 Inclusive policy in a modernization approach by changes or improvement of waste management system and providing new job opportunities for waste pickers</td>
<td>18</td>
</tr>
<tr>
<td>2.3.2.2 Advocacy and enforcement on no work and live in dumpsites by waste pickers</td>
<td>22</td>
</tr>
<tr>
<td>2.3.3 Internal Factors that seems to be common practices among government, NGO, donors, and others</td>
<td>25</td>
</tr>
<tr>
<td>2.3.3.1 Awareness of health hazards of community and waste pickers</td>
<td>25</td>
</tr>
<tr>
<td>2.3.3.2 Self-help/community groups</td>
<td>27</td>
</tr>
<tr>
<td>2.3.3.3 Financial supports</td>
<td>28</td>
</tr>
<tr>
<td>2.3.3.4 Technical supports</td>
<td>30</td>
</tr>
<tr>
<td>2.4 Gap of Knowledge</td>
<td>31</td>
</tr>
<tr>
<td>2.5 Key research questions</td>
<td>32</td>
</tr>
<tr>
<td>3 CASE STUDY OF PHNOM PENH</td>
<td>34</td>
</tr>
<tr>
<td>3.1 Introduction</td>
<td>34</td>
</tr>
<tr>
<td>3.2 Government policy and plan on Hazardous Waste in Phnom Penh</td>
<td>36</td>
</tr>
<tr>
<td>3.3 Involvement of other agencies or stakeholders</td>
<td>38</td>
</tr>
<tr>
<td>3.4 Involvement of Waste Pickers</td>
<td>43</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>Page</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>3.5 Selecting the study area</td>
<td>46</td>
</tr>
<tr>
<td>3.5.1 Research Method One</td>
<td>46</td>
</tr>
<tr>
<td>3.5.2 Research Method Two</td>
<td>47</td>
</tr>
<tr>
<td>3.6 Brief Description of the Interview Questionnaire</td>
<td>47</td>
</tr>
<tr>
<td>3.6.1 Interview of the waste pickers</td>
<td>47</td>
</tr>
<tr>
<td>3.6.2 Interview Questionnaire for governemnt officials and other stakeholders</td>
<td>49</td>
</tr>
<tr>
<td>4    THEORETICAL FRAMEWORK</td>
<td>50</td>
</tr>
<tr>
<td>4.1 Basic Principal</td>
<td>51</td>
</tr>
<tr>
<td>4.2 Hazardous waste minimization techniques</td>
<td>54</td>
</tr>
<tr>
<td>4.2.1 Source reduction or minimization</td>
<td>55</td>
</tr>
<tr>
<td>4.2.2 Hazardous waste recycling</td>
<td>57</td>
</tr>
<tr>
<td>4.3 Hazardous Waste Worker Health and Safety</td>
<td>60</td>
</tr>
<tr>
<td>4.4 Good practices on disposal hazardous waste from other developing countries or UN</td>
<td>61</td>
</tr>
<tr>
<td>4.5 Measurement/measures on cost-effective management from other developing countries or UN</td>
<td>63</td>
</tr>
<tr>
<td>5    DATA ANALYSIS</td>
<td>66</td>
</tr>
<tr>
<td>5.1 Description of the interviewed waste pickers</td>
<td>66</td>
</tr>
<tr>
<td>5.2 What benefit/revenue from being waste pickers?</td>
<td>68</td>
</tr>
<tr>
<td>5.3 What risks waste pickers face?</td>
<td>69</td>
</tr>
<tr>
<td>5.4 Health, economic, and social impacts</td>
<td>72</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>PAGE</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>5.5 How much do waste pickers know about hazardous waste?</td>
<td>74</td>
</tr>
<tr>
<td>5.6 How do waste pickers protect themselves?</td>
<td>75</td>
</tr>
<tr>
<td>5.7 Official and other stakeholders’ attitudes on hazardous waste and waste pickers</td>
<td>77</td>
</tr>
<tr>
<td>6 CONCLUSION</td>
<td>82</td>
</tr>
<tr>
<td>6.1 Introduction</td>
<td>82</td>
</tr>
<tr>
<td>6.2 Key Findings</td>
<td>83</td>
</tr>
<tr>
<td>6.3 Factors contributing to or hindering safe and cost-effective management and disposal hazardous waste from current practices</td>
<td>86</td>
</tr>
<tr>
<td>6.3.1 External Factors</td>
<td>87</td>
</tr>
<tr>
<td>6.3.2 Internal Factors</td>
<td>90</td>
</tr>
<tr>
<td>6.4 Current impacts of no change in external factors</td>
<td>93</td>
</tr>
<tr>
<td>6.4.1 Conceptual Policy Problems</td>
<td>93</td>
</tr>
<tr>
<td>6.4.2 Administrative and Implementation Problems</td>
<td>95</td>
</tr>
<tr>
<td>6.5 How to improve both external and internal factors?</td>
<td>97</td>
</tr>
<tr>
<td>6.5.1 Suggestion for Phnom Penh City and Cambodia</td>
<td>97</td>
</tr>
<tr>
<td>6.5.1.1 Strengthen policy framework</td>
<td>98</td>
</tr>
<tr>
<td>6.5.1.2 Enforce implementation goals</td>
<td>99</td>
</tr>
<tr>
<td>6.5.1.3 Increase awareness in sanitation handling of solid and hazardous waste</td>
<td>100</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>6.5.2 Suggestion for other developing countries</td>
<td>101</td>
</tr>
<tr>
<td>6.6 Suggestions for future studies</td>
<td>103</td>
</tr>
</tbody>
</table>

| REFERENCES                                                             | 105  |

<table>
<thead>
<tr>
<th>APPENDIX</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A Waste Picker survey – english version</td>
<td>111</td>
</tr>
<tr>
<td>B Waste Picker survey – khmer version</td>
<td>117</td>
</tr>
<tr>
<td>C Survey for minitry, municipality, and ngo – english version</td>
<td>125</td>
</tr>
<tr>
<td>D Survey for minitry, municipality, and ngo – khmer version</td>
<td>130</td>
</tr>
<tr>
<td>E IRB Approval Letter</td>
<td>135</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Common Household Hazardous waste</td>
<td>53</td>
</tr>
<tr>
<td>5.1</td>
<td>Hazardous conditions waste pickers encountered</td>
<td>70</td>
</tr>
<tr>
<td>5.2</td>
<td>Health problems in past 6 months</td>
<td>71</td>
</tr>
<tr>
<td>5.3</td>
<td>Percent of interviewers reporting waste pickers’ awareness on hazardous waste</td>
<td>74</td>
</tr>
<tr>
<td>5.4</td>
<td>Percent of interviewers reporting on protective items worn by waste pickers during waste collecting</td>
<td>76</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Rapid growth experienced in Cambodia is unusual</td>
<td>3</td>
</tr>
<tr>
<td>2.1</td>
<td>Household waste management process</td>
<td>17</td>
</tr>
<tr>
<td>3.1</td>
<td>Waste Picking Operation Chart in Phnom Penh, Cambodia</td>
<td>46</td>
</tr>
<tr>
<td>4.1</td>
<td>Sustainable development and the waste management principles</td>
<td>52</td>
</tr>
<tr>
<td>4.2</td>
<td>Waste minimization techniques</td>
<td>54</td>
</tr>
<tr>
<td>5.1</td>
<td>Waste picker’s income per day in Phnom Penh</td>
<td>68</td>
</tr>
<tr>
<td>5.2</td>
<td>Waste picker’s additional income in Phnom Penh</td>
<td>69</td>
</tr>
</tbody>
</table>
LIST OF DIAGRAMS

<table>
<thead>
<tr>
<th>Diagram</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Phnom Penh Municipality Vision</td>
<td>36</td>
</tr>
<tr>
<td>6.1</td>
<td>Dilemma at Present in Phnom Penh</td>
<td>94</td>
</tr>
</tbody>
</table>
LIST OF PHOTOS

<table>
<thead>
<tr>
<th>Photo</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Stung Meanchey dumpsite</td>
<td>39</td>
</tr>
<tr>
<td>3.2</td>
<td>Waste pickers at Stung Meanchey</td>
<td>39</td>
</tr>
<tr>
<td>3.3</td>
<td>Smokey mountain at Stung Meanchey dumpsite</td>
<td>45</td>
</tr>
<tr>
<td>3.4</td>
<td>Girl picking waste with hand fork</td>
<td>45</td>
</tr>
<tr>
<td>3.5</td>
<td>Interviewed at Stung Meanchey dumpsite</td>
<td>48</td>
</tr>
<tr>
<td>3.6</td>
<td>Waste pickers interviewed at Sensok community</td>
<td>49</td>
</tr>
<tr>
<td>5.1</td>
<td>Home nearby Stung Meanchey dumpsite</td>
<td>72</td>
</tr>
<tr>
<td>5.2</td>
<td>The kind of clothing and protective items worn by waste pickers at Stung Meanchey dumpsite</td>
<td>77</td>
</tr>
<tr>
<td>5.3</td>
<td>Handicrafts products include photo frames, bags and others made by waste pickers CSARO</td>
<td>80</td>
</tr>
<tr>
<td>5.4</td>
<td>More handicrafts products include photo frames, bags and rugs made by waste pickers at CSARO</td>
<td>81</td>
</tr>
<tr>
<td>6.1</td>
<td>CSARO advertising steps to composting</td>
<td>90</td>
</tr>
</tbody>
</table>
# LIST OF MAPS

<table>
<thead>
<tr>
<th>Map</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Map of Cambodia</td>
<td>34</td>
</tr>
<tr>
<td>3.2</td>
<td>Phnom Penh, Cambodia</td>
<td>35</td>
</tr>
</tbody>
</table>
Chapter 1

INTRODUCTION

In many urban cities of the developing world, the rapid growth in population and industry has led to an increase in the use of materials capable of producing hazardous wastes. Waste is invariably produced wherever human beings carry out economic activities and different materials are used. Such waste can be hazardous or non-hazardous. When waste is not properly handled, it can threaten the atmosphere, the water, soil, and the living organisms (UNEP, 1999). While waste disposal has been practiced in various forms for centuries, environmentally sound waste management is a much more recent activity.

This is seen most commonly in mining, industrial, agriculture, education, and trade and health sectors (UNEP, 2002). Consequently, this increase has led to the degradation of the environment and threatens human health and well-being. Waste is being increasingly generated in homesteads and other locations. Although some of this waste is considered non-hazardous, it can pose health and environmental risks if accumulated over time. It is difficult to control waste management because the urban centers in some developing countries continue to produce waste in the rapid rate.

Waste management is a major responsibility of local government, typically consuming between 30% to 50% of municipal budgets in developing countries (Zerbock, 2003). It is a complex task depending as much upon organization and cooperation between communities, private organizations, government authorities, and households as it does depends on the application of
appropriate technical solutions for waste collection, transportation, disposal, and recycling (UNEP, 2002). In particular, in developing countries, due to overloading capacity of local government authorities and unpopular practice of waste segregation, recycling of waste provides jobs and income to many of the urban poor.

1.1 Purpose

The purpose of this study is to investigate the sanitation and health risks and impacts issues related to the handling of solid and hazardous wastes for the Cambodian waste pickers in Phnom Penh.

1.2 Objectives

The main objective of this study is to address the current solid and hazardous waste management issues by informal waste pickers by:

- Identifying factors contributing to or hindering sanitary handling of solid and hazardous waste;
- Proposing the guidelines for improving sanitary handling of solid and hazardous waste;
- Discussing policy implications for better leader attitude on sanitary handling of solid and hazardous waste.

This study attempts to examine the environmental situation of solid and hazardous waste in Phnom Penh, socio-economic background of waste pickers and their current practices on handling solid and hazardous waste, and health risks and sanitation impacts of disposal waste by informal waste pickers.
1.3 Statement of Problem

Since 1998, Cambodia has experienced an unusual period of rapid economic growth. It is unusual given the country’s difficult history and the global experience of development (Figure 1.1). In fourteen consecutive years, from 1998 to 2007, Cambodia has achieved seven percent average annual growth. This growth performance rank sixth across all countries in the world (World Bank, 2009).

Figure 1.1: Rapid growth experienced in Cambodia is unusual (World Bank, 2009)

In recent years, this growth has brought with it challenges and problems that Cambodia is struggling to address. Among these are environmental problems, which often result from industrialization. Cambodia has experienced a high rate of economic growth through its industrialization process, particularly in the area of agriculture, construction, garment, and tourism. It has more than doubled its income per capita over the past decade, from US$285 in 1997 to
US$593 in 2007 (World Bank, 2009). This growth and accelerated urbanization in Phnom Penh and Siem Reap has created immense pressure on the urban environment.

As the result of this growth, Phnom Penh has become more integrated into the global economy, and the demand for recycled and reused waste increased. Previous studies have indicated that a relationship exists between the improper handling of solid and hazardous wastes and increased health risk. Studies of waste pickers in countries such as China, India, and Vietnam have identified waste pickers as a high risk group for poor individual and public health (World Bank, 2004).

At the same time, the inability of the government to provide adequate waste collection services for all of Phnom Penh has lead to a polluted environment, inevitably leading to negative health effects. The handling of waste, including recycling, collection, treatment and disposal, is crucial to providing a cost-effective waste management system that is able to reduce public health and environmental risks (World Bank, 2004). Unfortunately, most of the municipal waste in Cambodia is not safely disposed. Though there have been significant improvements by the community and private organizations responsible for waste collection and disposal. Proper handling of solid and hazardous waste will remain severely limited when the industries and hospitals producing it do not take responsibility. Recycling and reusing at least 12% of total waste in Phnom Penh is an active industry in Cambodia, driven by an informal network of waste pickers, waste collectors, and waste buyers.
1.4 Significance of the problem

In the wake of increased urbanization in the large cities of Cambodia, the ever-increasing quantities of waste have overwhelmed local government’s capabilities to cope efficiently. The infectious medical wastes and toxic industrial wastes are not segregated from domestic waste (with the probable exception of radioactive materials), exposing the waste pickers to a wide array of risks (Cointreau, 2006). Even when segregated from other wastes, they are often placed in large waste rooms that must be emptied manually by workers with picks and shovels without proper sanitation handling system.

Waste pickers make their living sorting and recycling secondary materials. They encounter high occupational health risks, including contact with human fecal matter, paper that may have become saturated with toxic materials, bottles with chemical residues, metal containers with residue pesticides and solvents, needles and bandages (containing pathogenic organisms) from hospitals, and batteries containing heavy metals. Exhaust fumes of waste collection trucks traveling to and from disposal sites, dust from disposal operations, and open burning of waste contribute further to occupational health problems (Cointreau, 2006).

To address Cambodia’s waste management issues, researchers must also examine the people behind the work. Gaining insight into the lives of the waste pickers will result in a broad understanding of social and economic advantages for Cambodia. Communities, governments, NGOs, policy makers, and researchers
need to understand the role that waste pickers play, not only in waste management and public health in Cambodia, but also in society at large.

Cambodia faces major challenges in dealing with the increasing amount of municipal, healthcare, and hazardous wastes. The country has responded with a sound legal framework, an aggressive investment plan, and an emphasis on improving local services, especially in major cities like Phnom Penh and Siem Reap. However, achieving the goal of safe and cost-effective management and disposal of waste will remain a major challenge, requiring concerted efforts by governments, industries, hospitals, waste operators, and individuals. Without taking the necessary measures to establish effective handling, treatment, and disposal systems, the growing quantities of waste may have various impacts, from increased health risks to environmental degradation (World Bank, 2004).
Chapter 2

LITERATURE REVIEW

This chapter reviews current waste management in developing countries and the role of waste pickers. To understand the current situation, it identifies factors contributing or hindering sanitation handling of hazardous waste by waste pickers from international experiences. Then gap of Knowledge and key research questions are raised.

2.1 Current Waste Management in Developing Countries

The recycling industry provides employment opportunities to a large number of workers, especially to the urban poor in developing countries. In the hierarchy of informal occupations, waste picking is ranked lowest (Sankaran et al., 2008). In developing countries, a significant portion of the waste pickers found at open dumps are children and women (Cointreau, 2006). However, waste pickers are just like other poor people, often not properly appreciated by society. Despite their very important role in waste management chains throughout the world, waste pickers are often considered social outcasts (Langenhoven & Dyssel, 2007). In this study “informal recycler” refers to waste pickers, scavengers or collectors who make a living by recycling waste.

Mitchell (2008) explored the experiences of informal waste collectors (waste pickers and junk buyers) in Hanoi, Vietnam. She argued that Vietnam’s globalizing economy and urban transition have been a catalyst for the growth of the informal waste collector population in Hanoi and also play a partial role in the gendering of this group and the work the collectors undertake. On average,
female waste pickers are producing the same amount of income and working the same amount of hours as men. More women and children are seen in waste collection in developing countries due to the growth of the urban economy and availability of new gendered occupations.

Recycling takes the form of scavenging, the primary work of which is done by poor and socially disadvantaged individuals known as waste pickers. Women and children often comprise the majority of waste pickers in developing countries. In Cambodia, about 70% of waste pickers are children (CSARO, 2007). Waste pickers make a living by selling materials they collect from dumpsites, waste bins, waste shops, streets, and roadides. Typically, these wastes come from domestic, industrial and commercial sources (Hunt, 1996).

Waste pickers work 14 hours per day and can earn up to 4000 Cambodian riels ($1 US) per day scavenging plastic, glass, metal, and anything that can be sold to recycling companies. Earning barely a penny an hour, they put themselves at incredible health and safety risks (“The Garbage”, n.d.). Health surveys indicate that their health status is poor and their life expectancy falls far below the national averages (Cointreau, 2006). The risk is greatest in developing countries due to increased exposure because waste pickers do not have adequate tools or handling methods to deal with the waste. Based on health studies conducted in India, waste pickers suffer from occupation related musculo-skeletal, respiratory, and gastro-intestinal problems (Sankaran et al, 2008). The most common diseases among waste pickers include tuberculosis, bronchitis, asthma, pneumonia, dysentery, parasites and malnutrition (Wilson et al., 2006).
2.2 Role of waste pickers

Waste pickers play a fundamental role in areas lacking sufficient waste management and waste recycling systems. First, municipal systems are only able to handle a fraction of the waste generated in a city, and excessive waste is ultimately processed by waste pickers. For example, in Indonesia, it is estimated that waste pickers decrease total urban waste by one-third. In Mexico, it is estimated that waste pickers remove 10% of municipal waste. In Bangalore, India, waste-pickers prevent 15% of the municipal waste from going to the dumpsite.

Secondly, informal waste pickers benefit society and the environment because their recycling activities result in raw materials being used less intensively in production and manufacturing. Accordingly, the availability of a variety of natural resources is preserved. For example, if the waste papers collected and recycled by waste-pickers were not supplied to the recycling process, paper mills would be forced to increase the use of pulp made from timber. Using virgin pulp would encourage the falling of forests, exacerbating the incidence of flood and soil erosion. By using recycled materials, the operating costs of a paper mill consuming waste papers are a fraction of those of a plant using raw pulp (Madsen, 2006).

In addition to the clear environmental value of waste picking, there are also important social and economic contributions to society at large. Waste picking provides income to migrants from rural areas that tend to earn much less in their home villages. It also enables the poorest citizens to meet some of their
basic needs, such as collecting wood or other household items, without having to purchase such products (Moreno-Sanchez, 2002). Lastly, the activities of waste pickers reduce the public costs of cities' overall waste management strategies by reducing the amount of waste that needs to be collected, transported, and disposed. This results in cost savings for local governments and extends the life of dumps and landfills in developing cities.

Currently, most waste-pickers engage in the strategy of picking through waste materials and delivering these materials to another party for reprocessing or recycling. Waste pickers often are not involved in the reprocessing and recycling strategies because these processes involve larger investments and more complex schemes (Gonzales, 2003). During the initial stage, garbage trucks collect waste from the source, at which point the truck crews sort out the recyclable items. These items are dropped off at junk shops along the way to the dumpsite so that the crews can earn extra income to supplement their low wages. As the trucks enter the waste site, young boys are often hired by junk shop owners to jump onto the back of the truck to search for valuable items. Inside the entrance of the actual dumpsite, waste pickers await to pick through the remaining garbage as it is dumped off the truck. On the other hand, some waste pickers rely on more tedious but less competitive strategies. They go to sites that have been leveled by bulldozers and look for valuable garbage that may be inadvertently unearthed. Unfortunately, it is possible for these waste pickers to be crushed by the bulldozers, demonstrating another danger of the job.
In the final stage, waste pickers sort through the remaining garbage looking for the ash for metal and other valuable items. These waste pickers often cover the areas of the dumpsite that have been burned or are still burning. Some waste pickers remove whole clumps of ash and use waterways to clean off the ash in search of any overlooked valuable items. Paradoxically, while this is the least prosperous waste picking activity, it is also the most dangerous. These waste pickers are continuously subjected to harmful smoke, flame, and fumes from the smoldering garbage. Thus, those who gain the earliest access to recyclable materials have the greatest success. In comparison, those who get the "leftovers" receive the least gains and experience the greatest dangers (Gonzales, 2003).

Junk shops provide waste pickers with a venue to sell their scavenged items to the recycling market. These junk shops serve as middlemen and are often the cause of waste pickers' low incomes because they grossly exploit waste pickers by paying exceptionally low prices for items. Furthermore, the owners of the junk shops typically work close to the waste sites in order to capitalize on volume, quality, and transportation of waste products, further maximizing their profits (Gonzales, 2003). Waste pickers generally consider these junk shops to be opportunists as the shops often decrease prices, monopolize information, and control the waste pickers’ access to the dumpsites. On the contrary, without the existence of such shops, waste pickers would have no market in which to sell their scavenged items.
2.3 Factors contributing or hindering sanitation handling of hazardous waste by waste pickers from international experiences

Hazardous and solid waste management has now become a global issue. Researchers have proposed a number of technological options as viable alternatives for appropriate management and disposal of waste. These studies have significantly established the fact that waste management is not just a technical issue (UNEP, 2003) but has socio-political, economic, and cultural dimensions that need solving through a network of different stakeholders including, but not limited to, public and private organizations, community-based organizations, government, NGOs, and the informal sector.

Many developing countries do not have appropriate regulations or do not enforce the sanitary handling of hazardous waste. An essential issue is the clear attribution of responsibility for appropriate handling and disposing of waste (WHO, 2007). The most common problems connected with hazardous waste include the absence of waste management, lack of awareness about the health hazards, insufficient finance, human resources (staff with technical knowledge), and poor control of waste disposal.

2.3.1 External Factors - At the implementation level:

2.3.1.1 Coordination between public/private, NGO and community in supporting waste pickers’ occupation

Numerous comparative studies have been conducted that contrast similar public and private corporations. Ahmed and Ali (2004) investigated the public and private sector of waste management systems and found a direct correlation
between the way a resource is managed and the socio-economic conditions of people associated with the resource. In order to reflect in depth interactions between urban poverty and waste management, more inferences have been given to the urban poor. The purpose of Ahmed and Ali’s study was to understand the impact of urban environmental degradation on the welfare of the poor and to find out how they were coping with this degradation. Lee (1994) suggested that the provision of support by external NGO’s has shown great potential in assisting low-income communities in terms of empowerment and addressing environmental issues. For the longer term, she stated that the increasing activism of indigenous NGO’s in mobilizing community collective efforts represents a significant source of outside support.

Klundert and Lardinois (1995) argued that a top down approach to community development is not effective or sustainable. They state that positive and sustainable results are beyond the reach of even an intervention agency with the best intentions in developing countries. Neither municipalities, the formal and informal private sectors, NGOs, nor the community can solve waste problems on their own. However, they noted that forming partnerships between a mixture of private, public, and community involvement, both formal and informal, can be the most successful approach in strengthening urban environmental management.

Rathi (2006) explored two alternative approaches to waste management and estimated the cost in Mumbai, India. In her comparison of community participation and public private partnership, she found the cost per ton of waste management is 1518 Indian Rupee (INR) (US$30) with community participation
and 1797 Indian Rupee (INR) (US$35) with public private partnership (PPP).
According to this study, community participation in waste management is the
most cost effective; which makes a strong case for comprehensive community
participation in waste management. Mockler (1998) studied community-based
waste management systems in Indonesia. Her findings indicated that the scale of
projects varied from household level waste separation for composting and
recycling to small-medium scale neighborhoods. She suggested that these
projects and research studies addressed the following: technical aspects of
community based composing, management, economic feasibility, self-funding
mechanisms, and how to link household level actions with the primary and
secondary solid waste collection system successfully. Unfortunately, she noted
that in Jakarta, out of the 15 projects focused on household waste separation for
composting and recycling, only four have survived. Due to lack of financial
incentive, most households did not want to participate in the projects. Since there
is not much participation, there was an insufficient volume of organic waste to
produce sufficient quantities of compost to sell.

Waste collectors, scavengers or pickers tend to have low incomes because
they obtain their incomes from waste collection fees and from the sales of
recyclables (ADB, 2005). Medina (2000) pointed to a situation where waste
pickers are employed part time, which would allow them time to complete other
tasks, and use waste collection to supplement income from their other jobs.
Waste pickers are often perceived as untrusting because they are classified as poor
in their community. He noted that the nature of the work is often considered
unpleasant, dirty, and unhealthy. When the collectors are from the community, waste picking is less likely to be perceived as a negative occupation. Waste pickers gain a sense of responsibility for maintaining cleanliness of their community.

2.3.1.2 Garbage segregation at source

Hazardous waste management requires a lot of effort to increase awareness among consumers, the general public and industry, including segregation activities at the source. This can be accomplished through informational campaigns. Sutandyo-Buchholz (2005) suggested that community-based waste management is necessary and community management requires the highest level of community participation. Community members decide on what needs to be done and how to accomplish it. Partnerships in community-based solid waste management involve women and younger generations, who often perform special roles in community-based waste service. According to Anschütz (1996), there are some projects that women and youths have carried out. A plethora of projects in many developing countries prove that women are not only interested in waste management projects as a provision, but also its employment and income generating aspects. They carry out educational campaigns on sanitary behavior, which involves the management of the system as the wife of the head community unit. Children often help their mother with her daily tasks such as bringing waste to a garbage bin or a waste disposal. They learn from an early age how to conduct sanitary behavior in dealing with waste. This habit should be maintained both in their neighborhoods and social environments. Unemployed
adolescents can create income from solid waste services. For example, they can operate a waste service by charging a waste collection fee or making handicrafts from waste products such as papers or plastics. It is essential to take into account that the participations of youths should be encouraged with monetary rewards (Sutandyo-Buchholz, 2005).

In countries like India and Bangladesh, they have practiced waste separation at the source (household) for many years. This community-based composting project was started in 1995 to promote the concept of the 4 Rs (reduce, reuse, recycle and recover waste) in urban areas. It is based on the idea that the organic content from household waste, which accounts for more than 70% of total waste, can be efficiently converted into valuable composts (Enayetullah, 2005). This reduces disposal costs and prolongs the lifetime of landfill sites. It also reduces the harmful environmental impacts of landfill sites because organic wastes are responsible for groundwater contamination and methane gas emissions.

By turning the organic waste into compost, the soil in urban areas can be improved. The project involved setting up a number of small-scale enterprises in different neighborhoods. Figure 2.1 shows the household waste management process including collection, sorting, and marketing.
Activities include house-to-house waste collection, composting of the collected waste, and marketing of the compost and recyclable materials. Setting up separation at the household will provide waste pickers with safer jobs and a more stable income.

In Denizli, Turkey, a new municipal solid waste management system was established in 2003 with a sanitary landfill, an on-site composting facility, and a source separated collection system. According to Agdag (2009), since source separated collection was introduced in the new waste management system, the quantity of recyclable waste collected has increased from 195 tons to 1549 tons (Agdag, 2009). Thus, the amount of recyclable waste continued to increase by expanding the source separation collection system to all the districts of the city, which uses two waste collection methods used for residential waste in Denizli.
city: curbside collection, where black bags are used for storage instead of containers in some districts, and source separated/curbside collection. As a result of these changes, the revenue from recyclable waste and the capacity of the composting facility also increased. 

Waste separation at source is effective in Denizli for increasing revenue and recyclables as well as preventing scavenging. These recycling facilities have to be registered with the Ministry of Environment to obtain an authorized recycling license. The amount of recyclable materials collected by waste pickers is higher than the amount collected by the Denizli Municipality (Agdag, 2009). Source separation is the key strategy to waste management. In order to successfully implement source separation, the general public needs to be sensitized toward the whole concept and educated about the needs and advantages of doing segregation. The success of waste minimization depends largely on education to increase public awareness and change wasteful habits. For this reason, waste education to the public at household level must be implemented first.

2.3.2 External Factors - At the policy level:

2.3.2.1 Inclusive policy in a modernization approach by changes or improvement of waste management system and providing new job opportunities for waste pickers

Scheinberg (2006) studied waste pickers in a modernization approach. This opened new niches and allowed the governments and the formal sectors to form new relationships with each other, but waste pickers may not benefit from this process. On a positive note, as a solution to addressing the waste
management problems when waste picking is contextualized as providing new job opportunities are available to waste pickers by keeping materials out of landfills (Scheinberg et al., 2006). In order to support sustainable and positive changes, there needs to be commitment to work with waste pickers embedded in their professional context. Therefore it is pertinent to support them in finding and entering more stable economic niches, which can become available through the process of modernization of waste management.

Some developing countries are designing programs that offer alternative jobs and improve waste pickers’ skills. For instance, a few NGOs in Phnom Penh, Cambodia have opened workshops to train waste pickers in composting and making handcrafts. Some waste pickers learn to use sewing machines, and recycle paper and plastics to make picture frames, hats, flower vases, tissue box containers, and rugs. At the International Conference on Urbanization and Global Environmental change (UGEC 2010) poster presentation, one person commented on my poster, “Why don’t these waste pickers work with the NGO to make some profit from their handcrafts?” Waste pickers can work with NGOs to profit from the handcrafts they make, but this would not create a stable income. The handcrafts are not yet up to standard compared with other name brand products. By the time the waste pickers finish and try to sell one of these products, they have lost time doing what they do (and profit most from) best, which is waste picking. The goal is to train waste pickers with skills to market themselves for better jobs than collecting waste. Another option is to find better marketing clients that are connected with big markets where these handcrafts can be valuable
and sellable. Composting waste is another alternative job for waste pickers. Waste pickers can market themselves with composting companies and earn a higher income.

Many developing countries have practiced household waste separating and setting up material recovery centers in order to practice the 3Rs (reduce, reuse, recycle) of the environment. In material recovery centers, which are used in many developing countries such as Indonesia, Malaysia, Philippine, and Thailand, waste is brought from the households or industries to the center before going to the landfill. Waste pickers work at the centers and bring recyclable wastes to junk shops or middlemen. Each waste picker is registered at the center, which is a good method for developing countries to monitor waste pickers and give more accurate information to census reports (World Press, 2009).

When setting up these centers, municipal regulations are implemented where waste pickers as employees or members of cooperative group are made aware of the health risks and standard tools to be used to prevent illness and how to properly separate the waste. The process is further regulated as junk shops or middlemen have to be registered with the center and cannot change the rates on the waste pickers, and many material recovery centers are proctored by the private sector (Wangpanit garbage recycling separation plant in Thailand), municipals (in the Philippines), self help groups (in Indonesia), or NGOs (WorldPress, 2009).

**How well is the material recovery center working?**

The use of material recovery centers can significantly reduce the volume of waste sent to the landfills and dumpsites. About 10% to 30% of waste still
remains as residual waste, which is unacceptable to zero waste proponents. A private waste company in the Philippines (Lacto Asia Pacific Corporation) has developed a system to convert residual waste into concrete bricks thereby further reducing the residual waste to only two to three percent. The project offers new job opportunities to the informal sectors as well as city residents. This case illustrates the marketability of low technology, low-cost recycling systems. Lacto Asia Pacific Corporation has designed the Happy Soil System, which produces high grade compost of commercial value allowing material recovery centers to be self-sustaining.

As of the end of 2003, more than 100 Happy Soil Systems were opened in various parts of the Philippines, as well as in Lebanon, Kota Kinabalu, Sabah, Malaysia and Canada. San Fernando City, La Union, whose mayor founded the Solid Waste Management Association of the Philippines (SWAP), has adopted an Environmental Citizenship Program. The program promotes the Ocho-Ocho Duties of the Environmental Citizen, which highlights waste management. The city’s sanitary landfill and material recovery facility has become a major tourist attraction, with visits from 982 groups of other local government units, national agencies, NGOs and schools so far.

*Should other countries consider setting up material recovery center?*

The down side to setting up a material recovery center for other developing countries is lack of financial support. Investing in a material recovery center will help reduce waste dramatically as well as offer opportunity for waste pickers. Thus in Europe, North America, Latin America and in Asia-Pacific
countries, such as Japan and Australia, the use of waste for energy and material recovery purposes has long been an accepted practice.

2.3.2.2 Advocacy and enforcement on no work and live in dumpsites by waste pickers

A study was conducted in Karnataka, India concerning the handling and disposal of household hazardous waste. However, the general public’s lack of awareness about dangers associate with waste is not a top priority for politicians in Karnataka. Open dumpsites are predominate in all districts and in absence of controls, these sites still contain hazardous waste in which waste pickers may live and work. This type of special and harmful waste require specific attention from public and civic authorities as their dangers necessitate separate collection, proper handling and disposal process of these wastes (Lakshmikantha, 2007).

Gonzales (2003) studied the scavenger of Payatas, Philippines, where one organization Lupang Pangako (or ‘promised land’) Urban Poor Association, Inc. (LUPAI) works with the Payatas Scavengers to improve the living conditions in the dumpsite. At meetings with city and national government agencies, the LUPAI air grievances and give recommendations on land and livelihood issues. One of the original leaders of LUPAI, the previous waste picker Jaime Salada, is now a recycler-entrepreneur. Jamie Salada invented a ‘laundry brush’ made from discarded plastic foam insulation and plastic netting, transforming waste materials into a new product that has penetrated the mainstream market. In the process he has created livelihoods for his neighbors through contracting and direct employment. The brush is easy to make, so many have copied Jaime’s product.
He does not mind this, however, because he has continually improved his product while lowering his costs. From an original unit price of 12.00 Philippine Peso (PhP) (US$ 0.28), he now sells thousands of brushes at 3.00 PhP (US$ 0.07) per piece to some of the largest supermarket chains in the country. At the same time, he is always on the lookout for new products that can be made from dumpsite waste materials (Gonzales, 2003).

In other parts of the world like Latin America, India, South Africa, and Asia waste pickers are quickly learning to network with each other to set up an informal international organization to empower their needs. Waste pickers know what they need to fight for and what would make a difference in their lives. They want to move beyond picking to different forms of recycling and getting fair prices for these recyclables. Many waste pickers worry about children, especially their own children, working on landfills. They want to see good laws that protect children and allow them to go to school and develop their talents instead of picking up waste to contribute income for their family. Other waste pickers want access to good health facilities and pensions, but every waste collector wants people to acknowledge them as useful workers that deserve to be treated with respect.

There are many reasons to organize but how to go about this? The first step is to build and maintain a democratic organization. Waste pickers brainstormed a number of concerns they have. The concerns included but were not limited to occupational health issues in landfills, access to recyclables at an increased number of points, improved working conditions, medical and insurance
provisions along with livelihood alternatives and their recommendations being taken to the government (Global Alliance of Waste Picker, 2011).

Presenters also outlined different strategies to highlight waste picker issues with landfills. They gave information through interactive sessions with graphic presentations, games and exercises. Input ranged from landfill laws to policies and trends in landfill management and the move towards controlled, sanitary landfills which often exclude waste pickers and the implications of this trend. The workshop highlighted that working conditions of landfill waste pickers across the globe were very similar and so were their problems.

Information exchange visits organized by the Kagad Kach Patra Kashtakari Panchayat (KKPKP) waste picker trade union in Pune through the Asia Network and the Alliance of Indian Waste Pickers regularly aid an exchange between Indian waste pickers and those abroad to get a picture of each other’s struggles and strategies. The African waste pickers heard about the formation of KKPKP and its work with waste pickers and even toured a Pune landfill. Local waste pickers in Africa explained how their main problem was that truck drivers sometimes keep the high quality dry waste, so the waste pickers got little of value.

While interacting with local waste collectors about work situations in landfills in both India and Africa, pickers realized that the situation was similar in all countries. The threat of privatization, and minimal government support or protection loomed over everyone’s heads as they realized their struggles are all the same.
2.3.3 Internal Factors that seems to be common practices among government, NGO, donors and others

In many developing countries, there seems to be a common practice among the government, NGOs, and formal and informal sectors regarding problems in solid and hazardous waste management. The public lack awareness of the health hazards of waste picking, and few waste pickers have organized alliances or self help groups, so they have little protection. Also, there is opposition against waste disposal facilities from public and communities. The limited allocated budget for waste management as well as the lack of co-operation between local authorizes causes problems and technical expertise is weak and ineffective in waste recycling programs and regulations.

2.3.3.1 Awareness of health hazards of community and waste pickers

The lack of awareness of how to handle waste together with poor hygiene habits has made the work of collecting waste especially challenging, as collectible waste is often a combination of solid, domestic, industrial, and hazardous waste. Furthermore, the polluted environments resulting from accumulated waste piles in the vicinity of homes have a health effects on waste pickers, families, and neighbors (Madsen, 2006). As a result of the limited space for waste storage and lack of awareness about health risks, the garbage piles accumulated overtime. Moreover, food and water supplies can become contaminated with toxic substances leaking unsuspectingly into the environment from the garbage piles.

In addition, the basic nature of the tools used by waste pickers, such as hand trolleys and shovels, further compounds the dangers because direct human
labor is still required to complete much of the work. As a result, workers are directly exposed to dangerous or hazardous wastes that may potentially endanger their health. Studies of waste pickers in India have demonstrated that tuberculosis and dysentery are among the most common diseases suffered by waste pickers. Notably, women working at waste sites suffer from higher rates of gynecological diseases as compared to women working in other occupational sectors and they are also at greater risk of bearing children with congenital, physical, emotional and developmental problems (Dolk et al, 1998).

According to Madsen (2006), studies showed that there is often no source of water at the dumpsites. In Vietnam, one study observed that there were no available shelters to protect workers from the rain, sun, heat, and no sanitary place to safely prepare and eat food. It was also discovered that farmers allowed livestock to feed on vegetation growing at these dumpsites during the day. Due to poor environmental management, these farm animals, as well as dogs and rats living at the dumpsites, expose waste-pickers to the constant danger of infectious and parasitic diseases from animal waste and animal bites. Furthermore, accidents and injuries can also occur. For example, many waste pickers receive stab wounds from exposure to sharp objects, which often result in infections. This is exacerbated by the lack of adequate protective clothing and footwear for working at the waste sites. The government, other stakeholders and informal sectors should work together to make others aware of the health hazards that can cause major issues in the future. The public needs to be aware of these issues and, if possible should be involved in their communities (Chhun, 2009).
2.3.3.2 Self-help/community groups

In developing countries, there are not many self-help groups being organized due to the fact that informal sectors (waste collector, waste pickers, or scavengers) are not aware of such groups until introduced by their community or NGOs. In Cambodia, some NGOs assisted in forming self-help groups among households in selected sangkats (villages) and at dumpsites. These self-help groups established small-scale enterprises to produce goods from hygienically processed recycled materials, such as handicrafts, bags, sandals, and simple furniture. Small business management skills such as basic accounting, marketing, and product pricing were taught along with technical skills (ADB, 2008).

In addition, a partnership with JFPR (Japan Fund for Poverty Reduction) and Phnom Penh, Cambodia, was able to set up a self-help business promotion funds. These funds provided the waste pickers with start-up capital for small businesses such as garbage collection, segregation, and transportation and supported the work of NGOs by providing equipment, tools, uniforms for 100 community waste collectors, and temporary waste bins (ADB, 2008). Basically, forming self-help groups not only informs the public and solves problems but this kind of participatory approach can build trust and partnerships, create income-generating activities, and improve the environment.

According to Klundert and Lardinois (1995), women usually initiate many community-based self-help projects. Traditional divisions of labor generally assign women the responsibility to run the household, produce domestic foods, and take care of the children. Therefore, women are at a higher risk of coming in
contact with the waste materials, have the greatest interest in a clean and relatively odor-free environment, and are most concerned when their children's injuries become infected due to unsanitary circumstances. For example, in Kerala, India, a women’s self-help group was working to collect household waste for delivery to municipal collection points, thereby providing incomes to thousands. Such employment opportunities should be expanded. A number of delegates explained how state authorities, community-based organizations and civil society often formed partnerships to manage household waste disposal (UN, 2010). More self-help groups need to be created in developing countries since most local governments are not financially equipped to provide informal sectors help with their livelihood.

2.3.3.3 Financial support

One of the biggest concerns in developing countries has been the lack of creditability given to the poor, especially the waste pickers. The poverty levels of waste pickers are directly linked to lack of access to capital, credit, and other economic resources. For example, without credit it is impossible for waste pickers to get the tools and materials necessary to practice their skills or trades. In addition, waste pickers cannot reserve resources, materials, or inventory for when prices are low and sell when prices rise. Without access to credit, there is simply no money for them to start an enterprise to earn their own money and make any progression economically, which would impact good nutrition and health, and inhibit better opportunity for their children.
In light of these considerations, facilitating access to credit has been identified as a key strategy in improving the standards for waste pickers in developing countries, especially for those that are self-employed in the informal sector. However, in the past many of the local financial intermediary World Bank lenders have gone to government-owned development finance corporations (Madsen, 2006). As a result, waste pickers in developing countries have less access to these sources of capital. Instead, they turn to microfinance agencies in the nongovernmental organization (NGO) sector for access to credit outside the formal banking sector.

Access to credit and savings options have been identified as a successful solution for women. Microfinance, which provides small, short-term loans without requiring collateral, replicates the attractive features of the informal sector lending to attract women clients and minimizes the risks associated with informal lending simultaneously (ADB, 2008). The micro-credit funding was designed not only to deliver start-up capital but also to convince other micro-credit financial institutions to offer loans to waste pickers and people with good repayment records. International development agencies and the Asian Development Bank consider the promotion of women entrepreneurs and the use of microfinance as a way to improve the waste picker livelihood in impoverished communities. According to Madsen (2006), microfinance agencies have provided access to credit and saving options to more than three million women, the small borrowers in developing countries. This is a good start in developing financial
support towards the informal sector and most definitely helps the waste pickers have more opportunity to improve their livelihood.

2.3.3.4 Technical support

In developing countries, waste pickers lack the technical knowledge in sanitary handling of hazardous waste. Waste pickers do not have the appropriate equipments (protective gear or devices) to protect themselves from the risks associated with their work. There should be some technical programs available to educate waste pickers in waste sorting and processing. The following actions should be taken: conduct pilot programs that are highly visible to initiate work, make it as inexpensive as possible, and gear the programs toward market waste pickers. If the waste pickers were organized and their collection of recyclable waste at the source was facilitated, the quality of the recyclable goods would be higher and increase in value. Moreover, it would also allow the waste pickers to relocate from the unhygienic environment of garbage dumps.

A project conducted in Matale, Sri Lanka and Quy Nhon, Vietnam was designed to service around 1,000 households and to treat between two and three tons of waste per day. Each center provided a daily door-to-door collection service using cycle carts operated by a team of waste pickers, who were provided with uniforms and safety equipment such as masks, boots and gloves. Household members were trained to separate waste into organic and inorganic wastes. Once these centers were operating, the governments were profiting approximately 15% instead of increasing spending in waste management. Community-based composting has been practiced in China, Indonesia, India, and the Philippines.
The key innovation of the model used in this project is the enrichment of organic compost to make organic fertilizer, which is more cost-effective and beneficial for the farmers as compared to chemical fertilizer. Unlike chemical fertilizer, organic fertilizer returns organic matter to the soil, thereby replenishing it and reducing the amount of fertilizer needed (UNESCAP, 2006).

This approach provides higher and regular income and offers better working conditions for waste pickers because it depends on two relatively stable sources of income: user fees and sale of compost. It is a solution to two urgent problems in urban and rural areas. In urban areas, it contributes to solving the problem of collecting and disposing of waste, while in rural areas it contributes to addressing the problem of deteriorating soil conditions by returning organic matter to the soil. More projects should be conducted in other developing countries that will improve waste pickers’ livelihoods.

2.4 Gap of Knowledge

In this section, I identify some gap concerning the area of research in sanitary handling of hazardous waste. Many previous studies focus on a single area, for example, waste pickers’ health risks in handling hazardous waste and neglecting the area of practical public policy on hazardous waste for developing countries. The weakness in studying waste pickers alone can solve only short-term problems not long-term problems encountered by waste pickers. Many waste pickers are dying, exposed to serious communicable diseases, have disabilities and bad conditions for progress in human development.
The weakness in previous studying only the policy benefit but not the benefit for waste pickers shows ineffective policymaking in waste management in long-term. Most developing countries and their local governments have limited funds. This puts the waste pickers at a disadvantage: they cannot survive due to the lack of employment opportunities, limited occupation skills, and consequently no substantial income. My research focuses on both the benefit for waste pickers and public policy in hazardous waste management.

2.5 Key research questions

Due to limited capacity and resources of government agencies, waste pickers’ involvement in handling of solid and hazardous waste in developing countries plays an important role even though this role is commonly unrecognized. Key research questions are not only to identify the role of waste pickers but also to support their role as it influences the environment in the sanitation way. Several factors contributing or hindering sanitary handling of hazardous waste by waste pickers include external and internal factors. Therefore, this thesis investigates these factors by using Phnom Penh, Cambodia as a case study with these research questions:

- To what extent the current practices of governments, NGOs and other stakeholders aiming at increasing internal factors can effectively improve sanitation handling of hazardous waste by waste pickers?

The thesis examines socio-economic and health condition of waste pickers after they received the support from those stakeholders.
To what extent do the external factors play a role in improvement of sanitation handling of hazardous waste by waste pickers?

The thesis reviews and draws the international experiences and proposes more sanitation way to Cambodian practices.

An overarching research question is: “How can one improve solid and hazardous waste management methods that would benefit waste pickers and while solving the environmental problems to then increasing urban sustainability?

Given Cambodia’s unprecedented economic growth, waste from households, industry, commercial enterprises, and hospitals are expected to increase rapidly over the next decade. Managing waste is a monumental challenge because of the substantial costs and yet large potential benefits to public health and the quality of life. It is also important for improving the lives of many poor Cambodians living under US$ 2 a day, who are more susceptible to health effects from improper waste management and rely on informal waste collection and recycling activities for their livelihoods.
Chapter 3

CASE STUDY OF PHNOM PENH

This chapter 3 introduces a case study of Phnom Penh, especially in the issues of solid waste management and different stakeholders’ role and involvement. It also describes research methods.

3.1 Introduction

Recognizing the economic and social costs of poor waste management, the Cambodian government is addressing these issues through a combination of policies, financing, public awareness, and participation.

Map 3.1: Cambodia (ADB, 2008)

Phnom Penh is the capital and the largest city in Cambodia. Phnom Penh has a population recorded at two million of Cambodia’s population of over 13.3 million in the 2008 census (UNDP, 2008).
The majority of the hazardous waste in Cambodia\(^1\) comes from the textile industry and hence is not as hazardous as other wastes in terms of the deleterious effects it can have on all forms of life if improperly transported, disposed of, stored, or treated. Usually, where there are low levels of industry there will be low

---

\(^1\) Hazardous wastes are generated through industrial activities and are becoming a major issue of concern in many developing countries as increased industrialization takes place. By-products of industrialization can include heavy metals such as arsenic, lead, and mercury. Hazardous waste can also be created through processes that utilize different forms of oil, products such as PVC and plastics. Other dangerous by-products include dioxins and furans, substances recognized to be extremely dangerous to all forms of life (High Power Committee on Management of Hazardous Wastes, HPC, India, 2004).

Separation of special wastes at the household level is not common in cities of developing countries. Hazardous wastes can be more or less toxic and dangerous, depending on their chemical make-up and quantities. The most hazardous waste of all is nuclear, radioactive waste, found in some developing countries including India. Fortunately, this is not an issue in Cambodia because it does not use nuclear energy.

The Solid Waste Management Sub-Decree refers to hazardous wastes as radioactive substances, inflammable substances, pathogenic substances, irritating substances, corrosive substances, oxidizing substances, and any other chemical that may cause damage to human and environmental health.
levels of hazardous waste produced. Still it is important that these wastes are
cared for properly.

3.2 Government policy and plan on Hazardous Waste in Phnom Penh

Phnom Penh Municipality has planned some strategies for waste management for 2005 to 2015.

Vision 2: Environment and Natural Resource
Phnom Penh is made sustainable city with people living with good quality of water, soil, air and well managed on solid waste and liquid wastes

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.1</td>
<td>Establish a comprehensive waste collection and disposal system and infrastructures.</td>
</tr>
<tr>
<td>2.2.2</td>
<td>Prevent pollution from toxic and hazardous wastes.</td>
</tr>
<tr>
<td>2.2.3</td>
<td>Reduce waste to disposal facilities.</td>
</tr>
<tr>
<td>2.2.4</td>
<td>Recycle and reuse wastes and incorporate green zone in city development plan.</td>
</tr>
</tbody>
</table>

Diagram 3.1: Phnom Penh Municipality Vision (PPM, 2005)

The Law on Environmental Protection and Natural Resource Management, which was approved in 1999, has 27 articles dealing with general provisions, national and regional environmental plans, environmental impact assessment, natural resource management, environmental protection, monitoring, record-keeping, inspection, public participation and access to information, environmental endowment funds, interim provisions, and a section on penalties.
In addition, the law contains three sub-decrees on water pollution control, solid waste management, and air and noise pollution control.

According to the sub-degree on solid waste management from the Ministry of Environment, a policy on recycling in households, factories and cities/municipalities, has not been implemented in Phnom Penh. Article 4 states: The Ministry of Environment does have some guidelines on disposal, collection, transport, storage, recycling, minimizing, and dumping of household waste in each provinces and cities in order to ensure the management of household waste in a sanitary manner. Article 5 explains that the collection, transport, storage, recycling, minimizing and dumping of waste in the provinces and cities is the responsibility of the authorities of province and city. The implementation as mentioned in Article 5 shows that (cities) shall comply with the guideline on the sound management of waste specified by the Prakas (declaration) of the Ministry of Environment.

There is no section or notion concerning waste pickers’ involvement in handling solid or hazardous waste, but the article sub-degree does mention some environmental awareness policy on solid waste and hazardous waste issues. Article 12 covers the Ministry of Environment shall issue Prakas on the quantity of toxins or hazardous substances contained in the hazardous waste that could be allowed to be disposed of in order to ensure the human health and environmental quality protection, and bio-diversity conservation. As a result, the Ministry of Environment has drafted plans for waste management but has not fully implemented the policy due to a limited budget (MOE, 1999).
The management of hazardous waste in Cambodia is relatively centralized around Phnom Penh City. Sarom Trading is a privately owned enterprise that currently collects, transports and disposes of all of Cambodia’s hazardous waste at its site, located about 20 km from Phnom Penh in Ang Snoul, Kandal Province. The contract between the industries and Sarom Trading center was a coordinated effort among Garment Manufacturers Association in Cambodia, Ministry of Industry, Ministry of Environment, and the company itself. The individual industries are completely responsible for paying a fee to the Sarom Trading center.

The dumpsite is reasonably controlled but not truly sanitary. The Ministry did not develop guidelines for the construction of the site but did specify that individual dumpsites should be about 60 meters by 60 meters in length and width and about 5 meters deep. When a hole is full, it is covered up and a new one is built in the same area. There is no liner at the site. The capacity of this dumpsite is for a period of 5 years for each hole dug.

3.3 Involvement of other agencies or stakeholders

Several agencies at the national level are usually at least partially involved in waste management. However, there are often no clear roles/functions of the various national agencies defined in relation to waste management as well as no single agency or committee designated to coordinate their projects and activities. This section reviews the legal responsibilities of the agencies concerned in Phnom Penh.
Ministry of Environment (MOE): The environmental protection and natural resource management law clearly prescribes that the Ministry has a responsibility for establishing proper guidelines for waste management and supervising its execution. The MOE is also responsible for monitoring and
enforcing compliance with the environmental law and the operation and discharge permits. Therefore, the ministry has the responsibility for waste management at the national level.

**Phnom Penh Municipality (PPM):** The sub-decree on solid waste management prescribes that the collection, transport, storage, recycling, minimizing and dumping of waste in provinces and cities is the responsibility of the authorities of the province and city. Therefore, the PPM has the responsibility for waste management in the city.

**Phnom Penh Waste Management (PPWM):** PPM established two service organizations in February 2001, namely the Cleansing Authority of Phnom Penh (CAP) and the Wastewater Authority of Phnom Penh (WAP). Both were established based on the government sub-decree of April 1999 regarding the government’s public administrative financial policies. To reduce the administrative costs and increase operational efficiency, the PPM decided to merge the two organizations into one authority, Phnom Penh Waste Management (PPWM). A statute that PPWM describes that PPWM is responsible for the solid waste business in the city. According to its statute, PPWM has very broad mandates; it may itself deliver waste management services, such as collection and disposal, or contract out these services, and monitor the performance of the service providers (Sarun, 2009).

**Responsibilities of the concerned agencies in practice:** In the present waste management system, PPWM, which has a wide mandate in waste management to control the operation performance of the service provider (private company), is
presently only responsible for the operation of its own disposal site, without any permit from the MOE. The MOE, which is responsible for monitoring and enforcing the environmental law, seems unable to perform its task completely, although it admits that the operation at the disposal site by PPWM is neither technically nor environmentally acceptable (Sarun, 2009).

**Existing financial arrangement system:** The PPM does not have adequate financial resources to operate its own collection and disposal systems. It has solved this cash flow problem by franchising out the waste management services to a private company, which can recover its cost from people who benefit from the service. In this way, the waste service can be offered in the city but the service quality control has not been fully implemented because the PPM has yet to ensure financial resources for monitoring the performance of the service provider. It should be noted that the PPM created the PPWM but has not allocated any funds to the body for operation. The revenue of PPWM is mainly from the disposal fees levied on private companies, with a small part from grants distributed from international donors (Kum et al, 2005).

NGO may enter into waste management related activities for a number of reasons such as social concerns for waste pickers, introducing new recycling technology, extending micro-credit, and concern for the substandard environment for the urban poor. Their scope of work may include primary collection, rehabilitation of waste pickers, building awareness in the communities, dissemination of information, research and the introduction of new technology.
NGOs traditionally work closely with communities and there is usually good cooperation from the community members.

There are several NGOs providing various programs to child waste pickers and involved in community-based development projects such as micro-credit finance, in cooperation with Village Development Committees. In Phnom Penh, Community Sanitation and Recycling Organization (CSARO) and Cambodian Education and Waste management Organization (COMPED) are the only NGOs specialized on waste management. The two NGOs are mainly working on:

- Organizing community development and facilitating infrastructure development activities.
- Conducting outreach, education, and health care activities for waste pickers, poor community residents and school children.
- Framework Conditions for Waste Management
- Organizing waste pickers into self-help groups.
- Producing compost from waste (ADB, 2006).

Japan International Cooperation Agency (JICA) funded a few projects in Phnom Penh, Cambodia aimed to provide waste collection services in a model area where waste was not collected because the roads were too narrow for the waste vehicles. In cooperation with an NGO like CSARO, former waste pickers were organized as waste collectors, and they started a waste collection service using pushcarts. They go door-to-door, collecting and depositing waste in a container installed near the main road. A public corporation then hauls the container to the final disposal site. In addition, the households was involved in the model area during
the planning stage and thoroughly discussed a fee collection system to be put in place so that the waste collection service could be financially sustained.

3.4 Involvement of Waste Pickers

In 2005, there were more than 3,000 waste pickers in Phnom Penh city, which generates approximately 930 tons of daily waste, 585 tons/day by households, and 345 tons/day by commercial and institutional establishment (ADB, 2008), especially around the Stung Meancheay dumpsite (CSARO, 2007). The majority were women and children from the urban poor.

Waste pickers make their living by sorting through garbage on the street or in front of people’s homes to collect materials such as aluminum, glass, and plastics to sell to waste collectors. In Phnom Penh, most of the waste pickers live on the periphery of the disposal site in Stung Meancheay. They work at night in public places, sorting waste without protection such as gloves or masks because of the lack knowledge of safe waste handing techniques, sanitation and basic health care, and are thus vulnerable to dangers such as disease, injury, and assault from the other waste pickers (ADB, 2006).

In Cambodia, even though waste separation at the source is not practiced, some valuable waste is still sorted out prior to collection and transportation. Approximately 12% of total waste is collected from households and from commercial areas by informal recycling groups (Glawe et al, 2005), collecting primarily soft and hard plastics, glass, steel, paper, cardboard, aluminum, alloys, etc. Some of the items are also exported to Vietnam and Thailand for recycling.
The role of waste pickers in Phnom Penh, Cambodia is similar that of those in any developing countries such as India, Indonesia, Philippines, and Vietnam. The majority of waste pickers are women and children usually migrants from rural to urban areas. Likewise, waste pickers are not recognized in the community. The differences between Phnom Penh and other large urbanized cities, such as Bangalore, India and Manila, Philippines, is that waste pickers have more opportunity to participate in community based projects supported by NGOs. These large cities undergo many waste management projects such as composting, separation at source, and the 3Rs (reduce, reuse, and recycle). Phnom Penh is still at the developing stage where waste management has not been implemented. There are some small NGOs in Phnom Penh that work with waste pickers introducing them to community groups and educating child waste pickers about waste collection, but there is still much work to be done in Cambodia. (Interview with CSARO by Chhun in 2009).
Photo 3.3: Smokey mountain at Stung Meanchey dumpsite (Chhun, Photo taken in 2009)

Photo 3.4: Girl picking waste with hand fork (Chhun, Photo taken in 2009)
3.5 Selecting the study area

The study was carried out at the Community Sanitation and Recycling Organization (CSARO) as well as the Stung Meanchey dumpsite in Phnom Penh, Cambodia. CSARO provides training to waste pickers in aspects of group management, paper and plastics recycling, composting and other areas as mentioned in Section 3.3.

![Waste Picking Operation Chart](image)

Figure 3.1: Waste Picking Operation Chart in Phnom Penh, Cambodia
Source: G. Chhun

3.5.1 Research Method One

Waste pickers’ working environment was observed directly by me and my research assistant for two days to obtain basic information on the occupational health issues, such as occupational safety hazards, and on-site resources.
3.5.2 Research Method Two

An interview was conducted by me and my research assistant with the waste pickers at CSARO’s community outreach area and the dumpsite as well as with officials at Phnom Penh Municipality, Ministry of Environment and Natural Resources and others groups concerned with the awareness, guidelines, and rule and regulations regarding hazardous waste as described in Section 3.6.

3.6 Brief Description of the Interview Questionnaire

The interview questionnaire is collected in the form of a survey. The survey collected descriptive information about waste pickers’ demographics, personal opinions and perceived health status as well as their knowledge and training in sanitary handling of hazardous waste. A translated version of the survey in Khmer was administered orally by Khmer-speaking interviewers. The interviews were used as primary data. In addition to the research, secondary data consists of data, documents, studies, articles, reports and other related publications by the Municipality of Phnom Penh, donor agencies, and local and international NGOs.

3.6.1. Interview of the waste pickers

A structured interview was conducted with waste pickers eighteen years or older. The interview in Cambodian language was conducted by Cambodian students at the Waste Picker Development Program (WPD) and the city dumpsite. SCARO staff assisted in gathering the local waste pickers for the interview. The interviewee selection was on the voluntary basis of waste pickers and their time
availability. Observation of child waste pickers was conducted at the mobile outreach center. The purpose of interviewing waste pickers was to understand their day-to-day operation at the dumpsite, and their awareness of hazardous waste, and collect their opinions and suggestions on future goals in waste management. The interview guidelines are attached in Appendix A and the Khmer version is in Appendix B.

Photo 3.5: Interviewed at Stung Meanchey dumpsite. These waste pickers home is near the landfills. (Chhun, 2009)
3.6.2 Interview Questionnaire for governmental officials and other stakeholders

A person-to-person interview with Phnom Penh Municipality, Ministry of Environment and others with interest and stakeholders in Phnom Penh city development was conducted. The study team also conducted interviews with the owner and management teams of CSARO. The purpose of this interview was to collect information on Phnom Penh’s current hazardous waste management development and their opinions on the informal sector’s involvement in waste management. The interview guidelines are in Appendix C and the Khmer version is in Appendix D.
Chapter 4

THEORETICAL FRAMEWORK

As mentioned in Chapter 2, Section 2.5, this thesis aims to investigate factors contributing or hindering sanitary handling of hazardous waste by waste pickers including both external and internal factors. The research questions are:

(i) To what extent the current practices of government, NGO and other stakeholders aiming at increasing internal factors can effectively improve sanitation handling of hazardous waste by waste pickers? The thesis examines socio-economic and health condition of waste pickers after they received the support from those stakeholders.

(ii) To what extent the external factors play a role in improvement of sanitation handling of hazardous waste by waste pickers? The thesis reviews and draws international experiences and proposes more sanitation way to Cambodian practices.

An overarching research question is: how to improve solid and hazardous waste management that would benefit waste pickers and while solving the environmental problem thereby increasing urban sustainability?

This chapter develops a theoretical framework for the above investigation into five issues: (i) basic principles, (ii) hazardous waste minimization techniques, (iii) hazardous waste worker health and safety, (iv) good practices on disposal hazardous waste for other other developing countries or UN, and (v)
measurement/measures on cost-effective management from other developing
countries or UN.

4.1 Basic Principles on Waste Management and Disposal

Three principles on waste management and disposal include: (i) to protect
health and environment, (ii) to minimize the burden on future generations, and
(iii) to conserve resources (Tammemagi, 1999).

**Protect Health and Environment:** Waste management and disposal must be
carried out in a manner that does not pose a risk to human health or the
environment, either now or in the future. This principle places important
constraints on the setting and design of disposal facilities and also on the form of
the waste.

**Minimize the burden on future generations:** Wastes should be managed in
a way that does not place a burden on future generations. This principle protects
future resources. That is, our grandchildren should not have to spend their time
and effort looking after the waste bequeathed by our generation. This principle is
a paraphrase of the U.N.’s definition of sustainable development.

**Conserve resources:** Nonrenewable resources should be conserved to the
maximum extent possible. There are two ways in which this principle applies to
waste management. First, the process of managing and disposing of waste should
not consume nonrenewable resources. In particular, this principle recognizes that
land is a valuable natural resource that must be protected. Secondly, this principle
requires that all useful resources should be extended from waste that requires
disposal. This principle is another way of stating that recycling is an important and fundamental part of waste management.

These three principles have been derived from the fundamental goal of integrating waste management. The relationship is illustrated conceptually in Figure 2 (Tammemagi, 1999).

![Figure 4.1: Sustainable development and the waste management principles. Source: (Tammemagi, 1999).](image)

Hazardous wastes are generated by industry, small businesses, households, hospitals, research and testing laboratories and the agriculture industry. To regulate hazardous waste handling, it is important to identify the hazardous waste. Various definitions, both qualitative and quantitative, have been used by the regulatory agencies of different countries for this purpose. Generally, hazardous wastes can be identified based on their characteristics and the lists of specific hazardous wastes provided in the legislation (Polprasert and Liyanage, 1996).
A waste can be considered hazardous if it exhibits one or more of the following characteristics.

**Ignitability:** Ignitable waste can create fires under certain conditions. Examples include liquids that readily catch fire, substances that are friction-sensitive or cause fire through absorption of moisture and ignitable compressed gases.

**Corrosivity:** Corrosive waste includes those that are strongly acidic or basic and those that are capable of corroding metal (such as containers, drums and barrels).

**Reactivity:** Reactive waste is unstable under normal conditions. They can create explosions, toxic fumes, gases and vapors when mixed with water or heated in confinement.

**Toxicity:** Toxic waste is harmful or fatal when ingested or absorbed. The toxicity can be chronic or acute. Toxic waste can cause carcinogenic, mutagenic and teratogenic effects on human or other life forms.

Table 4.1: Common Household Hazardous waste (EPA, 2009)

<table>
<thead>
<tr>
<th>Flammable - Ignites easily</th>
<th>Reactive/Oxidizer - Unstable chemical that may create an explosion or deadly vapors</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Floor and furniture polish</td>
<td>- Chlorine Bleach products</td>
</tr>
<tr>
<td>- Paints and thinners</td>
<td>- Fertilizers w/ Ammonium nitrate</td>
</tr>
<tr>
<td>- Hairsprays</td>
<td>- Iodine</td>
</tr>
<tr>
<td>- Fuel</td>
<td></td>
</tr>
<tr>
<td>- Motor oil</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Corrosive - Eats through metal/clothes</th>
<th>Toxic/Poison - May cause injury or death upon ingestion, absorption, or inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Oven cleaner</td>
<td>- Antifreeze</td>
</tr>
<tr>
<td>- Bathroom cleaner</td>
<td>- Pesticides</td>
</tr>
<tr>
<td>- Pool acid</td>
<td>- Outdated medications</td>
</tr>
<tr>
<td>- Photo chemicals</td>
<td>- Herbicides</td>
</tr>
<tr>
<td>- Drain cleaners</td>
<td></td>
</tr>
</tbody>
</table>
4.2 Hazardous waste minimization techniques

Blackman (2001) suggests hazardous waste minimization techniques by focusing on source reduction and recycling (onsite or offsite). The detail of his techniques illustrated in the Figure 4.2.

Figure 4.2: Waste minimization techniques (From US EPA), (Blackman, 2001)
4.2.1 Source Reduction or minimization

Source reduction is the most desirable process of hazardous waste management. In this process, waste generation should be avoided or minimized, as much as possible, at the source. The different approaches of source reduction are:

**Raw material alteration:** The effectiveness of raw material alteration as a source reduction technique generally differs according to the type of processing involved. This process refers to raw materials that are directly converted into a product that can be purified prior to processing to reduce waste generation but, since most primarily feed materials used in synthesis are already relatively pure. This technique generally results in minimal source reduction. Examples include the substitution of innocuous biodegradable detergents for toxic chlorinated solvents and the use of less toxic compounds instead of chromate corrosion inhibitors in cooling towers (Polprasert and Liyanage, 1996).

**Process modification through material substitution:** In certain instances, process modification is very effective in minimizing waste. Two or more distinct processes can sometimes manufacture a product. Certain processes generate considerably less waste than alternative processes. The following are some examples of successful waste reduction through process modifications. In the pulp and paper industry, removal of silica before the evaporation process in the cooking of rice straw and substitution for chlorine of chlorine dioxide or hydrogen peroxide in bleaching of pulp reduces the waste generation. In the textile industry
conventional fabric printing can be replaced by thermal printing (Polprasert and Liyanage, 1996).

**Equipment redesign:** Modification of equipment through redesign is another way to reduce waste generation. Improved reactor design enhances yield and reduces waste generation. In many chemical industries, solvents are used in absorption and extraction processes. For example, in the production of epochlorohydrin, waste generation was reported to be reduced by changing the reactor design and improving the mixing in the reactor (Polprasert and Liyanage, 1996). Another example is creating new PVC compounds without using lead.

**Improved housekeeping:** Good housekeeping practices are procedural or administrative measures which a waste generator can use to reduce waste generation. These typically involve simple and low cost measures which can be introduced in a short time without need for extensive process redesign or downtime. Some examples are:

- Changes in management and personnel practices that is employee training to raise awareness of waste reduction, and incentives to achieve it.
- Amendments to materials handling and inventory practices that is better handling and storage to reduce loss through damage.
- Improvements to operation and maintenance that is elimination of leaks and spills to reduce losses; optimized equipment performance to reduce downtime.
- Segregation of different wastes to optimize opportunities for re-use and recycling (UNEP, 2009).

**Product substitution:** Replacement of an original product with a different product that is intended for identical use can be an effective method of implant minimization. Some examples are:

- The substitution of citric acid-based for xylene, benzene and toluene containing reagents in histology laboratories.
- The substitution of non-hazardous proprietary liquid scintillation cocktails for standard xylene or toluene-based cocktails in radioactive tracer studies.
- The use of water-based inks instead of solvent-based inks in printing operations.
- The use of non-halogenated solvents in parts washers or other solvent processes.
- Detergents and enzymatic cleaners can be substituted for sulfuric acid/potassium dichromate (chromerge) cleaning solutions and ethanol/potassium hydroxide cleaning solutions.

### 4.2.2 Hazardous Waste Recycling

In handling hazardous waste, it may be necessary to process them prior to their disposal, reuse or further treatment through physical, chemical or a combination of physical and chemical processes. These processes help reduce the waste volume and prepare them for subsequent treatment and disposal.
Physical processes: Physical processes can be used to separate phases and components in the waste stream. Waste streams, which are not often single phase, require a phase separation process prior to treatment or recovery steps. This process needs some scientific knowledge, chemical processes or facilities investment in order to provide information whether local government agencies can handle, manage, or not in terms of technical, financial and other capacity.

Sedimentation: Sedimentation is a physical process whereby suspended particles settle under the influence of gravitational forces because of their size and density characteristics. This process needs some scientific knowledge, chemical processes or facilities investment in order to provide information whether local government agencies can handle, manage, or not in terms of technical, financial and other capacity.

Filtration: Filtration is a phase separation process widely used in the water and wastewater treatment. It can be used to remove suspended solids from a liquid to purify the liquid and to remove liquid from the sludge in sludge dewatering. This process needs some scientific knowledge, chemical processes or facilities investment in order to provide information whether local government agencies can handle, manage, or not in terms of technical, financial and other capacity.

Flocculation: Flocculation is a process by which small, unsettleable particles suspended in a liquid medium are made to agglomerate into larger, more settleable particles. This process needs some scientific knowledge, chemical processes or facilities investment in order to provide information whether local
government agencies can handle, manage, or not in terms of technical, financial and other capacity.

Reverse osmosis: Reverse osmosis process makes use of a semipermeable membrane to separate components of a solution. The membrane is permeable to the solvent but impermeable to most dissolved solutes, both organic and inorganic. This process needs some scientific knowledge, chemical processes or facilities investment in order to provide information whether local government agencies can handle, manage, or not in terms of technical, financial and other capacity.

Chemical processes: Some hazardous waste can be chemically processed to effect volume reduction (e.g., solidification), to neutralize, or to separate phases (e.g., precipitation). A combination of two or more chemical processes can be used together in some cases. This process needs some scientific knowledge, chemical processes or facilities investment in order to provide information whether local government agencies can handle, manage, or not in terms of technical, financial and other capacity.

Neutralization: Neutralization of an excessively acidic or basic waste stream is necessary either as a preliminary treatment or to prevent damage to the environment once they are subsequently discharged. The neutralization process is simply the interaction of an acid with a base to adjust the pH to the limits specified by the regulations or required by the subsequent treatment/reuse processes (Kiang & Metry, 1982). This process needs some scientific knowledge, chemical processes or facilities investment in order to provide information
whether local government agencies can handle, manage, or not in terms of technical, financial and other capacity.

Precipitation: Precipitation is a process that transforms some or all of the substances in solution into a solid phase. Adding appropriate chemicals to the solution and mixing thoroughly usually achieve this. This process needs some scientific knowledge, chemical processes or facilities investment in order to provide information whether local government agencies can handle, manage, or not in terms of technical, financial and other capacity.

Solidification: Solidification of hazardous waste is commonly practiced before the waste is disposed of in landfills. It is a process in which the materials are added to a liquid or semi-liquid waste to produce a solid. This process needs some scientific knowledge, chemical processes or facilities investment in order to provide information whether local government agencies can handle, manage, or not in terms of technical, financial and other capacity.

Incineration: Incineration is the most commonly used thermal process in the treatment of hazardous wastes. Thermal incineration uses high temperature thermal oxidation to destruct hazardous wastes (Polprasert and Liyanage, 1996).

4.3 Hazardous Waste Worker Health and Safety

Blackman (2001) and the report from OSHA (1998) identifies key hazardous waste worker health and safety into four areas:

Chemical Exposure: Chemicals exert toxic effects on humans by gaining access to the tissues and cells. The three major routes to exposure are inhalation, dermal absorption, and ingestion. Entry may also occur in the form of a puncture
wound or entry through mucous membranes of the eyes or nasal passages (Blackman, 2001).

**Explosion and Fire:** Hazardous wastes may spontaneously ignite or explode. The more frequent causes include activities such as movement of drums, accidental mixing of combustible chemicals, attainment of auto ignition temperatures, or introduction of an ignition course into an explosive environment.

**Bloodborne Pathogens:** Injury by contaminated needles and other sharp objects is a serious hazard to a variety of workers. Exposure incidents can lead to infection from the hepatitis B virus (HBV) or human immunodeficiency virus (HIV), which causes AIDS (report from OSHA, 1998).

**Heat Stress:** Heat stress is a major hazard for workers wearing protective clothing. The protective clothing materials that serve to shield the body from chemical exposure also limit the dissipation of the body heat and moisture.

### 4.4 Good practices on disposal hazardous waste from other developing countries or UN

Management of hazardous waste needs urgent attention in developing countries. The variety and classes of materials and sources from households to industrial and medical facilities makes this particularly challenging. Action is constrained by limited financial resources to deal with these problems and ignorance or unwillingness to acknowledge the risks.

Sound management of hazardous materials includes four elements: waste reduction, segregation, safe handling, and disposal. The best solution is to not generate this waste in the first place. When this is not possible, every effort
should be made to minimize generation, and generated wastes should be handled cautiously to reduce risks. Producers of hazardous waste should segregate different types of materials to make recycling easier and prevent chemical reactions or explosions.

USAID (2009) laid out best practices for accomplishing these goals in developing countries:

- Provide technical assistance and training to educate decision-makers, system operators, and the public. These efforts should strengthen stakeholders’ capacities to identify cost-effective waste reduction measures, and to help design and to put practical hazardous waste management plans in place.

- Establish incentives, disincentives, or regulations to promote waste reduction where it is not otherwise cost-effective.

- Establish dedicated hazardous waste recycling and disposal facilities. Few countries operate hazardous waste treatment and disposal facilities. Thus, much of the hazardous waste generated continues to be disposed of in dumps and landfills without any provisions for segregation, containment or treatment.

- Develop systems to ensure that waste is not illegally dumped. One model that provides checks on illegal dumping is the hazardous waste manifest system in the United States, where a “paper trail” (a sequence of required documents) is generated to prove that the material reached its intended final destination.
Explore options for contracting private sector firms that specialize in the handling and disposal of hazardous wastes (USAID, 2009).

4.5 Measurement/measures on cost-effective management from other developing countries or UN

Four measurement/measures on cost-effective management from other developing countries or UN include (i) reduce, reuse, and recycle, (ii) composting, (iii) Facilitate separation at disposal site, and (iv) incineration.

Reduce, reuse, and recycle: Reducing the quantity of waste that must be transported and disposed of should be a primary goal of all waste management programs. Waste should be recovered at the source, during transport or at the disposal site. Waste reduction can be accomplished through the increased use of source separation and subsequent material recovery and recycling. Separating waste materials at the household level occurs to some extent almost universally, and prevents the most valuable and reusable materials from being discarded. Following in-home retention of valuable material, waste-pickers currently remove most valuable materials either before garbage enters the waste stream or en route, especially in the lower and middle-income areas of many municipalities. In these instances, there is little need for additional encouragement of recycling. Even in the more affluent areas of developing cities, itinerant buyers of waste materials such as cardboard and glass are common. These buyers will help to divert many materials out of the waste stream (UNEP, 2003).

Composting: A somewhat more low-technology approach to waste reduction is composting. The waste of many developing countries would be ideal
for reduction through composting, having a much higher composition of organic material than industrialized countries. In developing countries, the average city’s municipal waste stream is over 50% organic material (Zerbock, 2003); studies in Bandung, Indonesia and Colombo, Sri Lanka have found that residential waste is composed of 78% and 81% compostable material, and market waste is 89% and 90% compostable, respectively (Cointreau 2006). Still, composting has not been overwhelmingly successful and widespread in practice throughout the developing countries.

Facilitate separation at disposal site: The placement of solid waste in a disposal site is probably the oldest and definitely the most prevalent form of ultimate garbage disposal. When waste pickers are allowed to access disposal sites, significant amounts of material can be recovered (Chhun, 2009). However, because they interfere with efficient operation of dumps and landfills, waste pickers are usually excluded from these sites, lowering recovery rates and causing severe economic hardship. Some sites provide a measure of structured access to waste pickers.

Incineration: Another option for waste reduction and disposal is incineration. Incineration should not be considered a disposal option since after incineration there is still some quantity of ash to be disposed of (probably in a landfill), as well as the dispersal of some ash and constituent chemicals into the atmosphere. This appears to be an extremely attractive option, however, with occasional exceptions; incineration is an inappropriate technology for most low-income countries. High costs and environmental problems have led to
incinerators being shut down in many cities, among them Buenos Aires, Mexico City, Sao Paolo and New Delhi (UNEP 2003).
Chapter 5

DATA ANALYSIS

In Chapter 5, I report data analysis of my collection in six areas: (i) What benefit/revenue from being waste pickers? (ii) What risks waste pickers face, (iii) Health, economic and social impacts, (iv) How much do waste pickers know about hazardous waste?, (v) How do waste pickers protect themselves, and (vi) Official and other stakeholders’ attitudes on hazardous waste and waste pickers. I begin this chapter by the description of the interviewed waste pickers.

5.1 Description of the interviewed waste pickers

The interviewed waste pickers were females between 18 and 52 years of age. Of the 24 interviewed waste pickers, two were not married; three of the waste pickers did not have any children and the other waste pickers either had between one to nine children in their household. Some waste pickers began collecting waste at the age of two and the oldest is age 49. Many started waste picking later in life due to economic and social pressures and loss of employment. Other waste pickers started early in their lives due to poverty and to help contribute to their family income.

Waste pickers worked from two to seven days per week for 10 to 12 hours per day. They did not have specific break times but took breaks often, dependent on how much recyclables materials they collected. Occasionally, some waste pickers spent time sorting their recyclables during their breaks. Their time spent collecting recyclables depended on the dump trucks’ schedules. Waste pickers gather around the dump trucks daily waiting for the trucks to unload the waste or
garbage. Waste is considered a good resource among waste pickers but through the public eyes is viewed as garbage. The rule of thumb for waste pickers in collecting recyclable waste is first come first served and finder keeper. Basically, whoever found the valuable recyclables (plastic, metal, and etc), gets to keep and resell to the junk shop.

Of the interviewed waste pickers 73.7% eat while at work and 99% of waste pickers work at the new dumpsite called Dangkor also known as Boeung Chorng Oek. The Dangkor dumpsite was opened a day after the Stung Meancheay dumpsite was closed on July 20, 2009. The new dumpsite is about 18km (11.18 miles) from the old dumpsite. Waste pickers travel to the new dumpsite by motor taxi. The majority of waste pickers complained that the Dangkor dumpsite is too far from their home location, so collecting recyclable wastes for their livelihood is very challenging as the dumpsite is not easy to access. As much as it is already difficult that their health is at risk, they simply do not have enough to pay for the transportation. They have to increase their work hours and working days to make enough money. Some waste pickers collected day and night, camping near the dumpsite due to the cost of traveling back and forth. The new dumpsite causes additional difficulties in its rules and regulations. Waste pickers are not allowed in the new dumpsite due to unsanitary conditions, the impact to health, and the danger to humans to be in and around the wastes. Despite this, waste pickers still manage to sneak and climb into the dumpsite. Several waste pickers said, “If they don’t pick the waste, they have no food on the table and cannot survive.”
5.2 What benefit/revenue from being waste pickers?

According to the interviewed surveys, the average daily waste picker income is between $2.01 and $2.50 (see figure 5.1). This daily income is as little as the national incomes (less than $2 dollars a day) for an underdeveloped country like Cambodia (UNDP, 2008). Waste pickers’ incomes are derived from a combination of different factors, such as age, marital status, and the number of children in the household. These factors contribute to identifying which age categories are significant in identifying who has more revenue.

![Figure 5.1: Waste picker’s income per day in Phnom Penh (G. Chhun)](chart.png)

Over 50% of waste pickers have other sources of income either from their spouse, children, or other occupation. In a waste picker’s household, the waste pickers and spouse earned about the same income. If given a small loan of 40,000
Cambodian riels ($100 USD), 54% of waste pickers wanted to start a small business, 20.8% wanted to buy equipment for their job, 8.33% wanted to pay for their children’s education, and 16.7% wanted the loan for something different (See figure 5.2).

![Additional income or revenue](image)

Figure 5.2: Waste picker’s additional income in Phnom Penh (G. Chhun)

5.3 What risks do waste pickers face?

More than half of the interviewed waste pickers wanted to start their own business when asked if they were given an opportunity to get a small loan. Essentially, they want to earn money in a way that did not require being concerned about their health. Waste pickers have no time to visit the doctor or go to the hospital when they are ill. Their health cannot be a priority.
The majority of waste pickers said their health condition is much worse than one year ago. Table 5.1 illustrates the hazardous conditions that waste pickers encounter, and Table 5.2 presents health problems that they faced within the last 6 months in the latter part of 2009. For example, they have experienced back and joint pain, skin problems, respiratory issues, and gastrointestinal problems. Due to the fact waste pickers worked in rain, cold and heat, these weather conditions impact their ability to find recyclable materials as well as additional factors contributing to their health problems. The majority of the waste pickers believe their health issues are related to their line of work. Also they do not see that it is a priority to put their health before putting food on their table. The fact that waste pickers eat at the dumpsite adds a much higher health risk because it is not sanitary.

Table 5.1: Hazardous conditions waste pickers encountered (G. Chhun)

<table>
<thead>
<tr>
<th>Substance</th>
<th>Frequency</th>
<th>Percent of interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airborne dust</td>
<td>Everyday</td>
<td>100</td>
</tr>
<tr>
<td>Blood</td>
<td>Everyday</td>
<td>53</td>
</tr>
<tr>
<td>Broken glass</td>
<td>Everyday</td>
<td>68</td>
</tr>
<tr>
<td>Chemical fumes</td>
<td>Sometime</td>
<td>53</td>
</tr>
<tr>
<td>Feces</td>
<td>Everyday</td>
<td>90</td>
</tr>
<tr>
<td>Mice/rats</td>
<td>Everyday</td>
<td>48</td>
</tr>
<tr>
<td>Mosquitoes</td>
<td>Everyday</td>
<td>79</td>
</tr>
<tr>
<td>Needles</td>
<td>Everyday</td>
<td>80</td>
</tr>
<tr>
<td>Sharp metal edges</td>
<td>Sometime</td>
<td>58</td>
</tr>
</tbody>
</table>
Table 5.2: Health problems in past 6 months (G. Chhun)

<table>
<thead>
<tr>
<th>Top 7 Most serious issues</th>
<th>Percent of interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin (irritated skin, rash, cut, bruise)</td>
<td>100</td>
</tr>
<tr>
<td>Respiratory (cough and shortness of breath)</td>
<td>100</td>
</tr>
<tr>
<td>Joint or back pain</td>
<td>100</td>
</tr>
<tr>
<td>Stomach ache and diarrhea</td>
<td>100</td>
</tr>
<tr>
<td>Head lice</td>
<td>98</td>
</tr>
<tr>
<td>Dental problems</td>
<td>95</td>
</tr>
<tr>
<td>Vision problems</td>
<td>94</td>
</tr>
</tbody>
</table>

Waste pickers have access to public health care but most choose not to visit. About 89% of waste pickers responded they were injured at work but considered it a minor problem. They would rather tolerate the pain and find money than waste their time at the doctor or hospital. Being a waste picker is not a safe job but they do it anyway to make a living. They fear not having enough money to survive; therefore health is not as important as the time they need to collect recyclables.

Waste pickers provided some suggestions to make their job safer.

- Requesting that an NGO such as CSARO help with medicine and provide a good living
- Wanting to stop waste picking and find a new job
- Wanting to have a new place to live
5.4 Health, economic and social impacts

A waste picker’s revenue is subsistence for them as mentioned in Section 5.2. First, waste pickers are aware of the risks in collecting waste, but this is not their main priority because they have to work under the pressures of the time and the economy. They are vulnerable. Secondly, their health is at risk because of their residential location. Their homes are located near the old dumpsites; therefore, they are exposed to the health risks associated with living near the dumpsites.

Social impact: if a waste picker is married, this helps their income but does not help in terms of health conditions.

Chronological sickness: Waste pickers have some awareness of health protection, but the need to earn money outweighs the potential health risks. They do not control the kinds of illness occurred while working with wastes. At times, their illness may be minor, so they do not seek help but over time this illness may
develop into a major issue. Not only will the illness affect their work and income, but it might be contagious and put their family and the community at risk.

*Risks to serious communicable diseases and disability*: Working with waste is not an ideal job, but if you are living as an urban poor and have no specific skills, being a waste picker may be the only option. From this thesis, evidences found that waste pickers are aware of the health risks and health impacts and protective tools and health guidelines available to them through training from NGOs and other cooperative organizations. The one thing that everyone, including waste pickers, NGOs, and government seems to neglect is that working with waste is not an easy task. Waste pickers spend most of their days in or around the dumpsites. Some of the general public thinks waste pickers are doing a good deed for the environment and at the same time helping their livelihood. On the contrary, the missing point is that waste pickers are at risk when exposed to hazardous waste and this may be a major issue for all people living in the city. Although waste pickers are living away from the city, the general publics are all at risk to serious communicable diseases.

Waste pickers, governments, and the general public need to be aware of this matter. They need to work together to find a way to help one another. So what do waste pickers need? They need standard equipment and tools if they continue to work these jobs (waste collecting). The ideal solution is to leave the job. When the government relocated the dumpsite to the Dangkor location, they made the right decision by closing the Stung Meanchevy dumpsite, but these waste pickers need alternative jobs to support their livelihood. Some NGOs (CSARO)
and international programs (JICA) are contributing to support the waste pickers by offering microfinance. However, the waste picker have limited entrepreneurship and business experience, it is too risky for them to change into a new business and to acquire debt from micro credit. According to the survey, they prefer to change to a secure and sanitary job if they have $100 savings.

5.5 How much do waste pickers know about hazardous waste?

Waste pickers are aware of the health risks in handling hazardous waste. Some waste pickers received formal training from NGOs; others received informal training at home, from their peers, or through their years of experience in waste collecting. Table 5.3, shows the percentage of waste pickers’ awareness of sanitary handling of hazardous waste. If the waste pickers are injured, over half of them would go to the hospital and 45.8% would go either to a doctor, clinic, or NGO. About 83.3% of waste pickers are trained in handling hazardous wastes and 45% are trained on a monthly basis.

Table 5.3: Percent of interviewees reporting waste pickers’ awareness of hazardous wastes (G. Chhun)

| Are you aware of health risks in handling of hazardous waste? | Yes 100 % | No 0 % |
| Where did you get the information? | NGO 66.7 % | Others 33.3 % |
| If injured, where do you go for help? | Hospital 54.2 % | Others 45.8 % |
| Are you trained in handling of hazardous waste? | Yes 83.3 % | No 16.7 % |
| How often do you get trained? | Monthly 45 % | Others 55% |
The NGOs providing training to waste pickers are CSARO (training in recycling and composting) and MARYKNOL (training in health risks). Even though the waste pickers are aware of hazardous wastes, this does not stop them from getting sick or contracting diseases from the wastes to which they are exposed. This is a major issue that needs to be addressed and simply not enough is done to protect them from their line of work.

5.6 How do waste pickers protect themselves?

From the interview survey, a majority of waste pickers wear protective items like simple clothes, gloves, scarves, masks, shoes and hats to work. More than half of the waste pickers wash their clothes immediately when they get home. The kinds of tools used for their jobs are sacks, rice bags, pointy sticks, and hand forks (kangav). Table 6.4, shows the percentage of protective items waste pickers wear or use, and the percentage that wash daily after work. All waste pickers use a sack to store their recyclable wastes and a hand fork to pick up the waste but these two items are not washed daily. Only 40% of the interviewed waste pickers wash their tools daily. Over a third of surveyed waste pickers use hat, shoes, masks, scarves, and gloves daily at their work. However, the protective items they have do not protect from odors and dirt. Basically the protective items are substandard (see Photo 6 for sample of clothing and protective items worn). They do not protect from pollution and hazardous waste workers may encounter at the dumpsite.
Table 5.4: Percent of interviewees reporting on Protective items worn by waste pickers during waste collecting (G. Chhun)

<table>
<thead>
<tr>
<th>Items</th>
<th>Wear or use</th>
<th>Wash daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves</td>
<td>Yes (88.9%)</td>
<td>Yes (70.8%)</td>
</tr>
<tr>
<td>Scarf</td>
<td>Yes (90.0%)</td>
<td>Yes (80.5%)</td>
</tr>
<tr>
<td>Mask</td>
<td>Yes (75.5%)</td>
<td>Yes (90.5%)</td>
</tr>
<tr>
<td>Shoes</td>
<td>Yes (80.5%)</td>
<td>Yes (70.5%)</td>
</tr>
<tr>
<td>Hat</td>
<td>Yes (80.0%)</td>
<td>Yes (60.5%)</td>
</tr>
<tr>
<td>Sack</td>
<td>Yes (100%)</td>
<td>Yes (40.3%)</td>
</tr>
<tr>
<td>Hand fork</td>
<td>Yes (100%)</td>
<td>Yes (30.9%)</td>
</tr>
</tbody>
</table>

About 70% of interviewed waste pickers would rent protective items if offered at an NGO. This shows that some waste pickers are concerned about the health conditions. However, even this concern does not stop waste pickers from entering the dumpsite. Staying alive and having food on the table are much more important to waste pickers. The issues still exist as waste pickers are surrounded by the bad environment, their protective items are substandard, and their minor health symptoms. If are not treated immediately will be a growing issue later.
5.7 Official and other stakeholders’ attitudes on hazardous waste and waste pickers

The Ministry of Environment (MOE) views informal sector (waste pickers) workers as valuable and important assets to waste management but the department does not work with these workers directly. According to the interview with an official for Ministry of Environment, the ministry supports the informal sector’s line of work and acknowledges their workmanship. There are 10 employees in MOE and 5 to 6 of those employees actually work on waste management. The ministry integrated waste management projects with other organization such as the Ministry of Planning, Phnom Penh Municipality, NGO, and international organizations. Donor agencies like JFPR (Japan Fund for Poverty Reduction) and JICA (Japan International Cooperation Agency) assisted
the ministry with research and master plans of solid and hazardous waste management. Although the plans are drafted, implementing them is a challenge due to not having a bog enough budgets. Therefore, it is very difficult to enforce a fine for improper waste management in the city. Basically, staffs at the ministry need help in developing technical skills in hazardous waste management.

Phnom Penh Municipality (PPM) does not work directly with waste pickers either but does have a positive attitude towards the informal sector and feels they provide useful waste management services to the city. An executive for the Department of Environment, stated, “We cannot not have informal sector,” meaning that the informal sectors (pertaining to waste pickers) are very important groups of people to have in the city. Without waste pickers, the general public would not realize how dirty the city is and how much impact waste has on the environment. Waste pickers made the city government aware of the poorest in the city cleaning up after everyone’s mess. The municipal consist of 75 employees, about 80% of the employees undertake work related to waste management. The municipality prepares management for solid and hazardous waste.

The city collects 1250 ton of waste daily but does not separate the waste at the source or household. The municipality does provide some education to the public on the awareness of health impacts dealing with hazardous waste. They try to inform the public to recycle and provide information on battery waste. Incentive programs are in place at schools to students about the health impacts of battery waste. PPM promotes the information via school and television. Overall,
PPM needs further training in urban environmental as well as technical management.

The community Sanitation and Recycling Organization’s (CSARO) main focus is to educate children and adult waste pickers in sanitary handling of solid and hazardous waste. The goal is to eventually help the waste pickers join self help groups where waste pickers can build their skills and get better job opportunities. Currently, CSARO is monitoring two urban communities, Samiki and Sensok, areas newly developed by the Cambodia government to relocate the urban poor. The program works so that the urban poor who originally owned homes or a piece of land in Phnom Penh city slum are compensated with some land in these communities. The communities are located in the outskirts of Phnom Penh, about 30 km (18.64 miles) from the capital. Relocating the urban poor to a new location is the government’s strategy of keeping the capital clean.

This move neglected the fact that more and more of the urban poor will become waste pickers as well as putting their livelihoods at stake. Not only are the poor away from the city but also have to travel longer distances to town for work, which create more and financial trouble. Some of these urban poor are waste pickers and some have limited skills to qualify for even as laborers. Their only skill is picking up recyclable waste and selling it to junk shop. With the old dumpsite closed as well, they have no source of income, and the new dumpsite is much further from the old dumpsite.

CSARO also had to relocate their office near these communities. They trained the poor and waste pickers to recycle and compost waste. They also
trained them in team building, communication, and handicrafts skills. Some handicrafts products include photo frames, bags, and other items as shown in Photo 5.3 and Photo 5.4. CSARO encourages the waste pickers to join self-help groups to earn additional income.

CSARO currently supports over 800 waste pickers through its mobile outreach and waste picker development programs. It has enabled the creation of more than 17 waste picker self help groups, encouraging mutual support and training opportunities to increase self reliance. It continues to pioneer innovative recycling programs such as compost production that provide both employment and environmental benefits to the urban poor in Phnom Penh, and to look for new opportunities to expand its support to other communities.

Photo 5.3: Handicrafts products include photo frames, bags and others items made by waste pickers CSARO (Chhun, 2009)
Photo 5.4: More handicrafts products include photo frames, bags and rugs Made by waste pickers at CSARO (Chhun, 2009)
Chapter 6

CONCLUSION

The last chapter summarizes key findings, internal and external factors contributing to or hindering safe and cost-effective management and disposal of hazardous waste from current practices, then discusses current impacts of no change in external factors. Then it proposes how to improve both external and internal factors.

6.1 Introduction

Improving solid and hazardous waste management can be a challenge for many developing countries, but it is not impossible. It may take some time to implement a good waste management system but, the improvement will be better than doing nothing at all. Countries like India, the Philippines, Malaysia, Thailand, Vietnam, Cambodia, and many others in Latin America, Europe, and Asia are working side by side, copying one another’s strategies to make their countries’ waste management systems better. Some developing countries might be going at a slower pace than others but, all are are trying to get some plans implemented. Many developing countries lack the financial stability to improve waste management, while other countries are able to get funding from the World Bank, financial institutions, or non-profit organizations and are able to upgrade their waste management system.

In order to support sustainable and positive changes, there needs to be a commitment to work with waste pickers embedded in their professional context.
The municipalities, the formal and informal private sectors, NGOs, or the community cannot solve waste problems alone. However, Klundert and Lardinois (1995) noted that forming partnerships between mixtures of private and public sectors along with community involvement, both formal and informal, can be the most successful approach in strengthening urban environmental management.

6.2 Key Findings

What do we learn from this case study and contribution to the international literature or theoretical framework?

- Recyclable garbage is minority (niche) in South-east Asia

The solid waste recycling market in Southeast Asia is emerging due to the inadequate landfill capacities, and the high cost of incineration; along with an increasing public acceptance of environmental controls is further driving this market. Countries with landfill space shortages are considering recycling as a promising alternative to combat rising problems related to disposal of waste. Many Southeast Asian countries such as Malaysia, the Philippines, Singapore, and Thailand are looking at strategic collaborations to cater to further economic expansion, and to provide competitively-priced waste management solutions, thereby innovating the solid waste recycling market and making it more capital-intensive. Many of the urban poor or waste pickers who are jobless can survive day by day by collecting recyclable waste to sell to the junk shop. A private Thai company, Wongpanit garbage recycling separation plant, purchases waste from the informal sectors, government agencies, industries, schools, and other places and export its items to the world market.
Family-based micro-enterprises with financial incentives are likely to be more successful than broad-based volunteer dependent models and can be economical.

Small micro-enterprises are often unregistered and operated by the informal sector in both urban and rural areas. Many micro-enterprises are family-based enterprise with family members and relatives helping out in operations. Some micro-enterprises are in the form of cooperatives with ten people or less. Micro-enterprises generally have limited or no access to microcredit or any type of banking services. In countries like India and Bangladesh, small-scale enterprises are set up in different neighborhoods to promote the concept of the 4 Rs (reduce, reuse, recycle and recover waste) in urban areas. It is based on the idea that the organic content from household waste that accounts for more than 70% of total waste can be efficiently converted into valuable composts.

In Cambodia, some NGOs like CSARO assisted in forming self-help groups among households in selected sangkats (villages) and established small-scale enterprises to produce goods from recycled materials, such as handicrafts, bags, sandals, and simple furniture. JFPR (Japan Fund for Poverty Reduction) provided self-help business promotion funds to some villages in Phnom Penh, Cambodia and these funds helped the waste pickers with start-up capital for small businesses such as garbage collection, segregation, and transportation. Micro-enterprises cannot be viewed as marginal since they comprise the backbone of the economy. However, micro-entrepreneurs have to go through middlemen just to get their produce or handicrafts sold to buyers. Where as
broad-based volunteer dependent models will not generate income for the informal sectors like small enterprises. One would note that the need for survival and livelihood for individuals and families propel people to set up small businesses.

- Subsidies may be needed, but should be reserved for start-up only and should be based on potential for sustainability

In some developing countries where waste management system is needed most, the government should reserved a portion of their budget towards developing a sustainably system. For instance, Cambodia’s government should set aside a budget and make top priority in waste management for the purpose of keeping major cities clean and providing a positive waste recycling market development like the Philippines and Thailand. Governments of these countries are drafting out policies to commercialize solid waste recycling. Policy measures such as social campaigns promoting the concept of waste recycling is leading to significant rise in awareness of the benefits of recycling.

- Top down waste collection, especially when privatized, may cut-off poor people from the most valuable materials, therefore, separation and material recovery centers are needed

In the Philippines, Malaysia, and Thailand, the governments, NGOs, or private industries adopted new technology to mange waste, the material recovery center or facility. The material recovery center is not new for developed countries but it is new for underdeveloped countries. Having a
material recovery center in major cities of developing countries is a major advantage for waste pickers. First, the center can provide new job opportunities for waste pickers. Secondly, waste pickers can better their livelihoods and avoid going to the dumpsite or landfill. Third, waste pickers are less exposed to health hazards from solid and hazardous wastes in material recovery centers as compared to landfill.

- Seemingly successful efforts, e.g., waste pickers collecting 12% of solid waste in Phnom Penh are at a high cost that of human health

Segregating waste at the source (households, businesses, factories, or hospitals) and then sending it to a material recovery center or for composting, before going to the landfill, would help the environment. Waste pickers alone cannot solve environmental problems. It is estimated that waste pickers decrease total urban waste by one-third in Indonesia. In Mexico, it is estimated that waste pickers remove 10% of municipal waste. In India, waste-pickers prevent 15% of the municipal waste from going to the dumpsite or landfill. Having a material recovery center can cut the high cost of the health risk and provide some protection because standard tools are used to prevent illness, and wastes are properly separated.

6.3 Factors contributing to or hindering safe and cost-effective management and disposal of hazardous waste from current practices

Currently, the Cambodian government and other related government agencies have made an effort to establish sanitation handling, treatment, and disposal systems in order to decrease health risks and environmental degradation
by closing access to dumpsites and providing incentives such as financial and technical assistance for a few waste pickers to change their occupation to others such as small trading.

6.3.1 External factors:

At the policy level:

An effort has been made in Phnom Penh city where the waste management system has improved somewhat by relocating the landfill further from the city. The waste pickers technically do not have access into the new dumpsite or landfill. A few NGOs in the city such as CSARO provide some projects like hand crafts for the waste pickers. Some NGOs, like CSARO or JICA, offer training in composting, sewing, and micro-financing to the waste pickers who desire to start up a mini-business.

The majority of waste pickers still find ways to get access into the dumpsites and continue their recycling waste occupation, even though waste pickers’ handling solid and hazardous waste is impractical. There are other affordable alternative technology and management methods such as establishing a material recovery center, changing to alternative higher income occupations, and others that are needed in order to keep waste pickers employed and reduce hazardous waste. Waste pickers need better opportunities for their livelihoods, and all of us need a safer environment and better health not only now but for future generations.

Some waste pickers have voiced their opinions of how difficult it has been for them to survive the new landfill far from their homes. The majority of the
waste pickers live on the old landfill. They are used to picking waste in their backyard, but now they are limited to these resources. Moving the new landfill was beneficial for their health, but the waste pickers now face a survival problem because they have to travel far distances to the new landfill as waste picking is the only occupation they know. Until the government establishes programs that provide job opportunities, the waste pickers are stuck with picking waste for a living in the landfill far from homes. Closing the old landfill has been beneficial for the city but leaves the waste pickers jobless. Many waste pickers complain to the NGOs but the NGOs are powerless.

*At the implementation level:*

There is not much interaction between public and private sectors, NGOs, and the community in supporting waste pickers’ occupations in Phnom Penh. Each organization has its own agenda regarding waste pickers. The Community Sanitation and Recycling Organization (CSARO) works with waste pickers by providing educational training to females and child waste pickers. CSARO conducts outreach, education, and health care activities for waste pickers, poor community residents and school children. They develop sanitation programs for child waste pickers and help women waste pickers develop craftwork skills. They also train some adult waste pickers in composting and organize waste pickers into self-help groups. CSARO does not receive direct support from the government but receives annual funding from European charitable organizations.

The national government processes solid waste, but action is essentially limited to the cities of Phnom Penh and Siem Reap. The Ministry of Environment
acknowledges waste pickers’ contributions to the environment, but the department does not work directly with the waste pickers. The Department of Environment in Phnom Penh does not have programs involving the waste pickers, but hopes to develop some in the future. Sarom Trading, a private company, currently collects, transports and disposes of all of Phnom Penh’s solid waste at its site. Cambodia’s largest garment industry is contractually bound to deliver waste to Sarom Trading, cutting off opportunity for the waste pickers. The community is unaware of waste pickers’ occupation and is more concerned about the safety and security in and around their neighborhood. Waste pickers have low reputation among the community, known for stealing and littering. The government, private firms, and the community are not working together to acknowledge the waste pickers’ contribution to the community at large.

Phnom Penh city has not implemented garbage segregation at the households, factories, businesses, or hospitals. Garbage becomes street litter where there is no authority monitoring. The government has posted a declaration (Prakas) in certain parts of the city stating, “if caught littering, the individual will be fined $100,000 Cambodian riels ($25 US dollars).” However, the Prakas has not been effective due to the lack of enforcement. More effort is needed from the government to get the announcement out to the public. The Ministry of Environment has drafted some guidelines on disposal, collection, transport, storage, recycling, minimizing, and dumping of household waste in each province and city in order to ensure the proper management of household waste in a sanitary way. Essentially, the collection, transport, storage, recycling, minimizing
and dumping of waste in the provinces and cities is the responsibility of the authorities of provinces and cities or an outsourcing company.

CSARO, on the other hand, has been working with waste pickers on composting organic wastes as well as advertising composting on their vehicle. More participation from the community and public, and private sectors is needed in order to have a clean city.

Photo 6.1: CSARO advertising steps to composting (G. Chhun, Photo taken in 2009)

6.3.2 Internal factors:

Solid and hazardous waste management problems are a challenge among the government and public, private, formal and informal sectors in Phnom Penh. For the most part, there has been little participation is had from all stakeholders, and the public is unaware of the health risks and health impacts associated with
those who are involved in waste picking. On the other hand, waste pickers are aware of the health issues involved in waste picking but still persist in their occupation even though the health protection tools used by waste pickers are not up to standard. The health guidelines for waste pickers are available but due to economic pressures waste pickers cannot follow the guidelines and there is not enough self-help groups organized to form an alliance for waste pickers. In addition, financial support is limited for waste management and local authorizes the lack cooperation to improve. Waste recycling programs and regulations are thus weak and ineffective.

**Awareness of health risk and health impacts:** Waste pickers have enough health awareness as described in Section 5.5; they do not need additional programs about health awareness. They have public access to health clinics and hospitals if they choose to visit when injured. However, the majority of waste pickers would not visit the doctor or go to the hospital due to needing all the time possible to find recyclables to sell. For the most part, waste pickers are aware of the health risks involved in waste collection but they do not have a choice; they would rather tolerate the pain than spend money on doctors or medicines.

**Health protection tools are not up to standard:** Waste pickers have proper health protection gear but these items are not up to standard as mentioned in Section 5.6. The protection items may not protect them from pollution and hazardous waste or chemicals. Even if standardized health protection tools are available for rent at the NGOs, the waste pickers cannot afford to rent the tools.
Some waste pickers will go without the tools and put their own health at risks. This is a serious issue that needs to be addressed in Phnom Penh.

*Under economic pressure waste pickers cannot follow existing guidelines:* Health guidelines are available for waste pickers at NGOs and other community services. For the most part, waste pickers do not follow the guidelines due to economic pressure as the survey result shown in Section 5.2. For instance if someone offers $100, waste pickers prefer to get job security instead of giving priority to their health protection. Their main concern is having income to support their family. Even if they get sick, they are not financially stable to seek out treatment. Therefore, many will work rather than waste a day or few hours at the doctor’s office. Waste pickers simply do not make time to take care of their health, they will use whatever they have available to protect themselves from their line of work.

*More self help groups needed:* Most waste pickers work alone and are unaware of existing self-help groups. When peers introduce other waste pickers to an NGO, some are reluctant to participate due to the limited time they have in finding recyclables to sell. The self-help groups are formed in Phnom Penh through the help of NGO. The NGO like CSARO provides the group with small business management skills such as basic accounting, marketing, and product pricing along with technical skills.

*Limited financial and technical support:* The lack of financial and technical support is and will always be an issue for waste pickers in Phnom Penh and Cambodia. This issue does not affect just waste pickers but the local
government and all stakeholders involved in waste management projects. As years pass, the number of waste pickers’ increases and the newer generation waste pickers as well will undergo similar issues in financial and technical needs. Thereby, the financial and technical support dried up after the first few years of the project implementation because waste pickers cannot raise sufficient capital to maintain their business.

6.4 Current impacts of no change in external factors

The handling of solid and hazardous wastes by waste pickers is not practical. Waste pickers alone cannot reduce, reuse, or recycle waste. At present, the Cambodian government has no sanitation system or mechanism. Waste pickers continue to increase their own and the communities’ health risks.

6.4.1 Conceptual Policy Problems

After the closure of the old dumpsite, waste pickers started going to the new dumpsite. Waste pickers often get harassed by the city officials and are seen fighting with private companies. Approximately 0.001% of waste pickers got microfinance credit from banks (CSARO, 2009). Therefore, even though government closed the old dumpsite, it does not deter human abuse. Waste pickers still make their way to the new dumpsite. It is an estimated that more than 100 waste pickers got into in the new dumpsite by climbing the fence. Diagram 6.1 (below) shows the present cyclical dilemma in Phnom Penh. If the policies of waste management do not change, the dilemma will continue. New policies on waste management need to be drafted, implemented, and enforced in order to change the trend.
Diagram 6.1: Dilemma at Present in Phnom Penh (G. Chhun)

*No system and mechanism:* Phnom Penh municipal has not set up a system or any mechanism for waste management in a way that protects the public health and the environment. The city has contracted with private companies to collect garbage, but not all garbage is collected in a timely manner. According to waste management principal one, “Waste management and disposal must be conducted in a manner that does not pose a risk to human health or the environment.” This is an important constraint on setting up and designing of disposal facilities. The city government should develop a system to ensure that waste is not illegally dumped and waste is properly managed to keep the city clean and environmental friendly.

*Using human beings:* Under principal two of waste management, “waste should be managed in a way that does not burden future generation.” If the Phnom Penh government still allows waste pickers to continue waste collection
improperly, the government needs to develop a system that is more effective for waste pickers. Setting up separation facilities at disposal sites or establishing incentive programs for both waste pickers and the general public will definitely help. This may minimize the burden on future generations, decrease the external costs for waste pickers, and improve public health.

Policy framework: The Phnom Penh municipal policy framework for waste management is very weak in solid and hazardous waste. The third principal of waste management is to conserve resources. There is a lot of work to done in establishing solid and hazardous waste recycling and disposal factories before bringing wastes to the landfill. Practicing the 3R (reduce, reuse, and recycle) is an important and fundamental part of waste management. Waste pickers have contributed their part in recycling wastes, but separating items at the source (factory producing wastes and households) is not a part of the current recycling plan.

6.4.2 Administrative and Implementation Problems

Environmental problems do not only affect health and the environment itself but also economic and social issues as well. The Phnom Penh municipal puts a low priority on waste management and did not enforce any regulation of illegal disposal of waste nor has it established better practices in waste management.

Priority: A low priority is placed on waste management in Phnom Penh. In order to maintain a clean environment for the public and provide more job opportunities for the informal sectors, waste management should be considered a
top priority. It is important to keep the city clean in order to minimize the health risk within the communities.

*Enforcement:* Phnom Penh municipal has a master plan for solid and hazardous waste management but it has not been implemented. They have opened a new dumpsite that is located in proximity to facilities that provide the following services: reducing waste composting and recycling. The new dumpsite will offer job opportunities, but waste pickers will not be included in the hiring process. The Ministry of Environment has posted some billboard or declaration (Prakas) warning that the public will be fined if littering; however, this has not been regularly enforced.

*Good practices:* Good practices in waste management have not been practice in Phnom Penh by the industrial and medical facilities or in the households. It is important to make an effort to inform the public about waste management. The government cannot do this alone. Waste pickers for example are in the habit of recycling wastes but they need some guidance in ways to safely handle wastes. Waste pickers primarily work alone in waste recycling, but some are part of self-help group, which is good for waste pickers to produce recycling waste products in terms of additional income but so insignificant due to the following:

- Small volume of production – waste pickers cannot produce like a machine
- These kinds of products are like souvenirs, not for daily life consumption. Thus the volume of sales is not visible.
- The products go to small markets where environmentally-minded people would purchase the products
- The product is not up to standard – waste pickers do not have enough skills or training

At times, being in a self-help group has no benefit, and there is competition among other waste pickers in the community. Therefore, self-help groups exist but are underutilized because neither NGOs nor governments have viable activities or any kind of incentive to work with waste pickers to have increased income. Even if waste pickers get together, they are inactive. These groups have to have some kind of project so they can be active and earn a substantial living.

6.5 How to improve both external and internal factors

The differences between Phnom Penh and other large urbanized cities, such as Bangalore, India and Manila, Philippines, is that waste pickers have more opportunity to participate in community based projects supported by NGOs and their government. These large cities undergo many waste management projects such as composting, separation at source, and the 3Rs (reduce, reuse, and recycle). Cambodia is at the development stage where waste management has not been implemented. Some small NGOs in Phnom Penh work with waste pickers introducing them to community groups and educating child waste pickers on sanitary handling of solid and hazardous waste.

6.5.1 Suggestion for Phnom Penh City and Cambodia

Some suggestions for Cambodia and its government are to strengthen the policy framework, enforce implementation goals, and increase awareness in
sanitary handling of solid and hazardous waste. If these suggestions are practiced, the waste pickers have not only better lives but also better income and at the same time the health and environmental is substantively sustainable.

6.5.1.1 Strengthen policy framework

**Improvement of the waste management system:** Cambodia needs to make the commitment to improve solid and hazardous waste management systems through design programs that will offer alternative jobs and improve waste pickers’ skills. Setting up material recovery centers is very promising for Phnom Penh and Cambodia as a material recovery centers will most definitely open up opportunities for waste pickers and low income individuals. Another option is to find better marketing clients that are connected with big markets where the handicrafts made by waste pickers can be valuable and sellable. Composting waste is another alternative job for waste pickers. Waste pickers can market themselves with a composting company and earn higher income.

**Allocate more budget for solid and hazard waste management:** The government should design programs to get the community and public involved in waste management by introducing incentive programs involving recycling waste for waste pickers and the community. Countries such as Malaysia, the Philippines, Singapore, and Thailand are developing sound resource management strategies as well as creating better policy frameworks on recycling can further aid in encouraging recycling, thereby bolstering the growth of the solid waste recycling market in Southeast Asia. Getting all stakeholders to participate in recycling will be a plus in keeping the city clean and encourage better health for the community.
The Phnom Penh municipal has started a program to recycle battery waste in schools by which the school can earn incentives for the school. A similar incentive program can be imitated as well for the community and waste pickers on disposal waste at the source or household.

6.5.1.2 Enforce implementation goals

More cooperation among all stakeholders: The public and private sectors, NGOs, and the community need to work together as a team. The public and private sectors as well as the community need to coordinate with NGOs to help improve the city’s environment by setting up programs to support the waste pickers’ occupations and encourage a more sanitary environment in the city. The Prakas or declaration (billboard) posted around the city needs to be enforced in order for the public to follow. Police should monitor littering and actually fine those who litter the streets.

Practice at source garbage segregation: There is a need to inform all stakeholders about garbage segregation at the source and make poster campaigns like other developing countries that already have established garbage segregation in households, businesses, or hospitals. They should also set up a reward system for those who voluntary participate and assist waste pickers. Separating waste at the source will reduce the volume of waste before it goes to the landfills, basically trying to conserve resources by reducing, reusing, and recycling wastes. Many developing countries like Malaysia and the Philippines practiced waste separation households at the households and setting up material recovery centers in order to
practice the 3Rs of the environment. Cambodia can set up similar facilities and practice the 3Rs.

6.5.1.3 Increase awareness in sanitation handling of solid and hazardous waste

Recycling and reusing wastes has been practiced in Phnom Penh and throughout Cambodia for years by informal sectors (waste pickers, waste collectors, and waste buyers). These waste pickers have high environmental and health concerns resulting from several training and environmental awareness-raising programs. Instead, they are under economic pressure to use effective tools, to stop working and get access to health care or service, and to change their career. This kind of practice can be improved by getting the governments, NGOs, donors and the community to be aware of the importance in sanitary handling of waste.

There should be a presentation conducted on waste pickers’ behavior to the public showing how dangerous waste chemicals can be when in contact with humans and other living organisms by creating commercials and television shows on sanitary handling of wastes. Get the community to participate in incentive programs and encourage the public to become involved in making the city a cleaner place. The waste pickers are risking their life in recycling waste in exchange for their livelihood. The people of Cambodia need to see the bigger picture why recycling waste is important and ensure that they will not burden the next generation.
6.5.2 Suggestion for other developing countries

Other developing countries in this world have similar waste management problems similar to those in Cambodia. Some countries might be just starting to develop a system to manage waste, and while other countries may be in the middle of implementing their master plan, but there will be obstacles all countries face at times. Regardless of what stage these countries are in to set up waste management system, countries follow the same patterns. The important thing is to make the environment a clean and healthy place for humans to live. Some suggestions for developing countries are to set a higher priority on waste management, increase public awareness and participation in sanitary handling of waste, and strengthen policy and implementation framework. In addition, to suggestions made for Cambodia.

The key goal is to minimize waste pickers by designing a program that will give waste pickers alternative jobs and skill development that will allow them to earn a higher income. Furthermore, an affordable technology needs to be designed and developed to provide job security for the informal sectors as well as protecting their health and the environment. Cambodia also needs to develop a system to ensure that waste is not illegally dumped and establish solid and hazardous waste recycling and disposal facilities in a manageable way to minimize the burden on future generations. This can be a start to a sustainable development in waste management practice.

The primary tools for municipalities in developing countries to use in promoting waste reduction and materials recovery are as follows (UNEP, 2009):
1. Promote educational campaigns for (a) public support of waste reduction and recycling (especially as individual economic incentives weaken) and (b) reduction of the stigma attached to waste work.

2. Study waste streams (quantity and composition analyses), recovery/recycling systems, markets for recyclables, and problems of existing practices to decide where there may be a facilitative/regulatory role for the municipal authority.

3. Support source separation, recovery, and trading networks with information sharing (especially of market information) and forums of stakeholders.

4. Facilitate small enterprises and public-private partnerships by new or amended regulations for cooperatives, loans to small-scale businesses, amendment of inhibiting zoning and control regulations, low-rent space for stockpiling depots, etc.

5. Assist waste pickers to move out of manual picking by instituting retraining programs or subsidization of sorting/redemption centers and control harassment of itinerant buyers and waste dealers by police.

6. After consulting the major stakeholders, communities should advocate, where advisable, selective waste reduction legislation on packaging reduction, product redesign, and coding of plastics.

7. Export recyclables if there is high demand in neighboring countries and non-toxicity is assured.
8. Promote innovation to create new uses for goods and materials that would otherwise be discarded after initial use.

6.6 Suggestions for further studies

Solid and hazardous wastes are increasing in our global society. It does not matter whether the wastes are produced in the developed or developing countries; each person is responsible for the waste incurred in his/her neighborhood. Especially with globalization, e-wastes are also a concern for our generation and future generations as well. If we do not find ways to reduce, reuse, and recycle wastes now, we will face a more challenging future. In order to minimize health risks and environmental degradation, the government and other related government agencies need to work together to establish sanitary handling, treatment, and disposal systems.

In this thesis, waste pickers are evaluated in how they handle solid and hazardous waste in developing countries. The thesis also examines the socio-economic and health condition of waste pickers after they received the support from the government, NGOs and other stakeholders. In addition, this thesis compares international experiences with Cambodian practices. More research is needed in the area where leaders’ attitudes should be evaluated from developing countries as well as from the developed world regarding waste management policy, what leaders’ attitudes are toward waste pickers and whether leaders can make a difference if they are place in a situation like the waste picker? Waste pickers did not choose their occupation but simply have to walk that path to earn
income. We need more concerned citizens to be involved in waste management so our world can be a safer place to live in.
REFERENCES


Management in Low-Income Countries. Background paper for UMP Nairobi.


Handling hazardous waste

1. What do you wear to work?

2. Where are your dirty work clothes stored?

3. How often are they washed?

4. Do you wear any of the following items when you are collecting waste?

   □ Gloves    □ Scarf    □ Mask    □ Sandals
   □ Shoes    □ Hat    □ Others

5. Do you use any tools while working?

6. Do you lift heavy objects while working? How heavy are they?

Health impacts of hazardous waste

7. When you work do you come into contact with any of the following?

<table>
<thead>
<tr>
<th>Substance</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>more than 3 time per day</td>
</tr>
<tr>
<td></td>
<td>1 time per day</td>
</tr>
<tr>
<td></td>
<td>Weekly</td>
</tr>
<tr>
<td></td>
<td>Monthly</td>
</tr>
</tbody>
</table>

airborne dust
blood
broken glass
chemical fumes
feces
flies
mice/rats
mosquitoes
needles
run-off
sharp metal edges
stray animals

8. Under what weather conditions do you work?

9. Does it bother you? Why?

10. In general would you say your health is: (check one)
Excellent □ Very good □ Good □ Fair □ Poor

11. Compared to one year ago, how would you rate your health in general now?

□ Much better now than one year ago
□ Somewhat better now than one year ago
□ About the same now as one year ago
□ Somewhat worse now than one year ago
□ Much worse now than one year ago

12. In the past 6 months, have you experienced any of the following problems?

joints/musculoskeletal
□ joint pain □ back pain □ other (please specify)

skin
□ rash □ hot; irritated skin □ scabies; pinworm
□ cut □ bruise □ other (please specify)

respiratory
□ cough □ coughing with blood
□ shortness of breath □ other (please specify)

gastrointestinal
□ stomach ache □ diarrhoea
□ bloody stool □ other (please specify)

other
□ urinary problems □ vision problems □ hearing problems
□ parasites (worms) □ head lice □ bone fractures
□ dental problems (i.e. bleeding gums, loss of teeth)
□ animal bite □ other (please specify)

13. Do you believe that any of the above were work-related? Please explain.

□ Yes □ No

14. In the past 6 months, did you ever visit a doctor or healthcare worker? If so, for what? Have you ever been admitted to a hospital? When? For what?

□ Yes □ No

15. Have you ever been injured at work? Please describe.

□ Yes □ No
Work conditions

16. Do you feel safe at work? Why or why not?
   □ Yes    □ No

17. Do you have any suggestions for making your job safer?
   □ Yes    □ No

18. What do you like about your job?

19. What do you dislike about your job?

20. Have you ever been subject to any physical or mental abuse from your peers because of your line of work? Please describe.
   □ Yes    □ No

Awareness of sanitation handling of hazardous waste

21. Are you aware of the health risks in handling of hazardous waste?
   □ Yes    □ No

22. If so, where did you get the information?
   □ Friends    □ Relatives    □ Co-worker    □ NGO    □ Other

23. If you are injured, where do you go for help?
   □ Doctor    □ Clinic    □ Hospital    □ NGO    □ Other

24. Would you join a cooperative group or self-help group?
   □ Yes    □ No

25. Would you rent protective items if offered at NGO such as CSARO?
   □ Yes    □ No

26. If, so how often will you rent the items out?
Training on sanitation handling of hazardous waste

27. Are you trained in handling of hazardous waste?

☐ Yes ☐ No

28. Where did you get your training?

29. How often do you get trained?

30. Would you be interested in getting training on sanitation handling of hazardous waste?

☐ Yes ☐ No

Background

31. Age:

32. Sex: ☐ Male ☐ Female

33. Are you married?

☐ Yes ☐ No

34. How many children do you have?

35. Who do you live with?

36. Where do you live?

37. What do you live in?

38. What do/did your parents do for a living?

Education

39. How many years of formal education do you have?

40. Describe a typical day in your life.
Employment

41. How old were you when you began collecting waste?

42. How many days per week do you work?

43. What are your hours of work?

44. How often do you take breaks?

45. What do you do during your breaks?

46. Do you eat while at work?
   □ Yes    □ No

47. Where do you work?
   Location:                  Type of site:

48. How do you get to work?

49. How far must you travel?

Income

50. What is your average daily income?

51. Do you have any other source of income?

52. What is it? What percentage comes from other sources?

53. If you were given a small loan of 40,000 riels (100 US) what would you do with it?
   □ Start a small business
   □ Pay for your children education
   □ Buy equipment for your job
   □ Others

54. Of the people in your household, who earns the most income?
APPENDIX B

WASTE PICKER SURVEY – KHMER VERSION


1. ដំណើរការប្រកួតរៀនថ្មីមកកើតមកពីកីឡាក្មា ។  

2. ដំណើរការប្រកួតរៀនថ្មីមកកើតមកពីការប្រកួតការងាររវាងមុខសេវាកម្ម ។  

3. ដំណើរការប្រកួតរៀនថ្មីមកកើតមកពីទ៍ដូចកីឡាក្មា ។  

4. ដំណើរការប្រកួតរៀនថ្មីមកកើតមកពីការប្រកួតការងាររវាងមុខសេវាកម្ម ។  

☐ កុមារ  ☐ កុប្បាល  ☐ ស្រេច  ☐ ការកើតមកពីទ៍ដូចកីឡាក្មា ។  

5. ដំណើរការប្រកួតរៀនថ្មីមកកើតមកពីការប្រកួតការងាររវាងមុខសេវាកម្ម ។  

6. ដំណើរការប្រកួតរៀនថ្មីមកកើតមកពីការប្រកួតការងាររវាងមុខសេវាកម្ម ។  

☐ កុមារ  ☐ កុប្បាល  ☐ ស្រេច  ☐ ការកើតមកពីទ៍ដូចកីឡាក្មា ។  

7. ដំណើរការប្រកួតរៀនថ្មីមកកើតមកពីការប្រកួតការងាររវាងមុខសេវាកម្ម ។  

<table>
<thead>
<tr>
<th>ភាសាខ្មែរ / ក្រុមអង្ករ</th>
<th>ការវិភាគវី ការវិភាគក្រុម</th>
</tr>
</thead>
<tbody>
<tr>
<td>ជាមួយទីផ្សារក្រុម/អង្គ/</td>
<td>ស្រេច ប្រែសាកស្តី/</td>
</tr>
<tr>
<td>អង្គី</td>
<td>ការប្រកួតការងារ</td>
</tr>
<tr>
<td>ចិត្ត</td>
<td>សម័យ</td>
</tr>
<tr>
<td>ត្រូវបាន</td>
<td>សរុប</td>
</tr>
</tbody>
</table>
8. ក្រុមតែឈើសកម្រិតរបស់ការសុក្ររបស់អ្នកសម្រាប់ប្រការណ៍?

9. ក្រុមតែឈើសកម្រិតរបស់ការសុក្ររបស់អ្នកអាចភ្ជាប់ប្រការណ៍ដែលមានតួលេខជាមួយរបស់អ្នកបាន?

10. ឈើសកម្រិតដែលអ្នកចុះបញ្ចូលដោយសារធាតុរបស់អ្នកហើយ៖

   □ ភ្លើង  □ ស្លាប់  □ ខ្សែ  □ ឆ្លាយ  □ ស្លនា  □ មីស៊ី

11. ឈើសកម្រិតដែលអ្នករីករាល់ប៉ុន្តែមានសុទ្ធភាពសម្រាប់ប្រការណ៍ច្រើនបំផុតឬចាប់រួមបញ្ចូលរបស់អ្នក?  
   □ ភ្លើងម្នាក់មួយ  □ ភ្លាក់ខ្លាច  □ ឆ្លាយ  □ មីស៊ី  □ ស្លាប់  □ ស្លាប់បង្អួស

   □ ភ្លើងម្នាក់មួយ  □ ភ្លាក់ខ្លាច

12. ក្រុមតែឈើសកម្រិតដែលអ្នករីករាល់ប៉ុន្តែមានសុទ្ធភាពសម្រាប់ប្រការណ៍ច្រើនបំផុតឬចាប់រួមបញ្ចូលរបស់អ្នក?  

   □ ភ្លើង  □ ស្លាប់  □ ស្លាប់បង្អួស  □ មីស៊ី  □ ឆ្លាយ  □ ភ្លាក់ខ្លាច

   □ ភ្លើង  □ ស្លាប់  □ ស្លាប់បង្អួស  □ មីស៊ី  □ ឆ្លាយ  □ ភ្លាក់ខ្លាច

13. ក្រុមតែឈើសកម្រិតដែលអ្នកចុះបញ្ចូលលទ្ធិសម្រាប់ប្រការណ៍ដែលអ្នកត្រូវបានបញ្ចប់នៅក្នុងប្រការណ៍របស់អ្នក?  

   □ ភ្លាប់ពុោរ  □ ភ្លាប់ពុោរ  □ ភ្លាប់ពុោរ  □ ភ្លាប់ពុោរ  □ ភ្លាប់ពុោរ  □ ភ្លាប់ពុោរ
5 គេង

☐ បំពvais  □ កូត គេង, បំពvais  □ រាប់កោន

☐ រាប់កោន  □ កូតគេង  □ សម្រាប់  □ សំណាល

6 អ្នកម្រូជី

□ កូត  □ កូតសម្រាប់  □ សម្រាប់  □ សំណាល

7 បូរពណ៍ និង រយៈពេល

☐ បូរពណ៍  □ រយៈពេល  □ រយៈពេលសម្រាប់  □ សំណាល

8 គ្រឿង

□ បូរពណ៍អន្តរ  □ បូរពណ៍សម្រាប់  □ កូតបូរពណ៍  □ សម្រាប់ព្រឹត្ត

☐ គ្រឿង  □ កូតគ្រឿង  □ កូតគ្រឿង  □ សម្រាប់ព្រឹត្ត  □ សម្រាប់ព្រឹត្ត

13. ដំីសក្លឹបបាច់ក្រមុនដែរការងាររកម្មការរបស់ប្រការីដូច្នេះចូរ?  

☐ ០០/២០  □ ១

14. អាចសាប់ភ្លេង និង ដំីសក្លឹបបាច់ក្រមុនដែរការងាររកម្មការរបស់ប្រការីទេ?  

ដំីសក្លឹប ប្រការីរៀបចំក្រមុនដែរការងាររបស់ប្រការីទេ? ដំីសក្លឹប?  

☐ ០០/២០  □ ១

15. ដំីសក្លឹបដែលប្រការីរៀបចំក្រមុនដែរការងាររបស់ប្រការីទេ?  

☐ ០០/២០  □ ១

9 សម្រាប់បញ្ចប់រៀន

16. ដំីសក្លឹបក្រមុនដែរការងាររកម្មការរបស់ប្រការីដូច្នេះចូរ? ដំីសក្លឹប វិញប្រការី?  

☐ ០០/២០  □ ១
17. ប្រធានបទប្រទញអីដែលមានប្រយោជន៍សំខាន់ប្រការការប្រការព្រឹត្តិការ?  
☐ ថ្មី/ថ្មី  ☐ ឈ្មោះ

18. ប្រធានបទប្រទញអីដែលមានប្រយោជន៍សំខាន់ប្រការប្រការព្រឹត្តិការ?  

19. ប្រធានបទប្រទញអីដែលមានប្រយោជន៍សំខាន់ប្រការប្រការព្រឹត្តិការ?  

20. ប្រធានបទប្រទញអីដែលមានប្រយោជន៍សំខាន់ប្រការប្រការព្រឹត្តិការ និង ប្រយោជន៍សំខាន់ប្រការប្រការព្រឹត្តិការ  
មានប្រយោជន៍សំខាន់ប្រការព្រឹត្តិការ? ឈ្មោះ?  
☐ ថ្មី/ថ្មី  ☐ ឈ្មោះ

5 សមាជិកមួយនៃក្រុមអាហារអស្រួលប្រការការប្រការព្រឹត្តិការផ្តល់បានអន្តរជាតិសម្រាប់ប្រការព្រឹត្តិការ  

21. ប្រធានបទប្រទញអីដែលមានប្រយោជន៍សំខាន់ប្រការប្រការព្រឹត្តិការប្រការព្រឹត្តិការ?  
☐ ថ្មី/ថ្មី  ☐ ឈ្មោះ

22. ប្រធានបទប្រទញអីដែលមានប្រយោជន៍សំខាន់ប្រការប្រការព្រឹត្តិការ?  
☐ ថ្មី/ថ្មី  ☐ ឈ្មោះ  ☐ អាហារអស្រួល  ☐ អាហារអស្រួល NGO  ☐ អាហារ  

23. ប្រធានបទប្រទញអីដែលមានប្រយោជន៍សំខាន់ប្រការប្រការព្រឹត្តិការ?  
☐ ថ្មី/ថ្មី  ☐ អាហារ  ☐ អាហារ NGO  ☐ អាហារ NGO  ☐ អាហារ  

24. ប្រធានបទប្រទញអីដែលមានប្រយោជន៍សំខាន់ប្រការប្រការព្រឹត្តិការ?  
☐ ថ្មី/ថ្មី  ☐ ឈ្មោះ  

25. ប្រធានបទប្រទញអីដែលមានប្រយោជន៍សំខាន់ប្រការប្រការព្រឹត្តិការ NGO  
☐ ថ្មី/ថ្មី  ☐ ឈ្មោះ  

121
CSARO?
☐ តុ/ទឹក  ☐ ឈូ

26. បញ្ចូលឆ្ងាញឬ មានក្តីរើសអិច្ចប្រយុទ្ធដែលកើតមកពីក្រុកដីជាង?

១០ មិនកំពុងអាចទៅទៅកាន់ការពិនិត្យមត្តុណានូវការបញ្ចូលមួយសេវានេះទេ

27. មានការប្រគល់ប្រទេសដ៏ល្អបំផុតមាននៅក្នុងការស្ថិតផ្លូវការសម្រាប់ក្រុងដីជាង?
☐ តុ/ទឹក  ☐ ឈូ

28. មានក្តីរើសអិច្ចប្រយុទ្ធដែលកើតមកពីក្រុកដីជាង?

29. មានក្តីរើសអិច្ចប្រយុទ្ធដែលកើតមកពីក្រុកដីជាង?

30. មានក្តីរើសអិច្ចប្រយុទ្ធដែលកើតមកពីក្រុកដីជាង?
☐ តុ/ទឹក  ☐ ឈូ

១១ រឿងរឿងប្រសិនបើ

31. មានយ៉ាងមួយ?

32. ☐ ខ្លាច:  ☐ ប្រសុី  ☐ មូល

33. មានក្តីរើសអិច្ចប្រយុទ្ធដែលកើតមកពីក្រុកដីជាង?
☐ តុ/ទឹក  ☐ ឈូ

34. មានក្តីរើសអិច្ចប្រយុទ្ធដែលកើតមកពីក្រុកដីជាង?

35. មានក្តីរើសអិច្ចប្រយុទ្ធដែលកើតមកពីក្រុកដីជាង?

122
36. នៅក្នុងក្រោមយើងកំណត់ថា？

37. នៅក្នុងក្រោមតើអ្វីដែលធ្វើឲ្យយើងកំណត់ថា？

38. នៅក្នុងក្រោមយើងរកឃើញអ្វីដែលធ្វើឲ្យយើងដឹងថា？

ឬ២ សារៈក្នុងសារៈ

39. នៅក្នុងក្រោមតើអ្វីដែលធ្វើឲ្យយើងដឹងថា？

40. ដូច្នេះសូមប្រឈមអំពីការធ្វើដំណើរការក្នុងរយៈពេលអ្វី？

ឬ៣ រឹង្វារសារៈ

41. នៅក្នុងក្រោមយើងយកឲ្យសូមជួយអំពីអ្វី？

42. នៅក្នុងក្រោមយើងយកឲ្យសូមជួយអំពីអ្វី？

43. នៅក្នុងក្រោមយើងយកឲ្យសូមជួយអំពីអ្វី？

44. នៅក្នុងក្រោមយើងយកឲ្យសូមជួយអំពីអ្វី？

45. នៅក្នុងក្រោមយើងយកឲ្យសូមជួយអំពីអ្វី？

46. នៅក្នុងក្រោមយើងយកឲ្យសូមជួយអំពីអ្វី？

☐ ថ្មី/ថ្មី  ☐ ស្រប
47. ទីឈ្មើត្រេកសារក្នុងរឿងណាមក?

ជីវាមាន: 

ប្រភេទក្នុង: 

48. មានទិវាហិរញ្ញវត្ថុរឿងហើយដែលក្នុងរឿងណាមក?

49. ដំណើរទិះក្នុងអាទិភ័ណ្ឌវិះដៅដោយណា?

១៥ កម្មសេចក្តីណាម៉ោង 

50. មានទិវាអ្នកបានបង្កើតពីអាទិភ័ណ្ឌអាចជួយប្រឹងប្រែណាម៉ោង?

51. មានទិវាអ្នកបានបង្កើតពីអាទិភ័ណ្ឌណាម៉ោង?

52. ដំណើរទិះក្នុងអាទិភ័ណ្ឌណាម៉ោង? ដំណើរអាទិភ័ណ្ឌអាចជួយប្រឹងប្រែអាទិភ័ណ្ឌណាម៉ោង?

53. ប្រឹងប្រែអាទិភ័ណ្ឌណាម៉ោងហើយមាន 40,000(100 USD)ដំណើរអាទិភ័ណ្ឌណាម៉ោងណាម៉ោង?

☐ បានប្រឹងប្រែណាម៉ោង
☐ ក្នុងទិវាអ្នកបានបង្កើតពីអាទិភ័ណ្ឌណាម៉ោង
☐ ក្នុងទិវាអ្នកបានបង្កើតពីអាទិភ័ណ្ឌណាម៉ោង
☐ មនុស្ស

54. ការប្រឹងប្រែអាទិភ័ណ្ឌណាម៉ោងណាម៉ោង ដំណើរប្រឹងប្រែអាទិភ័ណ្ឌណាម៉ោងណាម៉ោង ដំណើរដំណើរណាម៉ោងណាម៉ោង? ដំណើរណាម៉ោងណាម៉ោង?
1. What responsibilities does your Ministry (organization) have for waste management?

2. How many employees undertake work related to waste management in your ministry?

3. Is there a specific department for waste management in your organization?

4. Can you describe all the waste management projects your ministry has undertaken over the past 5 years?

4A. Of these projects which ones have specifically targeted hazardous waste management in Cambodian cities?

4B. Which areas were targeted?

4C. Where were they located?

5. Have employees in your ministry (organization) participated in any of the training courses?

   □ Yes  □ No

5A. How many employees participated in these courses?

5B. How long were these training sessions?

5C. What type of further training would be beneficial for employees of your department?
5D. Why? Please explain

6. Have you worked with donor agencies on any waste management projects over the past five years?
   □ Yes □ No

6B. Which agencies did you work with?

6C. What type of assistance was provided?

7. Do you work in cooperation with other government ministries, departments or other organization in your waste management activities?
   □ Yes □ No

7A. Which organizations?

7B. Please describe the form this cooperation has taken?

8. Could you briefly describe how waste management tasks as shared and delegated between your ministry (organization) and your provincial departments?

Now I would like to continue on to questions related to informal waste collection, community-based waste management organizations and the socialization of waste management services
9. What is your ministry’s (organization) view on the informal sector as valuable waste management services in Cambodia? Please explain

9A. Positive/Negative? Do you feel they provide useful waste management services?

□ Yes □ No

10. In the past five years, has your ministry (organization) been involved in any waste management projects, which have engaged the informal waste sector?

□ Yes □ No

10A. If yes, Could you describe these projects?

10B. Where are they located?

10C. Which Cambodian organizations have been involved?

10D. Have any foreign agencies have been involved with these projects?

10E. How you assess the effectiveness of projects of this type?

10F. In the future, will your department promote more projects of this type?

10G. Are there other types of projects which maybe more effectively engage the informal sector?

10H. If no, Are there specific reasons why these projects have not been undertaken?

10I. What would need to change to make these types of projects viable
10J. In the future, do you think projects, which involve the informal waste sector, will be initiated in Cambodia?

10K. Are these projects targeting health issues, or are they initiated to improve waste management services? i.e. source separation, improved collection, etc.

11. Has your ministry been involved with projects, which have engaged community-based waste management organization?
   □ Yes    □ No

11A. If yes, Where have these projects been located?

11B. Which Cambodian organizations have been involved?

11C. Which foreign agencies were involved?

11D. What type of assistance has been provided in these projects?

11E. In the future, will your agency promote further assistance to these types of projects?

11F. If no, Do you feel that community-based W.M are a potential option for increasing the level of W.M in Phnom Penh?

11G. What would have to be changed for these projects to be come more appealing for your department?
APPENDIX D

SURVEY FOR MINISTRY, MUNICIPALITY,
AND NGO – KHMER VERSION
១. ប្រយោគមានប្រយោគសំខាន់ស្ថាបន់តែងបំផូល ?

២. ប្រយោគមានប្រយោគតែងបំផូលមិនស្ថាបន់តែងបំផូល ?

៣. ប្រយោគមានប្រយោគសំខាន់ស្ថាបន់តែងបំផូល ?

៤. ប្រយោគមានប្រយោគសំខាន់ស្ថាបន់តែងបំផូលមិនស្ថាបន់តែងបំផូល ?

៥. ប្រយោគមានប្រយោគសំខាន់ស្ថាបន់តែងបំផូលមិនស្ថាបន់តែងបំផូល ? ២២ / សុ ១៨

៦. ប្រយោគមានប្រយោគសំខាន់ស្ថាបន់តែងបំផូលមិនស្ថាបន់តែងបំផូល ? ២២ / សុ ១៨
ប. គឺ។ គ្រួសារទធន៍មួយដែលគេនឹងប្រការឱ្យប្រព្រឹតត់ក្នុងសុវត្ថិភាព?

ច. គឺកូនប្រហ័ត្រិយឬគ្រួសារក្នុងសុវត្ថិភាព?

ដ. គ្រប់គ្រាន់ដើម្បីត្រូវបានជំនួញការដឹកនាំការងារខ្ពស់ដោយមិនមានការរៀបរាប់?

ឋ. គឺកូនប្រហ័ត្រិយឬគ្រួសារក្នុងសុវត្ថិភាព?

ប. គ្រប់គ្រាន់ដើម្បីត្រូវបានជំនួញការដឹកនាំការងារខ្ពស់ដោយមិនមានការរៀបរាប់?

ព. គ្រប់គ្រាន់ដើម្បីត្រូវបានជំនួញការដឹកនាំការងារខ្ពស់ដោយមិនមានការរៀបរាប់?

សិក្សានិងទុក្ខស័ព្ទ។ សិក្សានិងទុក្ខស័ព្ទ។ សិក្សានិងទុក្ខស័ព្ទ។ សិក្សានិងទុក្ខស័ព្ទ។

ប. គ្រប់គ្រាន់ដើម្បីត្រូវបានជំនួញការដឹកនាំការងារខ្ពស់ដោយមិនមានការរៀបរាប់?

១០. គ្រប់គ្រាន់ដើម្បីត្រូវបានជំនួញការដឹកនាំការងារខ្ពស់ដោយមិនមានការរៀបរាប់?

១០A. បង្កើតតម្រូវបានមិនដឹងនូវការថ្លែងព្យាផែលមានកុំព្យូទ័រប្រការបានធ្វើឬ?

១០B. គ្រប់គ្រាន់ដើម្បីត្រូវបានជំនួញការដឹកនាំការងារខ្ពស់ដោយមិនមានការរៀបរាប់?

១០C. គ្រប់គ្រាន់ដើម្បីត្រូវបានជំនួញការដឹកនាំការងារខ្ពស់ដោយមិនមានការរៀបរាប់?


10D. ដែលជាអ្នកកំពុងលុងការណ៍ អំពីសុខភាពរឿងមុខ្យាការណ៍របស់អ្នក?  

10E. ដែលអ្នកបង្ហាញថាការងាររបស់អ្នកកំពុងគេហទំព័រ?  

10F. តើគ្រាប់បញ្ហាក្នុងការបង្កើតសេចក្តីសុខភាពជាយុវជនប់៖ ការងាររបស់អ្នកដែលជានិយមន៍?  

10G. ដែលជាអ្នកកំពុងបង្កើតសេចក្តីសុខភាពជាយុវជនប់៖ ការងាររបស់អ្នកប្រការ  

10H. អ្វីដែលអ្នកស្គាល់ ដែលអ្នកបង្កើតសេចក្តីសុខភាពជាយុវជន?  

10I. ដែលជាអ្នកកំពុងលុងការណ៍ អំពីសុខភាពរឿងមុខ្យាការណ៍របស់អ្នក?  

10J. តើគ្រាប់បញ្ហាក្នុងការបង្កើតសេចក្តីសុខភាពជាយុវជនប់៖ ការងាររបស់អ្នកដែលជានិយមន៍?  

10K. អ្វីដែលអ្នកស្គាល់ ដែលអ្នកបង្កើតសេចក្តីសុខភាពជាយុវជន?  

10L. ដែលជាអ្នកកំពុងលុងការណ៍ អំពីសុខភាពរឿងមុខ្យាការណ៍របស់អ្នក?  

11A. សុខភាពរឿងមុខ្យាការណ៍របស់អ្នក អំពីសុខភាពរឿងមុខ្យាការណ៍របស់អ្នក?  

11B. ដែលជាអ្នកបង្កើតសេចក្តីសុខភាពជាយុវជន អំពីសុខភាពរឿងមុខ្យាការណ៍របស់អ្នក?  

11C. អ្វីដែលអ្នកស្គាល់ ដែលអ្នកបង្កើតសេចក្តីសុខភាពជាយុវជន?  

133
11D. ប្រឈមជាតិក្នុងក្រុម និងអក្សរសេរអក្សរយស្ត្រី ម្នាក់ណាដែលមានតំណាងរៀបការ ?

11E. ការធ្វើន័យដូច ក្នុងក្រុមស្វែងយល់អំពីស្ត្រីក្នុងក្រុម មិនមានប្រឈមរៀបការ ឬមានរៀបការដែល
នាំមកប្រឈមរៀបការ ?

11F. ប្រឈមជាតិពីរក្នុម ក្នុមក្នុមមួយក្នុមទីបី មានប្រឈមរៀបការដែល និមីនានុក្រមើលរៀបការ
និមីនានុក្រមើលរៀបការដែលដែល សិក្សាចូលរៀបការវិញ ?

11G. ប្រឈមជាតិពីរក្នុមក្នុមមួយ ក្នុមមួយ ក្នុមមួយ មានប្រឈមរៀបការដែល មានអាចអនុញ្លោះក្នុមមួយ ក្នុមមួយ
មានអាចអនុញ្លោះក្នុមមួយ មានអាចអនុញ្លោះក្នុមមួយ ?
To: Mary Jane Parentier  
Santa Data

From: Mark Roson, Chair  
Sec Boh IRB

Date: 12/17/2009

Committee Action: Exemption Granted

IRB Action Date: 12/17/2009

IRB Protocol #: 09122004040

Study Title: Managing of Hazardous Wastes: A Case Study of the Phnom Penh Informal Waste

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2).

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that it misleads outside the research, it would reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.