THE PRACTICE OF INFORMAL WASTE RECOVERY
AND
SOLID WASTE MANAGEMENT
IN
KATHMANDU, NEPAL

by
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We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

JULY 1997

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Date July 21, 1997
Abstract

The issue of Solid Waste Management (SWM) has become a major urban problem in developing countries. SWM is a basic service function which requires sizable injections of national and international assistance. Nevertheless, the results of investments are often far from satisfactory: large amounts of garbage remain uncollected, resulting in serious environmental pollution.

In most developing countries, two SWM systems exist side-by-side. One is a “formal system”, which is managed by public institutions or registered corporations. It is associated with registered ownership, organized labour, capital investment and modern technology. The main activities of the formal sector are typically based on collection, transportation and disposal of waste. The other, “informal system”, is based on waste recovery activities operating outside the official, legal, and institutional framework. It is associated with unregistered ownership, small scale operation, low capital and labour intensive inputs, and local technology. The purpose of this paper is to analyse the linkages between formal SWM and informal waste recovery practises in Kathmandu, Nepal.

Methods of investigation included interviews of actors involved in both formal and informal SWM systems and site observation. Through this investigation, the pathways of solid waste recovery of Kathmandu were identified. It was found that a highly organized informal sector recovers significant amounts of waste from the municipal
solid waste stream. Different actors in the informal sector play different roles in a rigid hierarchical social system. Informal waste recovery as a whole not only provides a source of income to one of the poorest segments of the population, but it also lessens the need for a costly, sophisticated SWM system.

Based on the findings of the study, the thesis concludes that informal waste recovery activities hold potential that is presently inhibited and handicapped in many ways. One of the major causes of such limitations is the lack of a source separation mechanism in the current SWM system. It is recommended that Kathmandu’s waste management handling agencies recognize the importance of informal recovery practices and encourage source separation to enhance the quality of the city’s overall solid waste management system.
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CHAPTER ONE: INTRODUCTION

Introduction and Research Problem

As cities grow, the issue of Solid Waste Management (SWM) becomes a major urban problem, especially in developing countries. SWM is a basic service function which typically consumes 20 to 50% of operational budgets for municipal services and often requires sizable injections of national and international assistance (Bartone and Bernstein, 1993: 25). Nevertheless, the results of investments are often far from satisfactory: large amounts of garbage remain uncollected, and uncontrolled dumping is common, resulting in serious environmental pollution.

In general, a principle based on waste recovery is beginning to transform thinking in solid waste management. In this thesis, waste recovery is defined as any productive use of what would otherwise be a disposed waste. In most industrialised countries, the principle of waste recovery has become an official policy, and is practised through private cooperation and citizens' initiatives. In developing countries, however, the principle is not widely practised (Bartone, 1990: 7). In these countries, the focus of SWM is on improving conventional engineering technologies based on effective disposal systems (Furedy, 1992: 42).

While the issue of waste recovery has received little attention from policymakers in developing countries, the "informal sector" has traditionally played an important role in
it. In the context of this study, the informal sector is defined as the segment of the private sector that operates outside the official, legal and institutional frameworks set up by agencies in charge of SWM. The sector is associated with unregistered ownership, small-scale operation, low capital and labour intensive inputs, and local technology. In contrast, the "formal sector" is defined as the segment of public bureaucracies or registered corporations that are officially in charge of SWM. The formal sector is associated with corporate ownership, large scale operation with capital investment and modern technology. It is estimated that approximately 10 to 40% of municipal solid waste in most developing countries is recycled through the informal sector (Lohani, 1990: 214).

The informal sector in developing countries is often closely interlinked with the formal sector. Thus, neither can be properly understood and developed in isolation. In practice, most urban SWM policy makers focus only on the formal sector and are usually not well-informed about existing informal practises of waste management.

This thesis analyzes the linkages between formal SWM and informal waste recovery practises in Kathmandu, Nepal. It shows that the informal sector plays an important role in Kathmandu's SWM scheme, especially with regard to waste recovery. The research questions that the author addresses in this thesis are as follows: (1) What are the recovery pathways of solid waste in Kathmandu? (2) What is the importance of the
informal sector? and (3) Is there a way to optimally link the informal sector into
Kathmandu's formal SWM system?

As far as the author knows, no study of SWM has been conducted in Kathmandu
before. Tracing routes of waste recovery provides unique insights into informal solid
waste management by SWM planners. Such information improves SWM practitioners'
capacity to be effective. The results of this study will also be beneficial for policymakers,
environmentalists, and academics.

Organisation of the Study

Given the above-mentioned research problems, the following topics were explored
in the course of research:

(1) Assessment of the current state of waste production in Kathmandu.
(2) Review of development of Kathmandu's solid waste management system.
(3) Identification of the roles and structures of informal waste recovery practises
in Kathmandu.
(4) Identification of recovery pathways of organic, paper, plastic, and glass waste.
(5) Policy perspectives regarding waste recovery and informal waste recovery
practises in Kathmandu.
(6) Identification of potentials and limitations of waste recovery processes in
Kathmandu.
The thesis is divided into five chapters. Chapter 1 covers research methodology, scope, and limitations of the thesis. The literature review of SWM, waste recovery, and informal practises in developing countries is covered in Chapter 2. The review is based on the premise that waste recovery is an essential component for SWM system in developing countries, and that an understanding of the particular roles played by the informal sector in the waste recovery field is crucial for designing a better SWM in developing countries.

Chapter 3 provides an assessment of waste production and waste management systems in Kathmandu. It reviews Kathmandu's recent experience with formal solid waste management, developed with the assistance of the German government. The main aim of this chapter is to explore how the imported SWM system proved unsuitable for Kathmandu's situation. The discussion leads to a conclusion that a reformed SWM system requires incorporation of informal waste recovery practices.

In Chapter 4, the primary findings of the researcher's work on identifying Kathmandu's waste recovery processes are discussed. The main purpose of this chapter is to identify actors involved in waste recovery and to analyse structures and pathways of recovery processes. This analysis highlights strengths and limitations of Kathmandu's current waste recovery system.
Chapter 5 offers some recommendations based on the researcher's field work and theoretical knowledge of SWM and waste recovery in developing countries. A specific proposal for a revised SWM system in which the informal sector play an integral role is discussed.

Methodology

Both primary and secondary data were collected for the study. The primary data were gathered in Kathmandu by the author with the assistance of several research assistants between December 1996 and April 1997. The information was collected through interviews and observations. The following people were interviewed: 60 scavengers, 20 itinerant collectors, 18 waste dealers, 12 waste wholesalers, 20 municipal workers, 10 industry executives and 10 government officials and community organisation workers. The study sample was a convenience sample of key informants who were willing to be interviewed. Of the 160 people approached, only 10 refused. All interviews, except for those with government officials, were conducted in Nepali. The interview guide was used to carry out interview.(see Appendix A). The interview guide covered the following issues: (1) socio-demographic characteristics of key informants, (2) waste recovery activities, (3) organisational aspects of activities, and (4) linkages between informal activities and formal sector activities.

A pilot survey conducted during November 1996 revealed some difficulties in carrying out the intended research. Informal workers were reluctant to answer certain
sensitive questions, such as their financial and legal status. To solve this problem, the researcher attempted to put interviewees at ease by explaining that the purpose of the research was purely academic and that their answers would be kept confidential. Information on sensitive issues, such as profits from waste transactions, was checked by asking the same question of different actors involved in the same transaction.

Primary data were also collected through observation of the sites where the activities took place. Through observation, the basic ideas behind tasks and organisation of activities became clear. Special care was paid by the researcher to remain unobtrusive during visits to the site.

Secondary data were collected from a number of sources: journals, newspapers, articles, project reports, proposals, evaluation reports, and other studies. Data on Kathmandu's garbage situation until 1990 are abundant and fairly accurate, as a result of German governmental assistance to the SWM sector. However, data after 1990 are difficult to obtain. Thus, some quantitative data after 1990 were estimated by the author, based on available information.

Scope and Limitations of the Study

The issue of SWM and recycling involves various sectors of society. It can be analysed from a social, economic, environmental, technical, or psychological perspective. This thesis analyses the issue mainly from a social and economic viewpoint, and does not
cover technical and psychological aspects. Furthermore, the scope of this study was limited to research on solid waste and its recycling in Kathmandu. Analysis on liquid or hazardous waste was not undertaken.

A major limitation of the study is the shortage of reliable quantitative data regarding the production of recyclable materials and the amount of recycled products manufactured in Kathmandu. This is because many informal waste recovery activities are carried out by small, unregistered entrepreneurs who do not usually record their transactions. Similarly, the amount of some recovered waste materials exported to India is not available because much of the trade takes place through illegal channels. As a result, accurate quantitative data on recycled materials were very difficult to obtain.
CHAPTER TWO: SOLID WASTE MANAGEMENT (SWM)

IN DEVELOPING COUNTRIES

Definition and Nature of Solid Waste in Developing Countries

The idea of waste arises from the perception that the material by-products of production and consumption have no further value. The Oxford Concise Dictionary defines "waste" as materials that are "superfluous, no longer serving a purpose, left over after use." Solid waste thus consists of physically firm, post-consumer, post-production residues that are considered to be no longer useful.

As by-products of production and consumption, the character of solid waste is influenced by many factors. These factors include: the consumption patterns of a society; its particular geographical character (urban or rural); the population's characteristics, income level, life style; and cultural and individual definitions of what is valuable and what is valueless. Any definition of waste is therefore an economically and culturally determined concept. While the production of solid waste is universal to human activity, there is no such thing as universal solid waste material (Sicular, 1989: 18).

Given these observations, it is understandable that there is at present no internationally recognised classification system for waste categories. Although the European Community and the OECD are developing new systems, the definitions of
Various types of waste, their hazards, recommended treatment and the differences between them and recyclable materials vary greatly between individual countries, to the extent that "no two are alike" (Gandy, 1989: 33).

An important issue in SWM in the context of developing countries is the relationship between waste and the urban poor. For low-income people, waste can be an important source to meet basic needs. For example, it is estimated that 52% of Indian households burn animal dung for cooking and for heating and lighting their houses (Furedy, 1990c: 5). Many shelters in squatter settlements in developing countries have been built with waste materials — from tree leaves to bicycle scrap metal (United Nations Development Programme Annual Report, 1996: 19). Occasionally, waste pickers resort to eating food waste (Fernandez and de la Torre, 1986: 34).

Waste can also be a source of employment. Most cities in developing countries have extensive waste recovery economies (Furedy, 1990a, b, c, 1993). Scavengers, itinerant collectors, middlemen, and a range of recycling industries are all common, and several million urban dwellers in Asia have created regular occupations based on waste (Furedy, 1993: 21). Those people range from scavengers who recover materials from streets and dumpsites, to workers in small recycling companies.

Examining the economic potential of waste, Sicular (1989) identified the dichotomous nature of solid waste. On the one hand, waste is valueless trash that needs
to be removed and disposed of effectively. On the other, waste is a resource from which
valuables can be extracted. Sicural distinguished these two perspectives by terming the
former “waste as waste” and the latter “waste as ore” (Sicular, 1989: 18-19). This
distinction highlights the essential question for waste management: for whom is waste is
waste, and for whom is it ore? In general, this distinction is not clearly recognised by
solid waste planners in developing countries. The result of this is unreliable official
statistics on waste generation and management, as a portion of recovered waste may be
excluded from calculations of total waste quantity. There is no reason to assume that
simply because one person decides an object to be useless and thus regards it as waste,
another will not see value in it.

Using the concepts of waste as ore and waste as waste, DiGregorio looked at two
existing solid waste management systems in developing countries. Examining Hanoi’s
waste management, he distinguished two systems—the refuse system and the recovery
system. The refuse system operates under ecologic motivation, driven by those whose
primary conception of waste is one of waste as waste. With such conception, the
principal strategy of the refuse system is to seek effective and sanitary methods of
removal, treatment and disposal of waste. The recovery system operates under economic
pressure motivated by the demand for recovered materials. The system is driven by a
network of scavengers, buyers, and traders whose relationship to waste is one of waste as
resource. The major strategy for the recovery system is to seek methods that derive
maximum resources from waste. This distinction is essential in understanding SWM systems in developing countries.

**Solid Waste Management (SWM) in Developing Countries**

The removal and management of solid waste in most developing countries are, like other basic services, far from sufficient. The deficient management of waste can cause problems in the urban scene in several ways. Waste is often thrown onto open land. This pollutes the surface of the land and contaminates soil, waterways and ground water. Or the waste may be burned, in which case it pollutes the air. Moreover, waste may be thrown into drains or streams, in which case it will pollute the water, hamper drainage, and create flooding. Accumulated waste on public roads can cause obstacles to traffic (Douglas, 1983).

Unmanaged waste also has serious health consequences. A World Health Organisation (WHO) report states that uncontrolled waste creates conditions favourable to bacteria, as well as the multiplication of rodents and vectors that are passive carriers of micro-biological human pathogens. Uncontrolled waste particularly affects preschool children and women (WHO, 1991: 321). Improved SWM is thus necessary for the healthy development of cities in developing countries.

SWM in developing countries typically involves five stages of activities: (a) local waste storage, (b) collection, (c) transport, (d) disposal, and/or (e) recovery. Table 1 summarises some of the various methods used at each stage. As the purpose of this paper
is not to elaborate on technical aspects, it will not discuss the methods in detail. Yet, clearly there are significant differences in the ways effective SWM is achieved in developing countries as compared to developed countries. While some of the differences are attributable to well-known dichotomies such as labour-intensive versus capital-intensive technologies (Bartone, 1986: 36), others are due to the waste characteristics themselves.
<table>
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<tr>
<th>SWM Method</th>
<th>Description</th>
<th>Technological Requirements</th>
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<tbody>
<tr>
<td><strong>Storage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household Storage</td>
<td>Each household stores waste in individual containers</td>
<td>Plastic bucket, Steel container with lid</td>
</tr>
<tr>
<td>Communal Storage</td>
<td>Waste is stored in communal containers in public spaces</td>
<td>Drum can, Depot, Enclosure, movable steel bin</td>
</tr>
<tr>
<td><strong>Collection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household Collection</td>
<td>Waste is collected door-to-door</td>
<td>Handcart, Animal cart, Truck</td>
</tr>
<tr>
<td>Kerbside Collection</td>
<td>Waste is collected at kerbside, where households place their waste containers</td>
<td>Handcart, Three-wheeled rickshaw, Dump truck</td>
</tr>
<tr>
<td>Communal Site Collection</td>
<td>Waste is collected from communal storage sites</td>
<td>Loading truck, Roll-up truck,</td>
</tr>
<tr>
<td><strong>Transport</strong></td>
<td>Waste is transported from collection points to treatment/disposal sites</td>
<td>Human-powered handcart, Animal cart, Pedal cart, Dump truck,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tripper truck, Rear-loading truck</td>
</tr>
<tr>
<td><strong>Disposal</strong></td>
<td></td>
<td></td>
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<tr>
<td>Open Dumping</td>
<td>Waste is dumped on open land or in the ocean</td>
<td>Land, Ocean, River</td>
</tr>
<tr>
<td>Sanitary Landfill</td>
<td>Waste is compacted, dumped and covered by layers of soil</td>
<td>Compactor, Bulldozer, Excavator, Landfill compactor</td>
</tr>
<tr>
<td>Incineration</td>
<td>Waste is burned and its residue is landfilled</td>
<td>Incineration plant</td>
</tr>
<tr>
<td><strong>Recovery</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal Feeding</td>
<td>Waste is used to feed animals such as pigs</td>
<td>Animals</td>
</tr>
<tr>
<td>Open-Window Composting</td>
<td>Organic waste is piled up and decomposed through bacterial action</td>
<td>Soil</td>
</tr>
<tr>
<td>Mechanical Composting</td>
<td>Organic waste is decomposed through mechanical stabilisation</td>
<td>Mechanical composting plant</td>
</tr>
<tr>
<td>Energy Recovery</td>
<td>Waste is heated to gain energy, usually in the form of electricity, heat or steam</td>
<td>Energy recovery facilities</td>
</tr>
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</table>

**Table 1. Some Common Methods Used For Solid Waste Management in Developing Countries**
Typically, waste in developing countries has two times higher moisture content and two to three times higher density than that of developed countries (Cointreau, 1984; Lohani, 1990). High density makes compaction-based systems redundant: packer trucks, bailers, and bulldozers are generally unjustifiable (Gandy, 1989: 35). High levels of both moisture and density indicate that incineration, a method used in the West, is probably not appropriate. Rather, Third World waste is more suitable (at least technically) for composting (Cointreau, 1982; Flintoff, 1976; Furedy, 1990c).

Many of the SWM systems promoted in developing countries during the last few decades have essentially followed a Western model. These systems are large, centralised, highly technical, and based on compacting and disposal (Sicular, 1989: 99). Although lip service has been paid to promoting waste recovery activities such as composting, the reality has been that material recovery systems are usually qualified as “(an) option only when feasible” (Furedy, 1990c). Thus, much of the focus has been on improving engineering systems, which essentially involve waste collection, transport and disposal.

Waste Recovery in Developing Countries

Definition and Structure of Waste recovery

In modern usage, the term “waste recovery” has evolved into a concept encompassing any productive use of what would otherwise be residue requiring disposal. This generalisation is, however, rather ambiguous as there are many levels involved in
waste recovery. Fig. 1 illustrates different levels of waste recovery. The following paragraphs explain each level briefly.

Fig. 1. Different Levels of Waste Recovery
(Source: Pearce and Turner, 1990)

Reuse/Repair: The shortest loop represents "reuse and repair". Reuse is the use of an item in its original form for the same or a different purpose (Gandy, 1989: 35). No significant transformation of the residual occurs. For example, grocery bags may be reused as garbage bags. This category also includes repair operations. Reuse and repair require fairly simple technological and material inputs, and are thus widely practised in developing countries.
Closed-Loop Recycling: Recycling can be defined as a method to reprocess waste in order to recover an original raw material. Two categories can be distinguished. Closed-loop recycling involves (a) the return of a secondary material to the same industry from which it came, and (b) processing of that material into the same or a similar product. The waste generally does not enter the waste stream and is reprocessed in the same production process at the enterprise level. An example is the recycling of a glass bottle into a new bottle.

Open-Loop Recycling: This category differs from closed-loop recycling in that the secondary materials used for it comes through the waste market. In open-loop recycling, materials are retrieved from the waste stream and are marketed in both formal and informal markets. As Fig. 2 shows, the materials enter the production cycle at an earlier stage than closed loop recycling. In addition, they are often reprocessed into totally different products. Composting from organic waste to produce fertilizer is one example of this category. This type of recycling is very common in developing countries (van Beukering, 1994: 231).

Energy Recovery: Energy recovery is a process aimed at capturing energy from residuals, usually in the form of gas, steam or electricity -- either by direct combustion or by first converting it into intermediate fuel products. One example is the production of bio-gas from cow dung. This method can be regarded as the final option for materials that cannot be reused or recycled.
As open-loop and closed-loop recycling are the most widely performed types of recycling found in developing countries, this paper focuses on them. The rest of this section will cover the topics of waste recovery and the economics of recovery processes.

Estimates of the theoretically achievable waste recovery rate for solid waste vary depending on different evaluations of the composition of the waste, the degree of material contamination, and the technically obtainable recovery rates for individual materials. Due to these factors, estimates for recovery rates for household waste in developed countries range from 40% by weight (Bartone, 1986: 21) to about 60 to 80% by weight (Lewis, 1992:43). For developing countries, the estimates for recovery of household waste vary between approximately 30% by weight (Baur, 1990:171) to 70% by weight (Lohani, 1990:3), depending on the type of waste.

The economics of waste recovery depend largely on the expenses associated with operating the recovery processes, including costs for collecting, sorting, cleaning and processing. Thus, some materials that require labour-intensive recovery processes are generally more feasible in developing countries, where labour is cheap and plentiful. For example, sorting is an essential component of the plastic recovery process, as it can only be recycled if the input is completely homogeneous (Vogler, 1984: 35). While plastic recovery is rarely practised in industrialised countries because of the high costs entailed, more than 400 small enterprises in Cairo recycle approximately 70% of the city’s plastic
Waste Recovery Options in Developing Countries

The adoption of suitable waste recovery technologies differs widely between developed and developing countries, due to differences in the availability of technologies, capital and labour. Some materials can be recovered by using simple technologies and minimum capital inputs. Table 2 provides brief descriptions of some widely used recovery techniques for various materials in developing countries. As the table indicates, most materials in developing countries can be recycled.
<table>
<thead>
<tr>
<th>Type of Waste</th>
<th>Process</th>
<th>Products</th>
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<tr>
<td><strong>Organic Waste</strong></td>
<td></td>
<td></td>
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<tr>
<td>Rice Husks</td>
<td>Extrusion</td>
<td>Fuel briquettes</td>
</tr>
<tr>
<td></td>
<td>Pulping</td>
<td>Paper board</td>
</tr>
<tr>
<td>Straw grass, jute stalks</td>
<td>Pulping</td>
<td>Straw board</td>
</tr>
<tr>
<td>Coconut husks</td>
<td>Carbonising</td>
<td>Activated carbon</td>
</tr>
<tr>
<td>Food waste</td>
<td>Composting</td>
<td>Compost</td>
</tr>
<tr>
<td>Animal bones</td>
<td>Chemical treatment</td>
<td>Bone meal for poultry</td>
</tr>
<tr>
<td></td>
<td>Carving</td>
<td>Buttons, Decorative items</td>
</tr>
<tr>
<td>Animal hair</td>
<td>Cutting, Slitting</td>
<td>Brushes</td>
</tr>
<tr>
<td><strong>Paper Waste</strong></td>
<td>Pulping</td>
<td>Carbon, Egg trays</td>
</tr>
<tr>
<td><strong>Plastic Waste</strong></td>
<td>Moulding, Blowing, Extruding, Pelletising</td>
<td>Plastic products (pipes, films, containers, bags)</td>
</tr>
<tr>
<td><strong>Metal Waste</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tin cans</td>
<td>Punching, Moulding</td>
<td>Ash trays, Jugs, Cans, Pots</td>
</tr>
<tr>
<td>Copper wire</td>
<td>Oxidation, Drying</td>
<td>Copper sulfate</td>
</tr>
<tr>
<td>Aluminum scrap</td>
<td>Melting, Casting</td>
<td>Metal parts</td>
</tr>
<tr>
<td><strong>Glass Waste</strong></td>
<td>Melting, Moulding</td>
<td>Aluminum Utensils</td>
</tr>
<tr>
<td>Broken glass</td>
<td>Melting, Forming</td>
<td>Glassware, Containers, Tiles, Decorative items</td>
</tr>
<tr>
<td>Bottles</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Textile Waste</strong></td>
<td>Buffing, Spinning</td>
<td>Yarn</td>
</tr>
<tr>
<td><strong>Rubber Waste</strong></td>
<td>Cutting, Stitching, Gluing</td>
<td>Slippers, Buckets</td>
</tr>
<tr>
<td><strong>Other Waste</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used engine oil</td>
<td>Chemical treatment</td>
<td>Cooking fuel</td>
</tr>
<tr>
<td>Cane wax</td>
<td>Refining</td>
<td>Polishes</td>
</tr>
</tbody>
</table>

**Table 2. Waste Recovery Processes and Products of Various Waste Materials**
(Source: Aye, 1990; Vogler, 1984; and Devkota, 1993)

Different waste materials have different recovery potentials and processes. For example, paper rapidly loses its value when mixed with other refuse, particularly with organic waste. Glass and metals are less vulnerable to contamination. Organic wastes destined for composting are easiest to handle if they are free from inorganic matter. Metals, glass and steel generally require elaborate processing, but can achieve a
significantly high recovery rate. In fact, the OECD estimates that over 90% of waste
glass can be recovered (Gandy, 1989: 38).

Materials unsuitable for recovery include those composed of many different
materials and those that are severely degraded. Laminates of aluminum, paper, and
plastics are generally technically and economically unfeasible for recovery (Pollock,
1987: 23). The same holds true for plastic products made of chemically incompatible
resins.

In general, municipal officials in developing countries consider solid waste as a
Thus, municipal officials often tend to adopt measures such as dumping, landfilling or
incineration, and give only superficial attention to recycling, composting and other

Part of the reason for the hesitation of authorities to recover waste can be
explained by the nature of existing recovery systems. In most developing countries, there
are highly developed informal sector networks of waste scavenging. These networks are
responsible for recycling significant amounts of the municipal waste stream (Bartone,
1990: 15-16). Scavengers are driven by the industry’s need for low-cost secondary
materials, and by their own high levels of underemployment and poverty.
Problems arise because recycling is in the hands of the informal sector. Authorities tend to view this sector with suspicion, and often regard scavenging as an impediment to managed waste disposal (Furedy, 1993; 1990c). This leads to conflicts and inefficiency. For example, street scavenging can result in garbage being scattered, thus impeding rapid collection. At the dumpsite, scavengers may get in the way of municipal dumping operations. As a result, authorities tend to view recycling as an “unsavoury activity” that hampers the removal of waste.

Informal SWM Activities in Developing Countries

Informal SWM: Definitions, Benefits, and Negative Aspects

The distinction between “formal” and “informal” has been explored in the field of planning literature, particularly with reference to employment and housing (Furedy, 1990c: 16). “Formal activity” can be defined as a practise that is associated with public bureaucracies or registered companies. These practises are generally controlled and regulated by formal law, usually involve organised labour, large capital investments, and modern technology. While “formal” activities are related to established organisations, “informal” activities are associated with unregistered and unregulated activities. Normally, informal activities are practised by small-scale individual and family enterprises, and involve low-capital but labour-intensive inputs. The informal sector plays a key role in employment, housing, and infrastructure in developing countries, and is regarded as central to the functioning of cities (Furedy, 1990c; Yeung and McGee, 1986).
Issues of formal/informal linkage are now emerging in the SWM sector. Here, the distinction is between (a) the officially mandated SWM system -- the collection, treatment and disposal systems developed by the municipality and registered corporations -- and (b) those other activities that significantly affect official SWM but are usually perceived as illegal and non-formal activities -- scavenging and other unregistered small-scale recycling activities (Furedy, 1990c: 17). Both formal and informal sectors are typically interconnected.

Informal waste recovery activities typically include various practises by different actors: (a) scavengers who retrieve secondary materials from streets, rivers and dumpsites, (b) municipal staff who both retrieve and transport materials, and (c) middlemen who buy and sell waste. Informal activities are often strongly interrelated with the formal sector. Material inputs required by registered recycling factories are often collected by scavengers and sold though middlemen. Also, municipal collection workers often engage in retrieval of materials during their working hours and sell them to dealers on their own time.

The importance of the informal sector has been recognised by various SWM experts. Bartone, the World Bank expert on SWM, has stated in his paper that “most of the sorting and recycling of municipal solid waste is almost always carried out by the informal sector through groups of highly organised scavengers” (Bartone, 1986: 39).
Studies carried out by the United Nations Development Project/World Bank Integrated Resource Recovery Project have emphasised that highly developed informal sector networks of waste recovery exist in almost all developing countries (Bartone, 1990:15). Lohani, an expert on Asian waste issues, estimates that approximately 40 per cent of solid waste is recycled by the informal sector in Asia (Lohani, 1990: 16).

Informal recovery practises have several benefits: First, recovery of materials lessens the need for extraction of raw materials which may be non-renewable (Sicular, 1989: 3). Second, the informal sector generates employment for both unskilled and skilled workers. It provides simple jobs such as waste-picking for unskilled workers, as well as trading and reprocessing jobs for skilled workers. For very poor people, working in the informal waste sector can be a last resort in the daily struggle for survival. In Manila, for example, an estimated 17,000 people make their living as dump site scavengers (Furedy, 1990c: 36). Third, the informal sector provides industries with materials at a lower cost than new materials. This can reduce dependence on the importation of raw materials required for production processes. In Egypt, plastic manufacturers can save an estimated 50% on costs of raw materials by using recovered plastics (Lardinois and van de Klumdert, 1994: 4). Fourth, informal recovery of materials is usually less costly and less environmentally damaging than disposal systems, which require a vast amount of capital for landfill management. (Sicular, 1989: 31; Denison and Luston, 1991: 43). Fifth, informal recovery reduces the volume of waste and therefore
reduces the public burden of collection, transport and disposal of waste (Sicular, 1989: 30; Lardinois and van de Klumdert, 1994b: 6).

The last point is of considerable importance for SWM. In Bandung, Indonesia, only 25% of the generated solid waste is collected and disposed of by the municipality. This is done in largely unsanitary fashion and at high cost. Scavengers, with no support or subsidy, recover approximately 7 to 15% of municipal solid waste (Sicular, Supardi, and Rasad, 1985). In Cairo, informal waste pickers collect approximately 2,700 tons of household waste per day, while the municipality collects 2,400 tons per day (Lardinois and van de Klumdert, 1994: 8). It is clear that the informal recovery sector can play a vital role in a city’s SWM system.

At the same time, informal recovery systems also have negative aspects, especially for the workers involved. First, systems are often characterised by unsafe working conditions. Because most of the activities are unregistered and thus not governed by labour laws, working conditions are often extremely poor. Furthermore, the handling of waste itself has potential health hazards. As was mentioned before, urban solid waste may contain large quantities of pathogenic micro-organisms. Second, in the absence of proper monitoring systems, some unregulated recycling enterprises may generate environmental pollution during their re-manufacturing processes (WASTE, 1996: 3). In Egypt, zinc and metal recovery from batteries creates land and water pollution, as the residue containing heavy metals is thrown away (Kobata, 1994: 11). Similarly, in
Istanbul, copper wire from electric conduits is extracted by burning the plastic covering the wire, thereby causing air pollution (Miyoshi, 1990: 21).

**Research on Informal Recovery Activities**

Recognition of informal recovery activities is fairly recent in the research field. Pioneering studies were conducted by Keyes (1974), who researched Manila scavengers, and by K. Taira (1969), who wrote about waste in Tokyo (Taira (1969) in Furedy, 1990c: 18). During the 1970s, a number of studies on informal waste recovery activities in various cities began to emerge (Asia: Siccular, 1989; Furedy, 1984a, 1984b, 1988, 1990a,b,c; Muttamara, Visvanathan, and Alwis, 1994; Poerbo, 1992; Lohani, 1984, 1990; Mukherjee and Singh, 1981; Huysman, 1994; Africa: Tevera, 1992, 1994; Kobiah, 1985; Leiman, 1985 Latin America: Birkbeck, 1979a, 1979b). Many of these studies focused on the issue of scavenging. Some research on scavenging issues was undertaken with a special focus on urban poverty and the informal sector (Keyes, 1974; Birkbeck, 1979; Furedy, 1984a), while other studies focused on profiles of scavengers (Birkbeck, 1979; Tevera, 1994; Huysman, 1994). A more recent debate on scavengers has focused on social aspects (Furedy, 1990c) and on the analysis of scavenging as a traditional mode of production (Siccular, 1989). Many of these papers were written from sociological and anthropological viewpoints. Other papers were written by people involved in formal solid waste management.
Many studies suggest that informal recovery activities are generally highly structured and involve various actors. Among those actors, scavengers and itinerant collectors are the primary recoverers of materials. The term scavengers has been applied in different ways. Blincow defines scavenging as "the activity involved in the collection and disposal of culturally-defined waste materials, whether that activity is done directly for subsistence, for exchange, for sale, for wages, or as is sometimes the case, for some combination of these". He identifies four categories of scavengers: (1) the destitute who scavenge mostly for direct consumption; (2) self-employed producers of materials from waste, and those employed by them for other than wages; (3) wage laborers employed in public or private services; and (4) owner-workers who are members of cooperative organisations (Blincow: 1986: 99).

Sicular, however, while appreciating the way Blincow's categories highlight the wide variety of employment structures of scavengers, criticises his failure to distinguish the essential dichotomy that exists among waste handlers. The dichotomy is between those who treat waste as waste and are employed to remove and dispose it, and those who treat waste as ore -- as a source from which valuable materials can be extracted. Based on this distinction, Sicular defines scavengers as those people whose relationship with waste is waste as ore. These people are engaged in collecting, gathering, or extracting materials from waste, usually for exchange value, though sometimes for use value (direct consumption). Their work generally involves some sorting or processing. In contrast, he defines those who treat waste as waste as refuse workers (Sicular, 1988: 16-18). In this
paper, the author uses the term scavengers according to Sicilari's definition, as opposed to refusers, who are generally employed by municipalities or other public bureaucracies, or sometimes by contractors.

While many studies are conducted on scavengers, less is known about itinerant collectors (Furedy, 1990c: 19). Itinerant collectors retrieve waste door-to-door from households, institutions, and offices. In the Philippines, itinerant collectors are known as "announced collectors," as they shout from the streets. They are found to some extent in almost all developing countries. They seek various materials such as newspaper, glass bottles, cardboard, metal and wood. In India, some collectors specialise in obtaining old saris and cloth, usually offering pots and kitchen equipment in return (Furedy, 1991:12). As itinerant collectors obtain waste from the source before it is mixed and contaminated, they are valuable actors within informal recovery systems. Nevertheless, municipalities in developing countries often view them as undesirable and dirty, and make door-to-door collection difficult or illegal (Keyes, 1974; Furedy, 1990c:19).

Very few studies have been done on the middlemen who act as liaisons between primary recoverers and the recycling industry. Those middlemen are generally categorised as dealers and wholesalers. They are different from primary recoverers in that they collect materials in large quantities and mostly deal with sorting and marketing of retrieved materials. It is generally believed that these wholesalers make large profits from their operations (Furedy, 1990a, 3; van Beukering, 1994: 238).
Social Dimensions of Informal Waste Recovery Practises

Any attempt to understand contemporary patterns of informal waste recovery activities and their place within different urban settings must take into account the social dimension of waste workers involved in these activities. It is particularly important to note any linkages between waste workers and any social stigmas attached to them.

Generally, waste workers are associated with low social status in many parts of the world. Scavengers have historically been from marginal status groups: gypsies, immigrants, heretical religious sects, semi-criminals, untouchables, and other low-caste/outcaste groups (Blincow, 1986). Among these social groups, one can often find a relationship between particular ethnic/caste status -- sometimes even "outcaste" membership -- and scavenging activities. Studies carried out in different Indian cities suggest that scavengers are from untouchable castes\(^1\), and that they live in residential segregation and are subject to many forms of discrimination (Furedy, 1990: 10; Furedy, 1984: 130). This is mainly because the waste material they handle is generally associated with impurity by members of most other groups. In such cases, there occurs a cultural linkage between the "polluted, stigmatised and excluded" ethnic/outcaste status and the defiling nature of scavenging work (Blincow, 1986: 102). Ethnic/caste values thus act to reserve these occupations for certain categories of persons in India. A similar "reservation" has been noted in several other societies. In Cairo, for example, waste is collected and processed exclusively by Christian Zabaleens.

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\(^1\) These low castes include the scheduled castes (Harijans, or untouchables) and backward castes.
There is also a specific linkage between waste work and women and children. In most developing countries, women and children predominate in the lowest levels of waste recovery activities, namely, the scavenging of least valuable items that require the greatest amount of simple labour for the lowest cash returns. Thus, in Asia, one finds mainly women and children working on dumpsites that receive large amount of organic and inert material, except at the specific times men know that trucks will arrive from special areas such as the airport or from wealthy residential neighbourhoods (Furedy, 1990b: 26). Similarly, a majority of Indian street waste pickers working in poor neighbourhoods where material with high economic value is scarce are observed to be women (Huysman, 1994:159). According to Furedy, cities where large quantities of more valuable items reach dumps have larger numbers of male waste pickers (Furedy, 1990a: 3)

It is possible that religious values may influence male: female ratios among waste pickers. In Muslim societies women may not feel free to pick up waste in public places. In Indonesia, women of scavenging families tend to engage in the cleaning and packing of waste, while husbands and sons seek out the waste (Sasono, 1988; Furedy, 1990a; 1993).

Children also form a major group in scavenging activities, as scavenging is one of the typical survival strategies adopted by abandoned or runaway children in situations
where social agencies offer little or no assistance. For many poor families, the scavenging labour of children can be crucial, since their income enables the family as a whole to earn more than the father and mother can alone. Yet, as WHO reports, children are particularly vulnerable to health hazards at waste picking sites, especially respiratory and parasitic problems (WHO, 1990:171, Furedy, 1990c:14).

While women and children comprise a majority of scavengers, the middlemen and managers of waste recycling industries are mostly men (Huysman, 1994: 155; Furedy, 1990a; 3; Miyoshi, 1990: 24). Often, the restricted opportunities for finding work put women and children at a disadvantage. They are generally paid less for the waste they sell, and receive less by way of advances or loans from dealers. Despite the fact that women and children play important roles in waste recovery processes, very few studies focus on these issues.

Social Relations Within the Waste Recovery Activities

The picture that emerges from various literature on waste recovery practices in developing countries is one of a complex system of activities with numerous actors fulfilling various tasks and roles. Typically, these actors are hierarchically organized. For example, in Cali, Colombia, a hierarchical network of scavengers, traders and warehouse operators form a rigid hierarchy in the city’s waste recovery sector (Birkbeck, 1978).
DiGregorio notes that on a technical level, these hierarchies within the waste recovery system appear as a division of labour processes based on scale and degree of specialization. (DiGregorio, 1993: 14). At the bottom of the hierarchy are the primary collectors--scavengers, municipal collectors, and itinerant collectors. Above the primary collectors are the dealers who trade a wide range of materials. Above dealers are the various wholesalers, who tend to specialize in one material and deal in large volume. In general, individuals in higher strata in the hierarchy tend to handle more materials, and tend to have larger working capital than those in lower strata (Sicular, 1989:45).

In many instances, these hierarchies are based on ethnic, caste, religion and communal affiliations. Often these affiliations act as mechanisms that assign specific tasks to particular social groups, thus segmenting a system. In Calcutta, Furedy noted that scavengers working at the Dhapa dumpsite were predominantly migrants from Bihar while buyers were mostly Bengali (Furedy, 1984). In Cairo, waste is collected and processed by Christian Zabaleens under contracts negotiated by Muslim Wahis.

While social affiliation acts as a basis for segmenting the system, there are some social mechanisms that create dependent relationships among various groups within the hierarchy. DiGregorio identifies three such mechanisms: (1) tying, (2) patronage, and (3) gatekeeping (DiGregorio, 1993:14-17). The most commonly observed mechanism is the institution of "tying." "Tying" occurs when more powerful waste handlers extend credit and other benefits to smaller handlers in return for an obligation to sell materials.
exclusively to them (Sicular, 1989: 45). Patronage is similar to tying, but it is based on social relations that are already established. These relations may be traditional relations among different castes, or relationships between ethnic, regions or religious groups that have evolved over time. There is often a degree of mutuality in these patronage relationships. Patrons typically supply access to the resource, access to the market, secure accommodation, cash advances, and sometimes relief during times of desperation. In exchange, they receive loyalty and the right to extract surplus from sellers.

Gatekeeping is a process in which access to markets and higher levels of hierarchy within the recovery system is controlled and maintained without extension of credits or benefits. This structure often develops into extractive forms of dependency in which dominant and subordinate social groups are dependent on each other. The case of a municipal dumpsite in Bandung, Indonesia, illustrate the gatekeeping mechanism. In this municipal dumpsite, scavengers are forced to pay municipal employers for the right to access to the dumpsite (Sicular, 1989).

**Organizing and Supporting Informal Recovery Activities**

Although informal recovery plays a pivotal role in urban waste management, generally authorities perceive this sector with suspicion and often refuse to admit its existence and its essential contributions (Bartone, 1990: 16; van Beukering, 1994: 233; Furedy, 1990c: 17; 1993; Tavera, 1992: 22). A typical response of municipalities or other government authorities to informal activities is to control, regulate and sometimes inhibit recovery activities. For example, in 1987, the city of Manila undertook a scheme
to eliminate scavengers in the city as a part of developing comprehensive SWM. The plan was to close down the “Smoky Mountain” dumpsite, where an estimated 14,000 people lived and worked, with the intention of “discontinuing dependence on waste as a source of livelihood in Metro Manila” (Furedy, 1990c: 25). Scavengers were to be relocated to other areas and provided with a social development program. The idea was to develop a fully controlled waste recovery system based on large-scale recovery plants.

Not all cities in developing countries attempt to eliminate informal activities: some municipalities adopt innovative policies that reconcile the interests of the formal and informal waste management sectors. In Indonesia, for example, scavengers and itinerant collectors have formed cooperatives with the support of the local and central government (Furedy, 1990c, 19; Cointreau and de Kadt, 1991; Pollock, 1987; Sasono, 1988). Once united into cooperatives, they are empowered to obtain better prices from dealers and wholesalers who buy materials on behalf of industries. They are also able to purchase better equipment, which allows them to meet industrial specifications and thus obtain higher prices. Similarly, in Ciudad Juarez, Mexico, local scavengers are provided support by the municipality to organize themselves into recycling cooperatives. The result is that they have received a concession from the municipality to operate the landfill and have thereby improved their working conditions (Bartone and Bernstein, 1993:51).

Some initiatives provide direct support to aid scavengers. In Egypt, with the help of World Bank funding, a neighbourhood of scavengers has received upgraded
community infrastructure such as water and drainage systems and streets, as well as improved collection equipment (Cointreau and de Kadt, 1991).

Some cities assist informal activities by promoting small-scale recycling industries. Several cottage industries to recycle waste into new products were established in 1989 in the Philippines with the assistance of the central government. The government also assisted new companies in networking with scavengers and other collectors, and in finding markets for their products (Cointreau, 1991). Similar schemes exist in Myanmar, where the central government provides technical and institutional support for small-scale, often family-owned cottage industries based on the utilization of waste. The materials used for operating these cottage industries vary from coconut husk and jute stalks to candle wax and used engine oil (Aye, 1990).

Innovative efforts are also made by non-governmental and community organizations. In 1990, in Bangalore, India, a group called Waste Wise initiated a comprehensive community-based waste management project that involved social, economic, environmental and educational components. Part of the activities involved organising scavengers and other collectors, and networking the collectors with city authorities and with middle- and upper-class residential areas (Furedy, 1992; Rosario and Weid, 1990). In Bangkok, Thailand, the Community Relations Group, a Bangkok-based NGO, supported scavengers living in the On Nooch dumpsite. The group assisted scavengers in acquiring land and developing low-cost infrastructure (Furedy, 1990c:33).
Such community efforts often suffer from typical limitations of small-scale community projects: shortfalls in funding, lack of expertise, and difficulties in making an impact on official thinking. Nevertheless, their potential for improving the conditions of waste recovery is great.

Conclusion

The aim of this chapter was to present important issues of SWM and waste recovery in the context of developing countries. The discussion has been premised on the argument that waste recovery and recycling are important enough in these countries to deserve more attention by SWM practitioners. From the environmental point of view, the recovery and use of solid waste can achieve resource savings. Social perspectives emphasise waste recovery’s importance in the livelihood of many urban poor. From the economic perspective, recovery and recycling may often be easily carried out in developing countries where labour is plentiful, and is less costly in the long term than sanitary landfills.

Despite the fact that recovery and recycling are beneficial for SWM schemes, developing countries tend to focus much of their strategy on improving disposal techniques, such as sanitary landfilling. However, sanitary landfilling can only be regarded as a temporary solution to a permanent problem: In many North American cities, sanitary landfills were the most economical and sanitary option in the 1950s and 1960s due to their low capital and operating costs and low labour requirements, as well as
the availability of land. Recently, however, many U.S. cities have run out of space for sanitary landfills and have had to either seek new sites far from the city, or turn to other costly disposal options such as incineration or exporting wastes across county, state, or national boundaries. Transportation costs have increased, resulting in a huge increase in sanitary landfill costs. If cities in developing countries choose to use sanitary landfills as the primary disposal method in their SWM scheme, they can expect similar problems to arise in the near future. Systems based on recovery and recycling will become much more appropriate in resource-scarce developing countries.

While many urban SWM planners focus on improving disposal methods, the actors in the "informal sector" play significant roles in waste recovery processes. In most cities, such informal activities are responsible for far more waste recovery and recycling than formally-sanctioned activities such as compost-making in municipal plants (Furedy, 1990c: 18). Moreover, informal activities are in general highly organised, in spite of the appearance of individual, casual work. Further, these activities are organized as a rigid hierarchy with internal social mechanisms. In such a situation, one of the main questions that needs to be asked of solid waste management planning in developing countries will be its impact on these informal waste recovery and recycling activities as they are currently carried out. Often, when cities try to increase the efficiency of waste management with more mechanisation, friction between formal and informal waste systems increases.
There is no societal recognition of waste recovery to the economy, and waste workers generally have no concept of the pivotal role their work plays in urban settings (Furedy, 1993: 18). As a result, the social status of waste workers, especially of primary collectors, is very low. The reason for low social status among waste workers is partly due to the historical and cultural linkage between a particular socio-ethnic status and waste work. The persistent association of particular socio-ethnic groups with "dirty work" often restricts the ability of these groups to improve their status and their working conditions. A special relation between women and children and waste work is also prevalent in many developing countries. Any attempt to improve existing SWM in developing countries should take these issues into consideration.
CHAPTER THREE: SOLID WASTE MANAGEMENT IN KATHMANDU

The aim of this chapter is to present an analysis of Kathmandu's waste generation and the city's SWM system. The chapter will begin with a brief description of Kathmandu, and will continue with a summary of literature on the quality and quantity of Kathmandu's solid waste. Following this, the history and development of SWM schemes will be analysed. The last section will scrutinise the current formal SWM system as of March 1997.

Background of Kathmandu

With a population of some 20 million and a per-capita income of US$190, Nepal is one of the poorest countries in the world (Nepal Statistics Bureau, 1996). Despite close cooperation with a multitude of donors for four decades, economic growth rates have barely kept up with population growth. According to the National Planning Commission of Nepal, 42.5% of the population lives in absolute poverty.

Kathmandu, the capital of Nepal, is located in the Kathmandu Valley in central Nepal. It is situated north of the Bagmati River with the country's second city, Patan, on the south bank (Fig. 2). The valley is surrounded by a ring of mountains with peaks as high as 2,700 metres. The altitude of the city is 1,340 m. The valley has a typical centripetal drainage system in that all streams converge to the central axis before draining through a narrow
gorge out of the valley. The city has a subtropical climate, with a dry, cool season from October to May, and a hot monsoon season from June to September.

**Fig. 2. Map of Kathmandu City**
(Source: Map of Kathmandu Valley, 1995)
Like other Asian cities, Kathmandu has experienced rapid population growth during the last few decades. Fig. 3 shows the population increase in the city between 1971 and 1996. The 1971 census showed a population of 150,402 in Kathmandu. The yearly population growth rates in Kathmandu in 1981, 1986, 1991, and 1996 were 4.17%, 4.29%, 6.29%, and 7.88%, respectively. Compared to 1971, the city's population in 1996 was nearly quadrupled. The main reason for this rapid population growth is rapid in-migration from rural areas (Kobayashi, 1994: 122). Although direct data on urban migration is not available, “apparent migration” data, computed from the difference between national growth rates and observed urban growth rates of towns, shows that 62% of the increase in urban population between 1971 to 1981 was caused by migration (Sharma, 1992: 117).

Fig. 3. Population Growth in Kathmandu City, 1971-1996
(Source: Sharma, 1992:21)
Kathmandu’s Solid Waste

Solid Waste Generation

Various quantitative data exist on solid waste generation in Kathmandu city. Most data were collected between 1985 and 1990, when the city was developing a comprehensive SWM system with German assistance. This information, however, must be treated with caution for several reasons. First, the data are not comparable over time, as different data are based on different sampling methods, locations and seasons. Second, certain items fail to accurately indicate waste generation as they are based on data collected at disposal sites and do not take into account reductions in the waste stream that arise at various stages on the way to disposal. Reductions occur because waste is taken away by scavengers and occasionally by animals. It is estimated that approximately 15% of Kathmandu’s waste is removed on the way to the disposal site (SWMRMC, 1993: 18). Third, most estimates of solid waste generation in Kathmandu do not take into account uncollected or illegally dumped waste. In summary, the existing data fail to accurately represent the city’s total waste generation.

Despite difficulties in obtaining precise data, some rough trends in the amount of waste produced are evident. In 1978, Lohani and Thanh determined that Kathmandu residents produced 0.25 kg of waste per person per day (Lohani and Thanh, 1978). During the 1980s, this amount increased to 0.4 kg (Sharma, 1985:17; SWMRMC, 1988: 31). By 1990, the estimate had risen to 0.565 kg (Rai, 1990:4). According to a United Nations Environmental Program report, the figure of 0.565 kg of waste per day is similar to the
average generation rate of other low-income countries (UNEP, 1990:23). The figure also suggests that waste generation per head in Kathmandu has more than doubled over the last ten years.

Total urban waste production was estimated in both weight and volume on the basis of the aforementioned waste generation rate. In 1989, Thapa estimated that the city’s population of 350,000 produced a total of 140 tons of waste per day. Assuming a population increase of 25.2% and a waste generation increase of 40%, Thapa projected that the city would produce 200 tons of waste in 1995 (Thapa, 1989: 12). A projection in volume of waste per day was also made in 1990. Fig. 4 shows that the projection of volume of generated waste is estimated to double between 1994 and 2004.
Characteristics of Solid Waste

Similar to other developing countries, urban municipal waste in Nepal can be characterised as dense, highly organic, and moist. According to Center of Economic Development Administration (CEDA), 70 per cent of Kathmandu's solid waste is biodegradable (CEDA, 1989: 12). Similarly, on the basis of waste samplings by Unnati Adhar Kendra, a small Kathmandu NGO managing household wastes, 74 per cent of waste was determined to be organic (Tuladhar, 1996: 332).
Lohani and Thanh (1978) estimated the density of Kathmandu's waste to be 600 kg/m³ (Lohani and Thanh, 1978: 25). A more recent study conducted in six locations by the SWMRMC in 1988 found that the density varied between 330 and 430 kg/m³ (SWMRMC, 1988: 3), with an average of 390 kg/m³. This amount is still comparatively high, although considerably less than Lohani and Thanh's 1978 survey. It is possible that changes in the composition of solid waste have taken place between 1978 and 1988.

The SWMRMC survey (1990a) found Kathmandu's waste to be highly moist. The moisture content of solid waste is usually expressed as the weight of moisture per unit of waste weight. For most solid waste in Asian countries, moisture varies from 15 to 40%, depending on the composition of waste, the season, and the humidity. The average moisture content for waste in Kathmandu was found to be 45.8% in 1988 (SWMRMC, 1990a: 25). The samples were taken in May 1988, during the dry season. Thus, Kathmandu's waste is more moist than other Asian countries.

While more data exist on the composition of Kathmandu's waste, they cannot be easily compared, due to differences in sampling methods. For example, in 1981, data were obtained at the collection point, where street scavenging had yet to take place, while in 1988, data was taken at the dumpsite after scavenging had occurred. The result is a decrease of components in recyclable material, such as metal or glass. Results from past waste analysis do, however, provide information on rough patterns of change in waste
composition over time. As Table 3 shows, in general the percentage of organic waste is decreasing slightly.

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<td>Organic Material</td>
<td>67.6</td>
<td>58.2</td>
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<td>28.9</td>
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</table>

† Data obtained before scavenging  
‡‡ Data obtained after scavenging

Table 3. Composition of Kathmandu's Solid Waste

Sources:
1. Mean value of two samplings taken at Thamel and at Bhonisko. (Tabarasan, 1976)
2. Tabarasan and Bidlingmaier's report: Possibility of Composting Municipal Waste In Kathmandu (Tabarasan and Bidlingmeir, 1982).
4. Survey of waste from six different sites in Kathmandu, conducted in May 1988 by the SWMRMC (SWMRMC. 1988).

History of Solid Waste Management in Kathmandu

Only a few reports written by foreign visitors describe the situation of Kathmandu’s garbage prior to the twentieth century. The existing reports however, offer contradictory images of Kathmandu’s waste situation. Three foreign travelers’ reports written in the late 19th century -- by Daniel Wright, Lt. Col. G. H. D. Gimlette, and Henry Ballantine -- all suggest that Kathmandu was quite a filthy city 100 years ago (Onta, 1994; Tuladhar, 1996: 45)
Wright, for example, describes the streets of Kathmandu as “impossible to clean without knocking down the entire city, as the whole ground is saturated with filth and rubbish” (Wright, 1877: 11-13). Other published documents suggest the contrary. Laurence Oliphant, who visited Kathmandu in 1852, described the city’s streets as being “well drained and comparatively clean, contrasting most favourably in that respect with any other Oriental town I have ever seen” (Oliphant, 1852 (1994)). Tuladhar explains the possible context of Oliphant’s positive words. As Oliphant was a guest of the then-Prime Minister of Nepal, the streets were most likely cleaned before his visit. Also, as he visited Kathmandu for only a short time, he probably visited only the city’s main streets. The other travelers, whose reports were more negative, had a chance to visit narrow lanes as well (Tuladhar, 1996: 367)

Despite the fact that Kathmandu was most likely a dirty city, waste management was probably not as major a problem as it is today simply because the city’s small population could not produce much waste. Moreover, the society had its own process of waste management. (Kobayashi, 1994: 2-5; Tuladhar, 1996: 366) Although refuse was thrown out of the window -- either into courtyards or directly into the street\(^1\), this waste was collected by the untouchable subcastes such as Cyyamme, Hara-Huru\(^2\), and Pode. Many of these outcaste and low caste groups were forced to live near the outskirts of the city.

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1. In the traditional Newari house system, housewives dumped kitchen waste in the chuka (courtyard surrounded by houses) (Nepal, 1965:180)

2. According to Nepal (1965: 186) the Pode are public executioners and skinners who also sell baskets and fish, while Cyyamme and Hara-Huru are scavenger castes who involve in cleaning street garbage and human waste.
In return for their waste-collection work, they received a small amount of money or grain. These waste pickers either dumped the waste on riverbanks or sold it to farmers as fertiliser. (Tuladhar, 1996: 366; Nepal, 1965: 45).

This system of managing waste, based on activities of low-caste and outcaste people, began to collapse in the latter half of this century, when the city's population dramatically increased and when the lifestyle of urban residents began to change (Kobayashi, 1994: 4). Further, the composition of solid waste began to change due to changing consumption patterns and the introduction of modern materials such as plastics (Poudel, 1994: 13). As a result of these changes, waste became an increasing problem in Kathmandu.

In response to these changes, the Nagar Panchayat Act of 1962 made municipalities responsible for the removal of garbage and hazardous materials from streets (Bista, 1986: 30). However, the municipality's role was limited to hiring sweepers to clean the streets. No arrangements were made for proper waste management, including the collection and disposal of waste.

Development of a SWM System in Kathmandu

In the 1970s, a major SWM project was launched in the Kathmandu Valley. This history of the Solid Waste Management Project (SWMP) began in 1971 with a report by F. Flintoff that described increasing waste handling problems in Kathmandu (Flintoff, 1971). On the basis of this report, the Nepalese and German governments initiated discussions on
cooperation in this field. In 1976, Germany commissioned Dr. Tabarasan to carry out a study on the possibilities of reorganisation of solid waste disposal in Kathmandu. The report described Dr. Tabarasan's extreme concern with the negative public health consequences of the existing system. He urgently recommended implementation of a new, comprehensive system (Tabarasan, 1976: 2). As a result, in 1979, a bilateral agreement was concluded between the two countries to commence SWMP from the following year.

Essentially, SWMP was developed in four phases since 1980. During the first phase (1980-1983), the project concentrated on developing a locally suitable and economically viable concept of waste management, along with the necessary infrastructure (Thapa, 1989). An executive agency for waste management, the Solid Waste Management Board (SWMB), was established under Nepal's Ministry of Works and Transport. The board, with the technical and advisory assistance of eight expatriate staff, organised a modern waste collection system in 16 wards of the city. Accordingly, 95 concrete bins were placed throughout the city. Traditional sanitation methods and impractical cleaning equipment, such as short brooms, were replaced with more efficient tools such as long brooms and handcarts. A disposal site and a pilot compost plant were established at Teku for recycling organic waste (Spreen, 1993).

The second phase (1984-1986) is referred to as the implementation phase (Pant, 1985: 4). Cleaning activities were expanded to 45 wards and rehabilitation of courtyards (Thapa, 1989:21). A full-scale composting plant (15 t/day) and two transfer stations were
established in Teku, along with a sanitary landfill in Gokarna. A system was developed to impose service charges with the aim of making the project self-reliant (Pant, 1985).

The main emphasis of the third phase (1987-1990) was to prepare for project operation by the Nepalese without German assistance. The intention was that by the end of 1990, Nepalese project management should be self-reliant in overall technical implementation, administration, financing and public relations. Financial self-reliance was to be achieved through the sale of compost and the collection of service charges from various sources. A computerised Management Information System (MIS) was introduced to improve administration. In 1987, SWMB was transformed into the Solid Waste Mobilisation and Resource Mobilisation Centre, a new legal entity administered under the Ministry of Housing and Transportation. By the end of 1990, the project seemed to have achieved most of its targets: it had prepared and enacted the Waste Act for waste management, introduced a tariff system which recovered more than 50% of its operational budget, and introduced many services, including public toilets and a septic tank service (Spreen, 1993: 26).

The SWM system introduced by Germany relied on systematic and large-scale collection-recovery/disposal methods: communal containment, primary collection, secondary collection, transfer stations, mechanical composting and sanitary landfilling. A flowchart of the system as it functioned during Phase 3 is depicted in Fig. 5. At this time,
an estimated 60% of waste was collected (Sreen, 1993: 65).

Responsibility for Kathmandu’s SWM was divided between two legal entities: the SWMRMC and the Kathmandu municipality. According to an agreement between the municipality and the SWMRMC signed in 1987, the task of cleaning the city was the responsibility of the municipality, which was to provide resources, manpower, and technical
assistance of the SWMRMC (SWMRMC, 1987: 22). Under this agreement, the municipality employed approximately 700 sweepers to work four hours per day cleaning major city streets. The municipality provided sweepers with equipment to collect waste, while the SWMRMC provided containers located at street corners for workers to empty the collected waste into. Containers were then trucked to transfer stations, from where the waste was sent either to the composting plant or final disposal sites for treatment.

By the end of Phase 3, the donor agency was very pleased with the outcome of the project, describing it as a “model project” (SWMRMC, 1988: 16). Encouraged by the success of the project, the evaluation team recommended a Phase 4, to be staffed solely by Nepalis.

Phase Four (1990-1993) thus saw the withdrawal of German assistance. During this phase, however, as the Germans started to reduce their involvement just when the country was undergoing major political changes, some of the weaknesses of the project started to surface which ultimately led to the collapse of the project. The political changes that took place in the country from April 1990 to the general elections in May 1991 brought a halt to activities such as composting, collection of operating fees, and the search for a new landfill site. In August 1991, the Teku compost plant—an integral recovery component of the SWM system-- had to be closed due to complaints from neighbouring residents.
Further, local elections held in Kathmandu in 1992 brought confusion and problems to Kathmandu’s waste management system. In particular, policy changes by the newly elected local government created major difficulties. In an effort to gain political support, the new government promised 900 permanent jobs in the SWMRMC, at a time when the centre was trying to reduce costs and decentralise its activities. Further, the newly created Nagarpalika, the municipal service department, refused to cooperate financially and technically with the centre on the basis of financial and political reasons (Tuladhar, 1996: 375). Immediately after the German withdrawal in 1993, the system began to deteriorate dramatically, leading to Kathmandu's 1993 “Garbage Crises”. Following the permanent closure of the Teku compost plant and the Gokarna landfill, the Teku and Sinamangal transfer stations were also closed due to strong neighbourhood opposition and political changes.

Having lost the system’s integral disposal and recovery components, the entire project essentially no longer functioned. The efficiency of the solid waste collection service was already dwindling due to the lack of funds required to repair equipment. Inefficient utilisation of field workers was another issue. As a result of these problems, garbage started to pile up on vacant public lands, along river beds and banks, and on streets. In particular, the banks of the Bishnumati River became severely polluted, as this was the main place for waste disposal. The situation became even worse due to growing hostility between the

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3 Kathmandu Municipality created the "garbage road" in 1993 to deal with mounting garbage piles. The road was located along the west bank of the Bishnumati River. The road was built by dumping a layer of approximately 10 ft of garbage, compacting it, and covering it with soil.
centre and the municipality. In essence, the system, which had been built up successfully over a decade, collapsed.

Although political changes were a major factor in the collapse of the SWM system in Kathmandu city, it was not the only cause. A project evaluation report written in 1993 pointed out several other “shortcomings” of the system that could not be explained solely by the advent of political turmoil (Rieger, 1993). Major project weaknesses identified included: 1) a top-down centralised system (Tuladhar, 1996; Ali et al., 1987), (2) lack of coordination between the municipality and the centre (Kobayashi, 1994; Tuladhar, 1996; Spreen, 1993), (3) lack of institution building (Tuladhar, 1996; Kobayashi, 1994, NESS, 1993), (4) dependency on international expertise, financing and machinery (Tuladhar, 1996), (5) absence of a sustainable financial base (Kobayashi, 1994), and (6) lack of awareness among residents (Kobayashi, 1994).

Current Situation of SWM in Kathmandu

Today, only a few components of Solid Waste Management Project remain visible. Fig. 6 depicts the flow of waste management in Kathmandu as of March 1997. Essentially, the responsibilities of the SWMRMC and the municipality have become more and more confused, with the latter absorbing the role of the former. Currently, there is no formal agreement between the SWMRMC and the municipality regarding the assignment of tasks. The municipality of Kathmandu, with donated equipment from India, has extended its waste collection and disposal activities well beyond the scope of work previously
established between the SWMRMC and the municipality. Thus, the municipality is now collecting and delivering waste to disposal sites. Occasionally, the municipality disposes of waste in public places, such as the banks of the Bishnumati River and along the Ring Road (Oeltzschmer and Betts, 1996: 28). The centre is responsible only for the haulage and disposal of waste at the Gokarna landfill site. Currently, the yard of the SWMRMC is full of broken equipment — more than 50% of the containers are scrapped and no longer used.4

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4 The quality of equipment maintenance is extremely unsatisfactory. In 1993, the following equipment was provided to SWMRMC by the German government: 178 containers, 52 collection vehicles, and 7 loaders and tippers. Today, only 44 containers, 12 collection vehicles, and 2 loaders and tippers are maintained by SWMRMC and the municipality (Oeltzschner and Betts, 1996: D-5-7)
Despite an extensive educational campaign mounted over the past few years, most households still throw their garbage into the streets or empty lots. A UNDP field survey reports that approximately 70% of households in Kathmandu throw their garbage into the streets (UNDP Nepal, 1989: 2). Currently, 680 sweepers are employed by the municipality to collect this waste from streets and public spaces (Personal communication with Mr. Tuladhar, Managing Director of Kathmandu Sanitation Department). They bring the waste to 44 skip containers located throughout main streets in the city. A fleet of 12 tractors...
transports collected waste to the landfill site, which is 14 km south of the city. To reduce transport costs, tractors are not allowed to bring waste to the landfill site unless they are full. Thus, if the tractor is not full, the waste is dumped at the Teku transfer site, or along the banks of the Bishnumati river, or along the Ring Road (Oeltzschner and Betts, 1996).

Some institutions, such as major hotels or international development organisations, have their waste collected by the SWMRMC on a contract basis. This waste is also dumped at Teku before being transported to the landfill site.

Currently it is estimated that around 40% of the waste collected in Kathmandu is brought to the Gokarna Landfill Site, which is already overfilled. Initially, in 1987, it was planned that the site would accommodate 270,000 m$^3$ of waste, which was estimated to be enough by 2001. However as of 1992, more than 400,000 m$^3$ of solid waste has already been dumped (Pradhan, 1993: 25). Extension of the site has been proposed for years, but due to strong neighbourhood opposition no concrete plans have been made. The lack of an alternative landfill site means that waste continues to be dumped at Gokarna, with alarming environmental consequences$^5$.

**Conclusion**

Production of solid waste is universal in human society, but the composition, character, and generation rates of waste vary according to prevailing patterns of material

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$^5$ According to the consultant report, the largest environmental problem associated with overfilling of the landfill site is the danger of surface water pollution. As there is no arrangement for collection and treatment of surface water and its runoff into the nearby Bagmati river, the pollution level is high, particularly in the monsoon season. Other major problems are noise, odour and gas emission problems (Oltzscheimer and Betts, 1996).
culture. Determining these variables is essential to selecting appropriate technologies and strategies for managing solid waste, regardless of whether a disposal or recovery-based system is to be used.

The composition and character of Kathmandu's solid waste indicates the city's solid waste does not respond well to handling, disposal and recovery techniques used in developed countries. The high moisture content and high content of soil and other inert matter tend to render the waste unsuitable for incineration and energy plants. In fact, the high non-organic content suggests that Kathmandu's solid waste is suitable for composting. Further, as Kathmandu's solid waste has high density, moisture, and carbon-nitrogen elements, pre-treatment processes for mechanical composting that require moisture is generally unnecessary. This suggests that more simple and labour-intensive composting techniques, such as the windrow system, may be appropriate.

The waste management system developed by the Solid Waste Management Project was essentially based on two strategies: a "mixed-waste" recovery strategy using a mechanical composting facility, and a sanitary landfill strategy. The mixed-waste recovery strategy occurred because waste material was combined in containers at collection points before it was processed at the Teku composting facility. Since the closure of the compost plant, however, the current system is based solely on a disposal strategy. Waste collected

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6 The simplest windrow system requires organic waste to be stacked in piles and turned occasionally to incorporate oxygen.
from the city's streets is dumped at the Gokarna landfill or along the Bishnumati River or Ring Road. In other words, the current SWM system does not involve recovery processes in its strategy.

A review of the SWMP and its outcome after fifteen years of project implementation reveals that while at some point the project seemed to be successful, an imported solid waste management system based on large-scale mechanical composting and sanitary landfilling proved inappropriate and unfeasible in the context of Kathmandu. Many of the problems experienced in implementing the formal system highlight the danger of succumbing to attractive technological "solutions." The fact that less than half of donated equipment -- whether tractors, compost facilities or containers -- is currently in use illustrates the danger of relying on imported technologies that require specialised skills for maintenance. The environmental problems involved in operating a sanitary landfill, and the elusive efforts to find suitable land for a new landfill site, raise questions regarding the long-term viability of this disposal strategy in Kathmandu, where land is scarce.

To improve the situation, Kathmandu needs to develop a revised system based on inexpensive and sanitary recovery and final disposition methods. One way to develop such a system is to integrate informal waste recovery activities. An assessment of Kathmandu's informal waste recovery system is the subject of the next chapter.
CHAPTER FOUR: WASTE RECOVERY IN KATHMANDU

In Nepal, traditional forms of resource recovery have been practised for many centuries. For example, rice straw was collected and used in roofing, while agricultural waste, kitchen waste, human excreta and animal waste were composted or sold to farmers as fertilizer. Wood waste was used as fuel and for building materials.

Today, materials are informally recovered from Kathmandu's solid waste stream. These materials include organic waste, plastics, paper, glass, metal, rubber, and textiles. The increase in consumption of modern materials such as plastics and glass has brought primary collectors, dealers and wholesalers to the city. Many of these workers come from India where the recycling industry is more developed. The open-border arrangement with India makes it possible for many Indians to enter Kathmandu.

This chapter aims to analyse Kathmandu's waste recovery system. It will first describe actors involved in recovery activities. The current recovery system in Kathmandu is organised as a hierarchy of primary collectors (scavengers, itinerant collectors and refuse workers), dealers, wholesalers and recycling industries. Individuals in each successive stratum in the hierarchy tend to handle more material and enjoy higher standards of living. This analysis is followed by four case studies tracing the pathways of organic, paper, plastic and glass waste. Information in this chapter is based on interviews with actors and direct observation of their activities.
Actors in Kathmandu's Waste Recovery

Primary Collectors

At the bottom of the recycling hierarchy are primary collectors, who obtain materials from waste sources. This stratum can be broadly classified into three different groups: (a) scavengers, (b) itinerant collectors, and (c) municipal sweepers.

(a) Scavengers

Scavengers pick up materials from dump sites or from public spaces, such as streets or riverbanks, where people dump their waste. In Kathmandu, three types of scavengers can be distinguished, depending on their work locations: (a) dumpsite scavengers who pick up materials from Gokarna or Teku dumping sites, (b) street scavengers who collect waste from garbage piles and containers in the streets, and (c) river scavengers who pick up waste from riverbanks and river dumpsites. Table 4 summarises the socio-economic profiles of each category of scavengers interviewed.
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<tr>
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<th>Street Scavengers (n=20)</th>
<th>River Scavengers (n=20)</th>
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<td>Rs. 1,500-1,700</td>
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</table>

Table 4. Basic Characteristics of Scavengers

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1 Nepali society is based on the Indian caste system, but the country's ethnic diversity has transformed the original caste system into a unique form. It is a combination of Hindu caste system (Bahun, Chhetri, Vaishya, Shudra and Outcaste) and tribal status (Hill tribe, Non-Hill Tribe).

2 Researcher's note: The author found that the question on specific caste can be quite sensitive, and chose not to probe further when people showed hesitation in answering the question about their caste. As a result, a total of ten respondents have unknown caste. The author believes that these "unknown" people may be from outcaste families.

3 A Rupee (Rs.) at this time was equivalent to around 2.2 Canadian cents.
Dumpsite Scavengers

In general, the dumpsite scavengers found at both the Gokarna and Teku dumping sites are longtime Kathmandu residents who have engaged in scavenging activities for about 10 years. Approximately 65 live in Teku and 45 in Gokarna. Most of them work alone, although sometimes they may work with family members. This group of scavengers is fairly homogeneous. At the Teku site, for instance, most scavengers are Tamang (a Nepali hill tribe). These scavengers are landless as a result of a landslide in their village 15 years ago. Most of the Teku dumpsite scavengers live in nearby houses constructed in 1986 with German assistance.

The activities of the dumpsite scavengers are well-organised. When a truck arrives at the site, experienced female scavengers pull out the garbage with a steel hook and separate all potentially valuable material into one pile. They pick out plastics, paper, metals, glass, jute sacks, and textiles. These materials are then further sorted into types and grades. This re-sorting is mostly practised by young, less experienced scavengers. Once sorted, materials are stored at specific locations. Bulky materials such as cardboard are brought to specific areas within the dumpsite. Other materials, such as plastics and paper, are stored in jute bags and kept in special storage huts built by individual scavengers. There appear to be informal arrangements between scavengers regarding storage location. Generally, long-term scavengers manage to place their storage huts at better locations, such as near the dumpsite gate. Typically, established scavengers are allowed to be the first to pick waste.
Dumpsite scavengers usually sell materials to dealers located within walking distance from the dumpsite. Dumpsite scavengers make a relatively good income – an average of 1,700-2,500 rupees per month. This is higher than the income of the average Nepali, who makes 800 rupees per month (UNDP-Nepal, 1995:12). It is, however, lower than the income of average urban Nepali, who make approximately 2,500 to 2,700 rupees per month (Sharma, 1995:24). The children of scavengers attend school, and only engage in scavenging activities during their days off. Among the 12 children observed at the Teku dumpsite, eight attend school on weekdays.

**Street Scavengers**

While dump scavengers tend to belong to an established and homogeneous group, street scavengers consist of individuals from various backgrounds. Table 4 shows that approximately half of the street scavengers interviewed were Indian, while 20% were Nepali. Many of the Nepali scavengers were reported to be landless labourers from nearby villages. Many of them work alone: there is no family involvement. Their age and gender varies as well. Many female scavengers were said to be widows. In addition, many street children earn their living as street scavengers.

The typical working pattern of street scavengers is to roam the streets in the early morning and again in late evening, and to go through waste piles and street waste containers. The equipment they use is unsophisticated: jute sacks and steel hooks.
Before street scavengers sell their collected materials, they sort them into various grades of paper, plastics, metal, glass, and bone. After sorting, materials are placed in jute sacks, and are ready to be sold. Interestingly, although street scavenging activities appear to be rather disorganised in nature, their practises are fairly well structured and controlled through informal agreements. For example, only five Nepali scavengers are allowed to have access to waste in Sin Durbar (government compound). This is done to restrict non-Nepali (Indian) scavengers from gaining access to waste. In general, different scavengers tend to cover different areas. It appears that there is an informal understanding among scavengers to not enter each other's territories. Similar to dumpsite scavengers, it was observed that long-term scavengers tend to have access to profitable areas, such as streets located near residential areas for expatriates.

River Scavengers

The great amount of waste disposed of in rivers gives rise to this third category of scavengers, who generally collect plastics and bits of glass from river or stream banks on a daily basis. Similar to street scavengers, river scavengers come from very deprived populations: young children who have no other working family members, street children, elderly single people, and widows. Compared to dumpsite scavengers, they make a meager income -- an average of 20 to 30 rupees per day. Some of them receive cash in advance from dealers to purchase food, while others may receive food and lodging from the dealers. Almost all of them live as squatters along riverbanks in Kathmandu.
(b) Itinerant Collectors

According to interview, some 1000 itinerant collectors are estimated to work in Kathmandu city. Difficulties in determining the precise number of itinerant collectors arise partly from their lack of enumeration in official statistics, and also because the number of collectors tends to fluctuate seasonally. In addition, it is very difficult for the researcher to enumerate them in their widely dispersed work places. Typically, itinerant collectors roam the streets of residential areas with bamboo baskets on their shoulders, shouting "khaali sisi, puraana kagaaj" ("empty bottles, old paper"). They normally collect only materials that have relatively high economic value, such as newspaper, clean white paper, glass bottles and metals. At the end of the day, the collectors sell the materials to dealers.
<table>
<thead>
<tr>
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<th>Itinerant Collectors (n=20)</th>
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<td>Gender</td>
<td>20</td>
</tr>
<tr>
<td>Male</td>
<td>20</td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
</tr>
<tr>
<td>Age Group</td>
<td>17</td>
</tr>
<tr>
<td>0-14</td>
<td>3</td>
</tr>
<tr>
<td>15-45</td>
<td></td>
</tr>
<tr>
<td>45+</td>
<td></td>
</tr>
<tr>
<td>Nationality</td>
<td>18</td>
</tr>
<tr>
<td>Indian</td>
<td>18</td>
</tr>
<tr>
<td>Unknown</td>
<td>2</td>
</tr>
<tr>
<td>Caste</td>
<td>18</td>
</tr>
<tr>
<td>Hindu Caste</td>
<td>18</td>
</tr>
<tr>
<td>Vaishya</td>
<td>2</td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>Average Period as Collector</td>
<td>1 year</td>
</tr>
<tr>
<td>Materials Collected</td>
<td>Hard Plastic</td>
</tr>
<tr>
<td></td>
<td>Metal</td>
</tr>
<tr>
<td></td>
<td>Old Newspapers</td>
</tr>
<tr>
<td></td>
<td>Copy paper</td>
</tr>
<tr>
<td></td>
<td>Glass Bottles</td>
</tr>
<tr>
<td>Average Monthly Income</td>
<td>Rs. 1,500-2,000</td>
</tr>
</tbody>
</table>

Table 5. Basic Characteristics of Itinerant Collectors

Table 5 summarises the socio-economic characteristics of 20 itinerant collectors interviewed. All the itinerant collectors are males; 90% are of Indian origin, and nearly 90% are between the ages of 15 to 45. Many of them collect any materials of value, but some specialise in one specific material. Some itinerant collectors work only for certain industries. Bhrikuti Paper Mill, for example, has an informal agreement with 12 collectors who collect uncontaminated newspaper. Some collectors have strong ties with dealers who come from the same village in India. Such collectors receive food, lodging
and working equipment from their dealers, as do certain river scavengers. However, most collectors have a weak relationship with dealers. Eighty percent of the interviewed collectors stated that they do not feel obliged to work for certain dealers, and that they go around to different dealers to find the best price for their materials. Their income is equivalent to that of dump scavengers: approximately 1,500 to 2,000 rupees per month.

The role itinerant collectors play in Kathmandu's waste recycling system is large. A significant fact about itinerant collectors is that they obtain waste at source before it is mixed, damaged and contaminated. Dealers thus prefer to buy materials from itinerant collectors rather than scavengers because the materials are clean.
(c) Municipal Sweepers

The third type of principal collectors are the municipal sweepers who are hired by the Kathmandu Municipality to collect waste from street garbage piles and waste containers. They routinely scavenge materials off their carts, especially metal cans, hard plastic items, and repairable items. All 20 interviewed refuse workers were engaged in scavenging activities, although they are not hired to do so.

<table>
<thead>
<tr>
<th>Municipal Workers (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Age Group</strong></td>
</tr>
<tr>
<td>0-14</td>
</tr>
<tr>
<td>15-45</td>
</tr>
<tr>
<td>45+</td>
</tr>
<tr>
<td><strong>Nationality</strong></td>
</tr>
<tr>
<td>Nepali (18)</td>
</tr>
<tr>
<td>Unknown (2)</td>
</tr>
<tr>
<td><strong>Caste</strong></td>
</tr>
<tr>
<td>Hindu Castes</td>
</tr>
<tr>
<td>Bahun (2)</td>
</tr>
<tr>
<td>Chhetri (7)</td>
</tr>
<tr>
<td>Vaishya (2)</td>
</tr>
<tr>
<td>Hill Tribes</td>
</tr>
<tr>
<td>Gurung (1)</td>
</tr>
<tr>
<td>Tamang (8)</td>
</tr>
<tr>
<td><strong>Average Period as Collector</strong></td>
</tr>
<tr>
<td><strong>Materials Collected</strong></td>
</tr>
<tr>
<td>Hard Plastic</td>
</tr>
<tr>
<td>Metal</td>
</tr>
<tr>
<td>Glass Bottles</td>
</tr>
<tr>
<td><strong>Average Monthly Income</strong></td>
</tr>
</tbody>
</table>

Table 6. Basic Characteristics of Municipal Sweepes
Currently, 680 municipal workers carry out street cleaning in Kathmandu city. The normal working hours are from 6 a.m. to 5 p.m. with a two-hour lunch break. The vast majority of them are women -- in fact, this lowest position in the municipal cleaning system is practically reserved for women. Due to necessity, a significant number of these women engage in street-cleaning with their babies tied to their backs.

Dealers

The dealers form a link between primary collectors of waste and wholesalers. As Table 7 shows, the scale and operations of dealers vary. Some small dealers employ only three people, while large dealers often employ more than twenty workers. In general, dealers at the riverbanks and inner cities run small operations, buying 100-200 rupees worth of material each day. Some small dealers specialise in one kind of material, such as plastic bags or tin cans. The equipment they normally own and use are small weighing scales and cutting equipment. Larger dealers usually accept almost all types of materials from scavengers as well as itinerant collectors. Typically, their working equipment includes a storage shed, weighing scale, cutting equipment, balers, calculators, and sometimes carts for transportation. Many of the large dealers tend to be concentrated near the Teku dumpsite area or outside the Ring Road.
<table>
<thead>
<tr>
<th><strong>Dealers (n=18)</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td>18</td>
</tr>
<tr>
<td>Male</td>
<td>18</td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>0</td>
</tr>
<tr>
<td>0-14</td>
<td>0</td>
</tr>
<tr>
<td>15-45</td>
<td>18</td>
</tr>
<tr>
<td>45+</td>
<td>0</td>
</tr>
<tr>
<td><strong>Nationality</strong></td>
<td>0</td>
</tr>
<tr>
<td>Indian</td>
<td>13</td>
</tr>
<tr>
<td>Nepali</td>
<td>5</td>
</tr>
<tr>
<td><strong>Caste</strong></td>
<td>0</td>
</tr>
<tr>
<td>Hindu Castes</td>
<td></td>
</tr>
<tr>
<td>Chhetri</td>
<td>16</td>
</tr>
<tr>
<td>Vaishya</td>
<td>2</td>
</tr>
<tr>
<td><strong>Number of Employees</strong></td>
<td>6</td>
</tr>
<tr>
<td>Less than 5</td>
<td>6</td>
</tr>
<tr>
<td>5-10</td>
<td>5</td>
</tr>
<tr>
<td>10+</td>
<td>7</td>
</tr>
<tr>
<td><strong>Materials Dealt</strong></td>
<td>12</td>
</tr>
<tr>
<td>Anything Valuable</td>
<td>12</td>
</tr>
<tr>
<td>Plastic</td>
<td>3</td>
</tr>
<tr>
<td>Metal</td>
<td>2</td>
</tr>
<tr>
<td>Glass</td>
<td>1</td>
</tr>
<tr>
<td><strong>Average Monthly Income</strong></td>
<td>3</td>
</tr>
<tr>
<td>Less than Rs. 2,000</td>
<td>3</td>
</tr>
<tr>
<td>Rs. 2,500-5,000</td>
<td>7</td>
</tr>
<tr>
<td>Rs. 5,000-10,000</td>
<td>3</td>
</tr>
<tr>
<td>Above Rs.10,000</td>
<td>5</td>
</tr>
</tbody>
</table>

**Table 7. Basic Characteristics of Dealers**

In addition to relying on their family members, dealers often hire labour from outside. Labour is needed for a variety of tasks: sorting, drying, baling, packing, trading, and book-keeping. Smaller dealers may hire scavengers or itinerant collectors on a daily, casual basis. Scavengers are paid in accordance with the amount of work performed. Larger dealers tend to hire ten to fifteen full-time workers who are paid a monthly salary. Sometimes these workers are provided sleeping facilities at the work site.
According to the interviewed dealers, the total estimated number of dealers in Kathmandu varies between 150 to 200. Because of the informal nature of dealing, these figures are not verifiable. Almost all of the dealerships are unregistered to avoid taxes. Table 7 shows that, similar to itinerant collectors, most dealers are Indian, particularly the large-scale established dealers. According to these large-scale dealers, their materials originate as follows: scavengers (20%), itinerant collectors (50%), and institutions (30%) (Personal communication with Mr. Prasad, manager of large paper dealer in Teku). Very rarely do households directly supply materials to them. The income of dealers varies greatly, depending on the scale of operations. Smaller dealers earn an average of 1,800 rupees per month, slightly more than scavengers. Larger dealers earn 10,000 to 20,000 rupees per month.

**Wholesalers**

The main customers for dealers are wholesalers, who tend to specialise in one material, such as paper, plastic, glass or metal. They purchase specific material from dealers, and sometime buy bulk homogeneous residue from factories and institutions. As they prefer to purchase materials in bulk, they generally do not buy from scavengers or itinerant collectors. Wholesalers accumulate incoming materials until the quantity is sufficient to make transport to recycling plants worthwhile. They also organise cleaning and compacting of materials. The variety of tasks involved in this sector creates a considerable amount of employment. As Table 8 indicates, the average wholesalers employs approximately 40 people for a variety of tasks. Many wholesalers maintain
strong ties with specific larger dealers. One large Indian wholesaler, whose operation is located at the Teku site, stated that he purchases from ten Indian dealers and seven Nepali dealers.

<table>
<thead>
<tr>
<th></th>
<th>Wholesalers (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
</tr>
<tr>
<td>Age Group</td>
<td></td>
</tr>
<tr>
<td>0-14</td>
<td>0</td>
</tr>
<tr>
<td>15-45</td>
<td>11</td>
</tr>
<tr>
<td>45+</td>
<td>2</td>
</tr>
<tr>
<td>Nationality</td>
<td></td>
</tr>
<tr>
<td>Indian</td>
<td>9</td>
</tr>
<tr>
<td>Nepali</td>
<td>3</td>
</tr>
<tr>
<td>Caste</td>
<td>Hindu Caste</td>
</tr>
<tr>
<td></td>
<td>Chhetri (9)</td>
</tr>
<tr>
<td></td>
<td>Vaishya (3)</td>
</tr>
<tr>
<td>Number of employees</td>
<td></td>
</tr>
<tr>
<td>10-20</td>
<td>2</td>
</tr>
<tr>
<td>20-40</td>
<td>8</td>
</tr>
<tr>
<td>40+</td>
<td>2</td>
</tr>
<tr>
<td>Number of wholesalers</td>
<td></td>
</tr>
<tr>
<td>dealing different materials</td>
<td></td>
</tr>
<tr>
<td>Plastic</td>
<td>25</td>
</tr>
<tr>
<td>Paper</td>
<td>4</td>
</tr>
<tr>
<td>Glass</td>
<td>4</td>
</tr>
<tr>
<td>Metal</td>
<td>10-14</td>
</tr>
<tr>
<td>Rubber</td>
<td>Unknown</td>
</tr>
<tr>
<td>Average Monthly Income</td>
<td>Rs. 73,000</td>
</tr>
</tbody>
</table>

Table 8. Basic Characteristics of Wholesalers

In contrast to dealers, who operate only inside the city, wholesalers often trade at an inter-city and sometime even at an international level. The wholesalers typically own
telephones and fax machines. As their average amount of stock is substantial, they require considerable investments in working capital. Thus, the number of wholesalers is considerably smaller than the number of dealers in Kathmandu. For instance, there are only four glass wholesalers operating in Kathmandu, while 25 wholesalers specialise in plastic. All of the wholesalers are registered companies, as only registered companies are allowed to transport materials out of the Kathmandu Valley. Obviously, the small number of wholesalers has led to an oligarchic market structure generating relatively high profits. The average wholesaler makes a significant amount, earning 73,000 rupees per month.

Socio-Economic Profiles and Status of Different Actors

The basic socio-economic characteristics of various actors involved in Kathmandu's waste recovery processes are summarised in Tables 4 - 8. This information, along with observations by the researcher, reveal some interesting features of actors. There are a number of similarities between profiles of waste workers in Kathmandu and those in other countries, as described in Chapter 2.

As in many other places in the world, there is a relationship between waste workers and ethnic/caste status in Kathmandu. In general, waste workers are from lower castes. However, the relationship is neither simple nor straightforward, as the city's waste

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4 For raising revenues purpose, some material exported from the Kathmandu Valley is taxed at the district border.
recovery process involves various actors from traditional Hindu caste groups, Indian
immigrants, and ethnic groups from Nepal's hills.

With regard to nationality, Indians tend to predominate among river scavengers,
itinerant collectors, large-scale dealers and wholesalers, while Nepalis are in the majority
among dumpsite scavengers and municipal collectors. In terms of economic status, it is
interesting to observe that Indians are most commonly found at the top (wholesalers) and
bottom (river scavengers) of the waste recovery community. Nepalis are more
predominant in the middle groups, although Indians, as itinerant collectors, are also
represented here. There are at least two reasons for the wide range of representation by
Indians: First, India has relatively more rich and poor people than Nepal. The rich
Indians have the capital to dominate Nepal's SWM industry, while the poor Indians -- who
are poorer than poor Nepalis -- are willing to do work that most Nepali would not do.
Second, Indians tend to dominate among itinerant collectors and wholesalers because of
their social connections. Many Indians migrated to Kathmandu in the 1970s, when India
was experiencing a recycling boom, to export waste material from Nepal to India. These
waste traders also brought along itinerant collectors from India, usually from the same or
a nearby village. As a result, an "Indian connection" developed between the recycling
factories in India and waste traders and itinerant collectors in Kathmandu. Even today,
when most waste material is brought to Nepali recycling factories, there still exists a
strong regional connection among Indian waste traders and itinerant collectors. For
example, all of the itinerant collectors interviewed in the Teku area were from the same
village in Surijab, north west region close to Nepal border in India. These collectors were brought into Kathmandu by an Indian paper wholesaler who works in Teku.

While Indians tend to engage in diverse waste work, Nepali people tend to dominate work that is more secure. Scavenging as a part of municipal collection, for example, is generally regarded as more economically stable than scavenging in public places, as it is part of the formal sector. Similarly, dumpsite scavengers enjoy the highest income among the three types of scavengers because the dumpsite ensures a larger amount of waste sources than street or river scavengers. The reason for Nepalis’ prevalence in such work is simply because only Nepalis are allowed to work as municipal or dumpsite scavengers. The same explanation accounts for Nepali domination in areas where street scavenging occurs. Only Nepali people are allowed to scavenge through government garbage containers. In other words, informal arrangements to protect the interests of Nepali scavengers exclude Indians from working in certain waste recovery sectors.

With regard to caste and its linkage to waste work, people from low castes tend to occupy the lower economic status work. For example, more Vaishya and Shudra can be found among street scavengers, river scavengers and itinerant collectors, while dealers and wholesalers are more likely to be Chhetri. The researcher also assumes that large segments of street scavengers and river scavengers are from outcaste families.\footnote{Please see footnote 2.}
Interestingly, dumpsite scavengers are mostly Tamang, while itinerant collectors are mostly from the Vaishya caste. Most Tamangs at the Teku dumpsite come from the same Tamang village, which had its farmland destroyed by a landslide. Similarly, as mentioned before, many itinerant collectors come from the same village in India. It is common in South Asia that village residents come from the same caste/ethnic group. Thus, if the population of one village adopts a particular profession, then the prevalent caste of that village will be over-represented in the new profession.

It is surprising to find a large number of high castes, such as Chhetris and even Brahmins, among municipal collectors. This is probably because in Nepal, many high-caste members live in poverty in villages. Nevertheless, in general, municipal workers are regarded as socially higher than other groups of scavengers. This perception may reflect the high percentage of higher castes among municipal workers.

As in other Asian countries, there is a clear gender-based division of labour among waste recovery workers in Kathmandu. Essentially, women tend to do work that pays the least, such as river scavenging. Women do not assume roles as itinerant collectors, nor as dealers or wholesalers. This is probably because women are traditionally not supposed to work outside the home. Thus, it is rare for a woman to play a significant role in waste recovery systems, unless she is a part of a successful family business.
Women are, however, found among municipal collectors. This is because the municipal cleaning system is virtually reserved for women in Nepal, as in other South Asian countries. Most other municipal waste work, including administrative work, is carried out by men. It appears that street cleaning is one of the few jobs that women are allowed to do outside their home.

In terms of social relations among different actors in Kathmandu’s waste recovery system, interview and observation data confirmed several points derived from literature review described in Chapter 2. For example, the relationship between primary collectors and dealers is prevalent in Kathmandu. River and street scavengers are usually bound to specific dealers through credit or other obligatory arrangements. In many cases, ethnicity or territorial factors play an important role in organizing this dependency relationship. For instance, in exchange for daily food and cash advances, young Indian river scavengers sell their collected material to dealers from their own Indian village below market price.

Another social mechanism that characterizes Kathmandu’s waste recovery system is the segmentation of work, on the basis of ethnicity. For instance, only Nepali scavengers are allowed to pick up waste in certain areas. Thus, certain access to work and materials is reserved to those that belong to one social groups.

This section discusses the recovery pathways of four different types of waste. Through interviews and observations, the author tried to determine the routes different types of waste take after consumers or industries no longer wish to use it. As far as the author knows, tracing routes of different types of waste has never been studied before. Tracing routes provides unique insights into informal solid waste management. Such information improves SWM practitioners' capacity to be effective.

Organic Materials

As in many other developing countries, organic waste is the most common type of solid waste in Kathmandu. Approximately 55% of the waste stream is organic (SWMRMC, 1989). Although the proportion of organics is decreasing due to rapid urbanisation, it is likely to remain the most common type of waste in the foreseeable future. Fig. 7 shows the identified pathway of organic waste in Kathmandu. Recycling of organic materials is straightforward and simple, in that it involves neither scavengers nor itinerant collectors. Most recycled organic materials are transferred directly from the source of waste to the recycling industry site.
Sources of Organic Waste

The main sources of Kathmandu’s organic waste are households, food industries, agriculture, and commercial institutions (NESS, 1996: 21). Organic waste from households is mainly kitchen and yard waste. In 1987, it was estimated that about 250 tons of organic waste was produced and disposed of daily from households in Kathmandu (Thapa, 1989:42). This organic waste, mixed with other types of waste, is disposed of in containers or in piles in the streets. Similarly, waste from commercial institutions, such as vegetable markets, restaurants and hotels, is thrown into public spaces (Food and Agricultural Organisation (FAO)-Nepal, 1995: 21).
Organic waste is also produced by farmers who live in and near the city. The main component of agricultural waste is crop residues such as corn stalks, straw, and husks. Most of this waste is, however, used by farmers for cooking fuel and composting.

Organic waste is also produced in large quantities by agro-based and animal-based industries, including rice mills, breweries, sugar industries, dairies, slaughterhouses, sawmills, and leather tanneries. The organic waste from such sources is generally recycled because it is available in large quantities, is easy to collect, and is generally uncontaminated by other waste. For instance, rice husks from rice mills are usually used by other industries to fuel boilers; and the ash from the boilers is sold to farmers as a soil conditioner.

Recycling Pathway of Organic Waste

Trade in organic waste is not as common as trade in other waste materials. Neither scavengers nor itinerant collectors collect organic waste. This is due to the low value of organic waste, the high level of contamination, and the difficulty of transporting the waste. In the past, members of the sweeper caste collected household organic waste and sold it to farmers\(^6\), but this practise has disappeared, at least in the Kathmandu area. Thus, most of the organic waste from households is thrown on garbage piles or waste containers in the streets. A portion of the organic waste in garbage piles is consumed by

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\(^6\) Nepal mentions that Cyames collected waste from household and sold it to Jyapu farmers at the nominal rate of half a rupee per kerosene-oil tin of garbage (Nepal, 1965: 44).
stray animals such as dogs, cows and pigs. The remaining waste is either dumped along riverbanks or is brought to the Gokarna landfill. A 1985 report stated that street scavengers occasionally ate edible organic waste out of starvation (SWMRMC, 1985), but this practice was not confirmed during interviews. During her stay in Kathmandu, however, the researcher observed one unidentified person eating from a waste pile.

Industrial and agricultural organic wastes are collected and traded, as these come in bulk and are easily recyclable. Industries buy buffalo bones, horn, animal hair, bristles and fat from butchers. As most of the valuable waste is generated in large quantities from a few sources, buyers can deal directly with waste producers. Again, scavengers, dealers and wholesalers have no role in these transactions.

Different forms of organic waste recycling occur in Kathmandu, the most common and straightforward form being composting. In Kathmandu, the aforementioned SWMRMC mechanical compost plant produced an average output of five tons per day between 1986 to 1990. As was explained previously, this plant is now closed. At present, commercial composting is done by two community-based organisations in Kathmandu. One is Unnati Adhar Kendra, a non-governmental organisation which produces 2,000 kg per month of compost using domestic waste collected from 200 households in the Teku area. The two sweepers employed by the organisation collect an average 300 kg of waste per day, of which about 75% is organic waste that is used for composting. Households pay Rs. 50 per month for waste collection services. The
compost is sold at Rs. 5/kg in the market. In addition to these two community
organisations, 35 nurseries in Kathmandu often use organic waste to produce compost for
sale. Each nursery produces an average of 300 kg of compost per month.

Another common and simple use of organic waste is animal feeding. In this form,
organic waste is either directly fed to animals such as pigs and cows, or is indirectly used
as processed forage. Squatters living near the Bishnumati and Bagmati rivers raise their
pigs by feeding them waste. Some stock-raisers and farmers in the city bring their
animals to these riverbanks for the same purpose.

Organic waste is also processed to make various types of animal food. Animal
bones from slaughterhouses are cooked and ground to make bone meal for poultry. The
only bone meal mill operating in the valley is Sher Bone Mill, a factory located six km
south of Kathmandu produces 2.5 ton of bone meal per day. The bone meal is produced
by mixing dried bones with chicken dung, mustard cake and ashes. Buffalo bones are
collected daily from more than 1,000 slaughterhouses and butcher shops in Kathmandu
and Patan. The cost of bones is Rs. 5 per kg, while the selling price for bone meal is Rs.
9 per kg.

Another observed form of organic waste recycling is the manufacturing of
secondary products. Table 9 summarises some of the products made from organic waste
in Kathmandu. In general, such manufacturing is performed by small cottage industries.
Among the most common organic materials for secondary products are bones and horns obtained from slaughterhouses, some of which are used to make high-value items such as buttons and decorative pieces. The process involves drying, disinfecting, cutting, smoothing, and carving the bones. There are currently 40 carving industries in Kathmandu, some of which export products to Europe and North America.

<table>
<thead>
<tr>
<th>Waste Material</th>
<th>Source</th>
<th>Product</th>
<th>Input Price</th>
<th>Output Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice husk/straw</td>
<td>Agriculture</td>
<td>Animal feed, mats, footwear, roofing</td>
<td>Straw: Rs. 100/ton</td>
<td>Mats: Rs. 20/piece, Footwear: Rs. 30</td>
</tr>
<tr>
<td>Buffalo/goat skins</td>
<td>Butcher households</td>
<td>Leather items</td>
<td>N/A</td>
<td>Leather bags: Rs. 250/bag</td>
</tr>
<tr>
<td>Hair</td>
<td>Butchers</td>
<td>Hairbrushes</td>
<td>N/A</td>
<td>Rs. 30-120</td>
</tr>
<tr>
<td>Horn/bones</td>
<td>Butchers</td>
<td>Buttons, decorative crafts</td>
<td>Rs. 5/kg</td>
<td>Rs. 2-10/piece</td>
</tr>
<tr>
<td>Sawdust</td>
<td>Sawmills, wood craft industries</td>
<td>Briquettes</td>
<td>Rs. 7,000 per truckload</td>
<td>1 rps/piece</td>
</tr>
</tbody>
</table>

Table 9. Secondary Manufacturing Products from Organic Waste

**Paper Waste**

Paper is the second largest component of Kathmandu’s solid waste stream, constituting six percent of the total. In general, paper recycling is fairly well developed, and existing paper reprocessing facilities have sufficient capacity to recycle all waste paper produced in Kathmandu. In practise, however, this does not occur, as only a portion of produced waste paper is collected. Consequently, a major paper industry in Nepal must import waste paper from Singapore and the U.S. to run its operations.

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Sources of Paper Waste

A recent feasibility study estimated the demand for paper in Nepal during 1994/95 to be 34,359 tons (Ballantine, 1994). In 1988, 6.2% of Kathmandu's waste stream was estimated to be paper. Assuming a total waste estimate of 198 tons per day, Kathmandu thus produces 12 tons of paper waste per day.

The main sources for paper waste in Kathmandu are households and institutions. Households use a variety of paper types, including newspaper, magazines, notebooks, paper wrapping, and cardboard. A 1990 survey suggests that the average Kathmandu resident produces 0.09 kg of paper waste per day (SWMRMC, 1990: 10). Business offices, banks, and schools generate a large amount of computer and high-quality white waste paper. Table 10 shows the amount of weekly waste paper generated by certain institutions in the city. Shops also utilise paper for wrapping and packaging purposes. It is generally believed that most of the paper waste generated in institutions is burned or disposed of. This is mainly because paper waste is very infrequently collected by itinerant collectors, as the paper has often been mixed and requires sorting before it can be sold to paper factories (NIES, 1996: 35).
### Table 10. Waste Paper Generation in Selected Institutions in Kathmandu

(Source: (1) Personal Contact with Ms. Buvhan, Administration Officer of UNDP Nepal, Others: NIES, 1996:13-15)

<table>
<thead>
<tr>
<th>Institution</th>
<th>Type of Institution</th>
<th>Amount of Waste Paper (kg/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Auditor General</td>
<td>Government office</td>
<td>45</td>
</tr>
<tr>
<td>Department of Tourism</td>
<td>Government office</td>
<td>6</td>
</tr>
<tr>
<td>Hotel Narayani</td>
<td>Hotel</td>
<td>10</td>
</tr>
<tr>
<td>UNDP (1)</td>
<td>International Aid Organization</td>
<td>300</td>
</tr>
<tr>
<td>Helvetas</td>
<td>INGO</td>
<td>7</td>
</tr>
<tr>
<td>Nabil Bank</td>
<td>Bank</td>
<td>81</td>
</tr>
<tr>
<td>Royal Nepal Airlines</td>
<td>Airline Office</td>
<td>63</td>
</tr>
</tbody>
</table>

Fig. 8 shows the recycling pathway of waste paper. Some household paper waste is collected by itinerant collectors, who make very little money from this. On average, an itinerant collector collects 2 kg of waste paper per week, which is equivalent to only Rs.4. Waste paper is traded in kilogram units, and many households do not want to wait until they have the minimum one kilogram needed to sell. Consequently, most household paper goes on waste piles.
Very little waste paper is retrieved from garbage piles by scavengers, as most of it is too contaminated to be of value. Consequently, the majority of waste paper in garbage piles ends up in the landfill site. Given that most households throw away their paper waste along with other waste (NIES, 1996: 32), very little of the waste paper produced by Kathmandu households is recycled.

Waste paper from institutions that is neither burned nor dumped is mostly collected directly by wholesalers. Institutions prefer to sell paper to wholesalers because they offer
higher prices than itinerant collectors. Moreover, only registered enterprises can legally buy and sell paper waste from institutions. Many of the institutions have informal arrangements with specific wholesalers. For example, the Nepal Police regularly sells bulk cardboard used to pack police uniforms to a wholesaler in Teku.

Because there are few scavengers and itinerant collectors involved in the waste paper trade, few dealers are involved in this field. Moreover, only three wholesalers are involved in Kathmandu’s waste paper recycling. On average, one wholesaler handles approximately 250 tons of paper per month.

Wholesalers sell waste paper to paper recycling factories. Essentially, the reprocessing of paper waste produced in Kathmandu is performed in three types of facilities: (a) two paper mills located in southern Nepal (Birkti Pulp and Paper and Everest Paper Mill), (b) one brown-paper mill in Pokhara (Nava Durga Paper), and (c) 26 recycling plants producing handmade paper in Kathmandu. Table 11 provides information on these facilities. One of the handmade paper factories is exporting its products to Europe.
<table>
<thead>
<tr>
<th>Factory</th>
<th>Location</th>
<th>Input (tons/year)</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birkti Pulp and Paper</td>
<td>Jainkot</td>
<td>6,000</td>
<td>Newsprint Writing Paper</td>
</tr>
<tr>
<td>Everest Paper Mill</td>
<td>Janakpur</td>
<td>4,000</td>
<td>Newsprint Writing Paper</td>
</tr>
<tr>
<td>General Paper Industry</td>
<td>Kathmandu</td>
<td>7 (schools)</td>
<td>Stationary, wrapping paper</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 (wholesaler)</td>
<td></td>
</tr>
<tr>
<td>PapAgain</td>
<td>Kathmandu</td>
<td>7 (mixed)</td>
<td>Fancy stationary</td>
</tr>
<tr>
<td>Nepali Paper Products</td>
<td>Kathmandu</td>
<td>12 (mixed)</td>
<td>Fancy stationary</td>
</tr>
<tr>
<td>Khoto Hate Kagai Udyog</td>
<td>Kathmandu</td>
<td>60 (white)</td>
<td>Stationary</td>
</tr>
<tr>
<td>Nava Durga Paper</td>
<td>Pokhara</td>
<td>864 (cardboard)</td>
<td>Brown craft paper</td>
</tr>
</tbody>
</table>

Table 11. Waste Paper Reprocessing in Selected Factories

Plastic Waste

The use of plastic in Nepal has increased rapidly over the past few decades. Consequently, the development of the plastic recycling sector is relatively recent. Fig. 9 depicts the pathways of the plastic recycling sector in Kathmandu.
**Sources of Plastic Waste**

Kathmandu's plastic waste is mainly generated by households, commercial institutions, and industries. In 1985, 1.5% of the total household waste was plastic. By 1990, this portion had increased to 6% (SWMRMC, 1990). In 1990, it was estimated that Kathmandu produced 22 tons of plastic per day (Mutz, 1990:21).
Commercial institutions such as shops and restaurants also produce plastic waste, usually in the form of plastic packaging. In 1985, 2.6% of the waste produced by small shops and restaurants in Kathmandu was plastic (SWMRMC, 1985b: 24).

Other sources for plastic waste are plastic product manufacturers and food industries, which also use plastic packaging. According to a director of the Nepal Plastic Manufacturer Association, approximately two-thirds of the plastic waste generated by plastic industries is recycled within the same industries. Because this plastic waste from this source is homogeneous and generally uncontaminated, it can be collected in bulk and is easily recycled.

The following are the main types of plastics used in Nepal: polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), and polyethylene terephthalate (PET). Common uses of these plastics and the potential recycled products that can be made from them are summarised in Table 12.
### Resin Type | Common Usages in Kathmandu | Possible Output
--- | --- | ---
LDPE | Plastic bags used by small shops and vegetable markets, Plastic sheets | Trash bags
HDPE | Shopping bags used by department stores, Milk pouches, Pipes | Pipes, Trash bags
PVC | Mineral water bottles, Footwear, Floor mats, Pipes | Trash bags
PP | Noodle packaging | Flower pots, Brooms, Battery cases
PET | Mineral water bottles | Bottles, Carpeting, Sleeping bags
PS | Loose-fill packaging | Egg cartons, Building insulation material

**Table 12. Common Plastics Found in Kathmandu’s Waste Stream and Their Possible Reprocessing Outputs**
(Source: NIES, 1996 and Lewis et al., 1992)

**Recycling Pathway of Plastic Waste**

Although the consumption of plastic in Kathmandu is a relatively new phenomena, the structure of plastic recycling is already well-developed. Essentially, plastic waste is collected from various sources by scavengers and itinerant collectors. Industries that produce the bulk of uncontaminated plastic waste sometimes sell the plastic directly to large dealers or to wholesalers.

Households generally throw their plastic waste onto garbage piles and into street containers. As explained previously, street and dumpsite scavengers go through these waste piles and pick up all valuables, including plastics. Valuable plastic items include clean PE shopping bags, HDPE milk bags, HDPE ghee bags, hard plastics and plastic foot wear. The scavengers sort the plastics, pack them in jute sacks, and sell to the dealers. Because of the low value and weight of plastic waste, heavily contaminated...
plastic is not picked up by the scavengers. The researcher observed scavenging activities at the Teku site and found that approximately one-third of plastic bags are left uncollected, especially colored shopping bags (HDPE).

Itinerant collectors generally do not buy plastic materials of high economic value, such as hard plastics from foot sandals. They mostly collect plastic waste from industries and institutions, where they can buy uncontaminated plastics in bulk. Most itinerant collectors have established informal arrangements with commercial institutions. For example, one interviewed collector revealed that he routinely visits the same three restaurants every two days.

The pathway of plastic is similar to that of most other waste materials in that it goes from primary collectors to dealers to wholesalers. There are currently 25 wholesalers dealing exclusively in plastic in Kathmandu. In Kathmandu, most of the wholesalers deal with 13 types of plastics. In terms of relations with recycling plants, all of them have formal contracts with factories. Gauri Trading Ltd., a very large wholesaler in the city, has a contract with Bhrikuti Paper to supply 250 tons of plastics per month. On average, wholesalers supply approximately 3,000 tons of plastics per year for recycling.

Most of Nepal's plastic recycling plants are located in the Terai, in southern Nepal, where land is relatively inexpensive. In 1995, approximately 4000 tons of plastic waste left Kathmandu for reprocessing (NIES, 1996:46). According to the Plastic
Manufacturing Association, there are approximately 330 plastic manufacturers in Nepal, of which about 50 have plastic recycling facilities (Personal communication with Mr. Gurung, Chairman of Nepal Plastic Manufacturing Association). Some plastic manufacturers produce only recycled products: Khukuri Chappal in Patan, for example, produces recycled footwear (*chappal*) from scrap PVC. There are 22 such plastic footwear manufacturers in Birgunj, 2 in Kathmandu, and 1 in Biratnagar. Product manufacturers commonly reuse their own process waste and mix recycled pellets with virgin pellets. Some plastic manufactures prefer not to use plastic waste to ensure quality. In Nepal, plastics are mainly recycled into PE pellets, PP pellets, PVC footwear, PE pipes, and PE sheets. PET is not recycled at all in Nepal. Information on plastic recycling industries is summarised in Table 13.

<table>
<thead>
<tr>
<th>Factory</th>
<th>Location</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enviroplast</td>
<td>Chitwan</td>
<td>PE and PP Pellets</td>
<td>PE and PP pellets</td>
</tr>
<tr>
<td>Khukuri Chappal</td>
<td>Birgunj</td>
<td>PVC footwear</td>
<td>PVC footwear</td>
</tr>
<tr>
<td>Himco Pvt. Ltd.</td>
<td>Patan</td>
<td>Milk pouches, ghee bags (HDPE)</td>
<td>PE pipes</td>
</tr>
<tr>
<td>Gaurishankar Plastic</td>
<td>Patan</td>
<td>HDPE products</td>
<td>PE pipes</td>
</tr>
<tr>
<td>Shar Plastic</td>
<td>Narayanghat</td>
<td>HDPE products</td>
<td>PE sheets</td>
</tr>
<tr>
<td>Prasad Pvt. Ltd.</td>
<td>Teku</td>
<td>HDPE products</td>
<td>PE pipes</td>
</tr>
</tbody>
</table>

Table 13. Plastic Recycling Manufacturers

Some plastic waste is illegally exported to India. Consequently, the precise amount is unknown. However, informal sources estimate that currently approximately 60 tons of plastics are exported to India per year.
At present, glass is collected, sorted and reused but not reprocessed, as there is no glass recycling facility in Nepal. One glass recycling plant which operated between 1986 - 1990 closed due to labour problems. Fig. 10 shows the pathway of glass waste in Kathmandu.
A 1990 survey indicated that glass constitutes 1.6% of the municipal solid waste stream (SWMRMC, 1990b: 22). This figure is an underestimate because most glass containers do not enter the waste stream: they are either reused within the household or sold to itinerant collectors. A more recent survey suggests that glass comprises 3.6% of the waste stream (Kiriti, 1993: 21).
Similar to organic waste, the major sources of glass waste in Kathmandu are households and commercial institutions. Glass waste produced by households includes non-reusable glass such as medicine bottles, broken glass containers and other broken glass items such as windows, light bulbs, and drinking glasses. While reusable bottles, such as beer and alcohol bottles, are generally sold directly to the itinerant collectors, broken glass ends up mixed with other waste in garbage piles and containers in the streets. The 1990 survey indicates 10% of total waste produced by households is glass (SWMRMC, 1990b: 23).

Restaurants and hotels generate the major part of glass waste in Kathmandu. Normally the soft drink bottles sold in shops are collected directly by manufacturers. Customers who buy those drinks in restaurants or shops are charged only for the drink (Rs. 8 for Coca-Cola), on the assumption they will return the bottle immediately after drinking. Those who bring the drinks home are charged more for bottles (Rs. 10-12 for Coca-Cola). Not surprisingly, the collection rate of soft drink bottles is high: Pepsi Ltd. in Kathmandu collects 90% of its bottles.

Recycling Pathway of Glass Waste

Glass waste, whether in the form of reusable glass or broken glass, is primarily collected by itinerant collectors and dealers. Scavengers do not usually collect glass because reusable glass is not generally found in the garbage stream and broken glass has a
very low market price. Thus, broken glass in the waste stream ends up in the landfill in Gokarna.

Itinerant collectors buy reusable glass bottles such as beer and whiskey bottles, on average collecting 300 kg of glass per week. The amount they collect fluctuates according with the season, increasing during the major festivals in the fall and spring.

While collectors retrieve glass from households, dealers generally buy glass bottles from bulk generators such as small shops and restaurants. They also collect broken glass from bulk generators such as the light bulb industries. There are approximately 50 glass dealers in Kathmandu. Most of them call themselves collection centres, and, unlike plastic dealers who deal in other waste materials as well, these dealers deal only glass. An average dealer employs seven persons for collection, sorting, and packing.

The recycling pathway of glass is similar to other pathways in that dealers sell the collected bottles to wholesalers. There are only 4 glass wholesalers in Kathmandu. The main tasks of wholesalers are collecting, cleaning, repackaging and transporting to glass-waste glass factories. Cleaning is done manually, mostly by women. On average, one wholesaler employs 18 women for cleaning, 2 male supervisors, and 5 men to pick up glass from collection centres. Unlike plastic wholesalers, the majority (75%) are Nepali.
There are 6 beer breweries, 8 alcohol and 13 juice manufacturers in Nepal. All of them reuse glass bottles. According to the director of Pepsi Ltd., about 90% of beer bottles and 70% of soft drinks bottles used in Nepal are reused by manufacturers. Some broken glass (cullet) is exported to India for reprocessing, but the amount is insignificant.

**Policy Perspectives of Resource Recovery**

The issues of solid waste management and recycling in particular have received very little attention from Nepali policymakers in the past. No clearly defined national policies with regard to SWM issues existed until 1996. Currently, the following laws and legislation relate to recycling exist:

- Municipality Act, 2048 (1992)
- Industrial Policy, 2048 (1992)
- Scrap Tax 2044 (1988)
- Solid Waste Management Policy, 2053 (1996)

The main aim of the Solid Waste Act passed in 1988 was to provide a legal basis for the establishment and operation of the SWMRMC. The act defined the centre’s scope of work, responsibilities and duties. With respect to recycling, Section 3 of the Act authorises the centre (a) to produce briquettes, compost and energy (biogas) from waste, (b) to make provisions to collect recyclable materials from waste, (c) to conduct research
to manage and mobilise waste, and (d) to provide technical assistance and training related
to recycling to the general public. Although the Act clearly states that the centre could
produce compost, briquettes, and biogas, only compost was produced. Furthermore, no
provisions were made for collecting recyclable materials as specified in the Act. The
centre did conduct three studies in 1988 and 1990 regarding the production of recyclable
materials within the city. However, the outcome and recommendations of these studies
were never translated into specific recycling guidelines.

The Municipality Act in 1992 was promulgated with the purpose of decentralising
development activities by making municipalities responsible for social and economic
development. The Act states that in the case of metropolitan areas, municipalities are
responsible for SWM and sanitation. However, it does not address the development of
recycling programmes at municipal levels.

The Industrial Policy of 1992 is the main piece of legislation setting out
government policy regarding industrial development. The utilisation of local resources is
a major objective of the policy, which emphasises the need to develop traditional cottage
industries utilising local resources. Cottage industries are thus exempted from income
tax, sales tax and value-added tax. However, although most scrap-based recycling
industries use local resources, few of them are considered cottage industries according to
the Act. As a result, only a few recycling industries -- such as handmade paper
manufacturers and bone and horn carvers -- can benefit from the incentives offered to cottage industries.

The Scrap Tax was introduced by the SWMRMC in 1988 with the aim of raising funds and encouraging recycling industries within the Kathmandu Valley. Currently, the SWMRMC and three District Development Committees (DDCs) in Kathmandu, Lalitpur and Bhaktapur are charging high taxes on all waste leaving Kathmandu. For example, scrap paper is now taxed at Rs. 2 per kg. This tax is seen as a major burden by all parties involved, including scavengers, scrap dealers, and recycling industries. The tax actually discourages recycling as it reduces the value of waste brought outside the valley, where much of the industry is located.

The Solid Waste Management Policy was formulated in 1996 with the primary objective of managing waste to minimise negative public effects. With respect to resource recovery, the policy states its intention of promoting recycling activities (Section 3; Subsection 3-1). However, it contains no specific guidelines on how to operationalise the mechanisms of waste recovery.

At present, there are no government policies or interventions regarding informal recycling activities. When German assistance was involved in improving Kathmandu’s SWM system, scavengers were at least unofficially recognised as an intrinsic aspect of the existing system. For example, government surveys to identify scavengers' health
needs at the Teku site were carried out and regular health checks were provided. Also, a picking platform was built at the composting plant so that the scavengers could retrieve recyclables from the waste delivered. However, with the withdrawal of German assistance and the closure of the compost plant, this support system collapsed. Scavengers are no longer allowed to live near the site, and no longer receive health checks. The picking platform broke and was never repaired. The inevitable conclusion is that existing policies and acts are not helpful for waste recovery.

**Conclusion**

Resource recovery and recycling in Kathmandu is potentially important for several reasons. First, Kathmandu's solid waste is suitable for recovery. About two-thirds of Kathmandu's waste is organic and can be composted. This compost is valuable for the farmers in the Kathmandu Valley. The remaining one-third of waste is non-organic and mostly recyclable (NIES, 1996: 35).

Second, effective resource recovery can drastically reduce the amount of waste. This has been proven by the experience of the NGO Unnati Adhar Kendra, which comports organic waste and sells the recycled materials. After composting and recycling waste from 200 households, about five percent of the incoming waste remains to be disposed. If only non-recyclable waste was to be landfilled, the municipality landfill would be sufficient for Kathmandu's waste. Moreover, the complaints of local people living near the landfill would diminish, as non-recyclable waste neither smells nor
attracts animals. In addition, a reduction in waste would create a more hygienic and pleasant environment, leading to a higher quality of life in the city.

Third, effective recovery can lessen dependence on imported materials required by industries for processing. For example, the recovery of local paper waste already reduces the amount of waste paper that needs to be imported to supply Nepal's newspaper industry. At the moment, Birkti Paper uses 25 tons of waste paper per day, of which only 60% is collected in Nepal.

Fourth, waste recovery processes can create jobs for skilled and unskilled workers. Kathmandu's most disadvantaged residents are able to gain some income through scavenging, which is a traditional form of income generation for Nepal's outcaste community. It would be unfortunate if Kathmandu, like the city of Manila, were to discourage a practise upon which disadvantaged people rely.

The benefits of resource recovery indicate that SWM planners should pay attention to the issue of waste recovery and recycling. However, most of Kathmandu's planners tend to focus on the technical issue of landfills. This focus is surprising given the well-documented international acknowledgment that landfilling is one of the least desirable methods for handling solid waste, especially in developing countries. A German fact-finding mission report published in 1996 described the following hierarchy of internationally accepted priorities (Oeltzschmer and Betts, 1996): (1) waste reduction;
(2) recycling; (3) energy recovery; (4) elimination of potential environmental hazards; and (5) controlled landfilling. Yet of the same report's seven recommendations, four focus on landfill sites, and none focus on resource recovery. Moreover, the report estimates that scavengers and other sources recover only one percent of Kathmandu's solid waste. This is a gross underestimate of the informal sector, as that number includes neither itinerant collectors nor wholesalers who buy directly from the source. This report illustrates the lack of SWM planners' knowledge about the informal waste recovery sector. In Kathmandu, very little effort has been made toward solving the waste problem through measures to increase composting and recycling of waste. Donors, governments, and SWM practitioners alike tend to focus on the formal sector.

Although the resource recovery process in Kathmandu holds potential, at least four major problems were identified during the course of field research. First, insufficient collection of waste limits the performance of the recycling sector. For example, Bhrikuti Paper has the capacity to recycle 55 tons of paper per day, an amount equivalent to all of Kathmandu's paper waste. However, because of the lack of effective waste paper collection, the company is forced to import an average of 10 tons of waste paper per day from Singapore and the U.S.. Meanwhile, much of Kathmandu’s waste paper is disposed of or burned. Similarly, Enviroplost, a plastic recycling factory, recycles two tons of scrap plastic per day, yet has the capacity to recycle three tons. If the additional scrap plastic was collected locally, then all actors in the system would benefit
Only a few types of waste materials have well-organised collection. Of all waste paper materials, only newspapers, copy books, press clippings and cardboard are collected systematically. At the moment, most office paper is not collected. Similarly, many PE products -- such as PE shopping bags, instant noodle packaging, and milk pouches -- are not collected. Given that the technology for PE recycling is present in Nepal (NIES, 1996: 25), it follows that the collection of such plastic would benefit the plastic recycling industry and reduce Kathmandu's waste stream.

Second, the contamination of collected waste limits the processing of certain materials, such as plastics, paper and organic matter. For example, the scrap plastic received by Enviroplast is often very degraded by contamination of soil and other waste. As a result, the company is forced to reject 30 to 50% of incoming scrap (interview with Mr. Prasad, manager of Enviroplast). Poor-quality waste material reduces the quality of the final product. A similar trend can be discerned in organic waste: The Teku compost plant, for example, used to process organic waste, but due to contamination of the organic waste with pieces of glass, plastics and paper, the final product contained small pieces of non-degradable materials, resulting in poor-quality compost (Oeltzschmer and Betts, 1996: 21).

Third, waste recovery in Kathmandu is limited by a lack of appropriate reprocessing factories. According to recycling experts (NIES, 1996: 126), almost all the materials currently found in Kathmandu’s solid waste stream can be recycled using
simple and inexpensive technologies. Moreover, NIES states most of the technology and
technical skills required for recycling materials are available in the country (NIES,
1996:103. However, for some materials, further development of technology is needed.
At present, there is no glass recycling factory in Nepal. Although it is claimed that more
than 90% of glass bottles produced in Kathmandu are reused, scrap glass, such as that
created by broken glass and light bulbs, is not recycled. The development of a glass
recycling factory would enable the recycling of such glass waste. Similarly, the recycling
of PET and PVC plastics does not occur in Nepal due to lack of technology. Given the
rapid increase in the number of empty mineral water bottles on Kathmandu’s garbage
piles, the transfer of such plastic recycling technology appears essential.

Fourth, poor working conditions for various actors are a major problem, especially
for scavengers and small dealers. The waste, which attracts rodents, is extremely
unhygienic and often contains sharp objects. Scavengers searching for recyclable
materials often injure themselves on broken glass and opened tins, and some come into
contact with chemical waste. It is generally believed that working conditions in recovery
activities are often worst for women and children. As described in Chapter 4, they are
usually involved in the dirtiest part of waste processing, such as scavenging at river
dumpsites. Even when they are employed by wholesalers, women are usually involved in
more potentially hazardous work, such as cleaning glass bottles by hand.
CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

Overview of Kathmandu's Waste Recovery System

According to WASTE, the Dutch research institution that focuses on waste management in developing countries, a typical SWM scenario in developing countries is as follows: "Municipalities send garbage trucks into the city to pick up the rubbish and sweepers to sweep the streets. Places that are not covered by municipal services are often filled with enormous quantities of trash, with dangerous substances. Costs are high, yield is low, and effectiveness is limited. Less than half of the trash is being collected. While garbage is dumped everywhere, the waste pickers go to work, combing the garbage dumps and streets, looking for usable waste to sell to middlemen, dealers and small recycling companies." (WASTE, 1996).

The current SWM situation in Kathmandu fits this description. Despite an effort to reform the city's formal waste management between 1980 and 1993, the current situation remains problematic. The collection and disposal services provided by Kathmandu municipality are ineffective, as they manage less than 40% of the city's total waste (Planco, 1995: 21). The environment surrounding the Gokarna landfill site is negatively impacted, and in addition the municipality discards garbage along the Bishnumati River and the Ring Road. Moreover, the municipal system lacks essential components for waste recovery, such as composting. The result is the citywide overflowing of garbage piles.
While the municipality struggles to manage the city’s waste problem, the informal sector is playing a crucial role in the city's waste recovery processes. The four case studies presented illustrate how the network of informal workers recovers significant amounts of waste from the municipal solid waste stream. The case studies also illustrate that, despite the apparently individually based and casual nature of its activities, the informal sector is highly organised. Further, the different actors in the informal sector play different roles. Informal waste recovery as a whole not only provides a source of income to one of the poorest segments of the population, but it also lessens the need for a costly, sophisticated SWM system.

The question at this point is how informal waste recovery activities are located within the current framework of the municipal SWM system. Fig. 11 describes the pattern of integration between municipal SWM and waste recovery activities in Kathmandu.
Fig. 11. The Current Pattern of Formal SWM and Informal Waste Recovery Activities in Kathmandu

Fig. 11 shows that many of Kathmandu's waste recovery practices essentially operate independently from the municipal solid waste management scheme. As described in Chapter 3, the city's municipal SWM system is a mixed-waste disposal system: various types of waste are mixed at the time of collection, and the only official disposition method for waste is dumping it in the landfill or along riverbanks or roads.
Waste recovery is practiced outside the framework of the municipal system, as the system has neither an official mandate nor a strategy to recover municipal waste. In this situation, the only mechanism linking the city's municipal waste management system with recovery activities are the scavengers and municipal workers. These actors play a primary role in bringing municipal waste into waste trade processes. They are the key actors in converting “refuse” into “resource”.

The distinction between two types of waste -- “refuse” and “resource” -- is essential in understanding Kathmandu’s SWM and waste recovery systems. Although much lip service has been paid to promoting waste recovery, in practice, Kathmandu’s municipal SWM planners seem to regard waste primarily as “refuse”. Consequently, many of their strategies focus on disposal. Since the withdrawal of German assistance, much municipal effort has been put into improving collection and landfilling strategies, while no effort has been made to develop waste recovery strategies, either composting or waste recovery. Moreover, there has been no official recognition of the fact that waste is an essential income source for many urban poor people.

Actors in waste recovery systems benefit little from the municipal SWM emphasis on refuse-based systems. Indeed, many of the problems in the city’s waste recovery activities identified in Chapter 4 are caused by the nature of the current refuse-based SWM system. Essentially, this is because the municipal system allows waste to be mixed, rather that facilitating waste separation mechanisms. The city’s mixed-waste
collection system causes heavy contamination of materials that are not separated from other waste at the household level. Organic waste, paper, and plastic tend to suffer the most from contamination, as once these materials are combined, their intrinsic value decreases. Paper and plastics are degraded with food scraps, while compostable organics are contaminated with plastic, metal and glass. Materials recovered from mixed waste typically have high levels of contamination, making it difficult for scavengers to sell these materials to dealers and wholesalers. As prices for these materials are lower than those of uncontaminated, separated materials, the bargaining position of scavengers is weaker than that of itinerant collectors.

Moreover, the city’s mixed-waste collection system does not encourage the existing informal source separation mechanism, namely, material separation by itinerant collectors. Currently, itinerant collectors only gather easy-to-handle materials with high economic value, such as newspaper, metal, and glass. Given the existing industrial demand for other materials, however, itinerant collectors could also gather uncontaminated materials like office paper and hard plastic, thus increasing the supply of waste material for the recycling industry. Further, the city’s mixed waste stream creates potential health hazards for scavengers and for municipal collectors, who often injure themselves on broken glass or tin while searching through piles of mixed waste for recyclable materials.
In short, the informal waste recovery system is limited by the current refuse-based SWM setting. In order to overcome these problems, the SWM framework must be reoriented toward a resource-based system. The next section will discuss recommendations for such a reorientation.

**Recommendations**

This paper's examination of Kathmandu's municipal SWM and its relationship with informal waste recovery activities reveals the failure of the current SWM system to optimize potentials of the informal waste recovery sector. It follows that the current system needs to be revised to accommodate certain aspects of informal waste recovery processes. Fig. 12 depicts the author's proposed revised system. The Figure is followed by points of recommendations.
Identification of Refuse and Resource in Waste Stream

The starting point for the revision of SWM in Kathmandu is a clear understanding of what components of the waste stream are to be managed (refuse) and what components are to be recovered (resource). The distinction of refuse and resource raises a basic social and economic question: to whom is waste material a resource? Planners of the revised SWM system need to acknowledge that much of Kathmandu's waste stream can be a
resource for many poor people. Therefore, the revised system should adopt approaches to optimize waste recovery. At the same time, the system needs to develop an efficient method to remove and manage unrecoverable refuse. The revised system should thus have two interlinked goals: 1) To optimize maximum waste recovery from the waste stream; and 2) To manage unrecoverable refuse in a more sanitary and efficient manner.

Source Separation in Waste Storage

To ensure better recovery from the waste stream, the revised system will need to incorporate a radical revision in waste storage and collection methods. Although currently there are no official initiatives for source separation, a casual separation mechanism is implemented by the informal sector, as described in Chapter Four. This mechanism can be broken down into the following components: (1) households and small shops separate certain valuable items -- old newspaper, high-quality paper, glass bottles, and metal—and sell these to itinerant collectors; (2) scavengers separate materials from mixed waste; and (3) institutions separate bulk materials to sell to dealers and wholesalers. The new source separation mechanism should attempt to improve the existing system, in addition to launching a new scheme of source separation.

The new mechanism will require a modification of waste storage behaviour. Previously householders, shopkeepers, and market traders combined most wastes, keeping separate only those they themselves could reuse or sell to itinerant collectors. Under the new system, they would be encouraged to sort different categories of waste –
organic, paper, plastic, metal, and glass -- into different containers, in order to simplify later handling. As this change would place a greater burden on householders and institutions, the initial stage might only involve separation of waste into organic and non-organic containers.

Households and institutions would be required to put organics into special household containers that are specifically designed to minimize odours and pest problems. Ideally, these organic waste containers would be kept outside, and the collectors who make compost from them -- nurseries or community organisations -- would pick up organic materials daily or every other day. This practice is currently carried out by the above-mentioned Unnati Adhar Kendra for 250 households in Teku. In areas where no such collection is possible, organic waste should be placed in containers with firmly-closed lids, which is feasible as they will contain no valuable materials for scavengers. This will also improve sanitation.

Inorganic materials should be first stored in household containers kept indoors, where they will be safe and dry. Similar to organic waste collection, the ideal scenario is that these materials are also collected at the household level. As Kathmandu's solid waste consists of only 30% inorganic materials and there is little health risk in storing inorganics indoors, inorganics can be collected less frequently than organic waste. Alternatively, where such a system is not established, people would be required to place inorganic waste in street containers designed to keep materials dry and protected from
These containers may be near organic containers, but the physical distance between the two types of containers should be large enough to eliminate any potential contamination of inorganic materials. The inorganic containers should be designed to facilitate scavenging practices by street scavengers and municipal collectors. Municipal employees could be employed on-site to teach people about waste separation.

**Collection of Separated Material**

After the waste is separated into organic and inorganic material, the collection of such material should, of course, be done separately. Currently, waste is collected from street containers by the municipality; there is no door-to-door collection system. The revised system would promote waste collection at both the household and street levels. An important aspect of the revised system is that collection at the household level is done through existing networks of the informal waste recovery sector, not by setting up a new municipal collection scheme.

There are various ways to utilise informal networks for efficient household collection; for instance, the employment of street scavengers by nurseries and community recycling organisations. These scavengers would be trained to collect the separated waste from households and deliver it to the appropriate sites. Funds for their payment could be collected from households by the community organisation. This system is successfully used by Unnati Adhar Kendra in Teku. Local SWM authorities could assist in starting up similar organisations in other parts of Kathmandu.
Another example of informal network utilisation is household collection by teams of scavengers and itinerant collectors hired and organised by dealers. In this case, the dealers could recruit scavengers and/or itinerant collectors through existing informal networks. Itinerant collectors could be assigned to buy material with high economic value, while scavengers may collect less valuable material. A similar scheme is used in Manila, where collection of separated waste is carried out through the leadership of eight dealers in the community (Furedy, 1990: 47-48). The major strength of this system is the use of dealers' existing networks and knowledge to efficiently collect waste materials.

While the informal waste recovery sector would have the responsibility of collecting household wastes, the city's SWM authorities would be responsible for collection from municipal street containers. To facilitate waste recovery, authorities should provide separate collection vehicles for organic and inorganic waste. Also, an attempt should be made to collect organic waste daily, as there is a large amount of organic waste in Kathmandu and organic waste tends to decay rapidly. In addition, special emphasis will need to be given to vehicle maintenance.

Special efforts should be directed for the collection of waste paper generated at offices and institutions.
Processing of Separated Waste Material

Investments in revising storage and collection mechanisms should be accompanied by corresponding investments in establishing appropriate recovery facilities for recyclable material. With regard to the recovery of organic waste, the disappointing German experience in operating the Teku composting plant shows that large-scale mechanical composting is not appropriate for Kathmandu. Evidence indicates that small-scale (one ton to three tons per day), labour-intensive composting is more suitable. The success of Unnati Adhar Kendra suggests the possibility of expanding a community-based composting program in Kathmandu. Local authorities should either establish their own small-scale compost plants, or support community organisations in building such compost facilities.

In addition, further development of processing facilities should be encouraged with regard to inorganic material recovery. This development should focus on the recovery of currently unrecovered materials in the solid waste stream: low-grade paper and plastics, PET bottles, and broken glasses. According to recycling experts, several potential uses for these materials exist (NIES, 1996): Low-quality paper could be recycled into egg cartons and packaging materials and low-quality plastics could be repelletised and made into bags; while broken glass could be melted and used for cullets. In fact, much of this type of recycling is already done in India, indicating that it is also possible in Nepal.
Local authorities should adopt measures to encourage the development of processing facilities, such as providing small grants and low-interest loans to potential manufacturers to finance start-up costs.

**Efficient Management of Refuse**

In addition to developing waste recovery mechanisms, efforts should be directed at managing unrecoverable waste in a sanitary and efficient manner. The most urgent problem is to find appropriate disposal facilities. It appears that in Kathmandu, the most suitable disposal facility will continue to be sanitary landfilling. As the current landfill site is almost full, priority should be given to finding a new landfill site. The environmentally damaging practise of dumping waste in rivers should stop immediately.
Regulatory Framework To Improve Waste Recovery

In planning a revised SWM system, there is a need to establish appropriate recovery-related laws, regulations, incentives, and corresponding inspection and enforcement procedures at the national and municipal levels. As summarised in Chapter Four, existing legislation regarding waste recovery is far from adequate, as there are neither guidelines nor a framework for operationalising policy statements. Moreover, the current scrap tax affects the income of primary collectors, dealers, and wholesalers, and thus discourages waste recovery at all levels. A new regulatory framework is obviously required.

First, the scrap tax should be abolished to encourage further export of waste material from Kathmandu. This would increase the amount of waste trade, and would provide an incentive to collect waste materials. Second, the Industrial Policy, 1992 should be amended to provide additional incentives to waste processing manufacturers. These amendments should (1) include traditional recycling industries such as composting in the list of cottage industries; and (2) provide economic incentives such as tax exemption status to waste-processing manufacturers. Third, a governmental framework/guidelines should be developed to operationalise policy statements regarding waste recovery. For example, each municipality should be required to set up a municipal recycling scheme.
Social Considerations for Waste Workers

An important aspect of the revised system is its consideration of the welfare of waste workers, and its support for improving their status, working conditions and earnings. Because many urban poor earn their income through collecting, sorting and trading waste material, the revised system would ensure the continuation of such practises, while seeking to improve working conditions. Working conditions for waste workers could be improved significantly by, for example, (a) providing containers for inorganic material that are easy to scavenge through, (b) providing scavengers with manual or very simple mechanical sorting equipment, (c) providing operational training to scavengers and dealers in health hazards and sanitation, and (d) requiring employers to provide appropriate working conditions. These measures should perhaps be offered with the cooperation of community and social organisations.

The revised system should also attempt to create an environment with increased social mobility, so that workers at the bottom of the social order in the recovery sector could move up to better working conditions and increased income. Cointreau states that the important factor in social mobility within waste recycling, apart from financial resources (to invest in equipment, transport and warehouses), is sufficient social status to develop networks and to be able to deal with representatives of industries that buy waste (Cointreau, 1991). In Nepal, attempts can be made to assist scavengers in organising themselves into a recognised group. However, it is extremely difficult for members of traditional outcaste groups to overcome the prejudice against them so as to be able to
negotiate effectively with other actors in a caste-based society. Thus, efforts should also be made to change prevalent values linking "filthy" waste with outcaste people. If societal values are to change so that people come to value waste recovery as an essential component of a global environmental ethic, then those who do this work must also be valued.

Institutional Arrangements

As described in Chapter 3, the current organisation of municipal SWM appears to be in a state of confusion. Since German withdrawal, the Kathmandu municipality has progressively taken over greater responsibility for SWM from the SWMRMC, with the latter currently providing transport and disposal services for waste collected by the Kathmandu municipality. However, the roles and responsibilities of each agency are not clearly defined, resulting in a high degree of inefficiency. Furthermore, neither institution has assumed responsibility for the issue of recovery and recycling, and thus the system lacks inherent institutional initiatives to develop recovery and recycling schemes.

The revised system will need to clearly define and assign responsibilities regarding recovery activities. Given the limited resources and capacity of public institutions, there is a need to involve non-public sectors such as private firms and community-based organisations in the municipal SWM system. In fact, it is frequently argued that, given the right conditions, privatisation of SWM activities is the best way to improve the poor efficiency of existing SWM systems. These conditions include: institutional and legal procedures that secure orderly and effective contracting
mechanisms; an institutional setting that allows competition; and the institutional capacity to enable effective supervision (Schertenlieb and Meyer, 1991; Leite, 1989). However, feasibility studies on the possibility of privatisation of Kathmandu's municipal services suggest that the necessary level of expertise is not yet available in Nepal (Oeltschner and Betts, 1996). Before pursuing privatisation, the municipality and the SWMRMC will need to develop the technical capacity to exercise proper contract control, along with mechanisms for inspection and supervision. Thus, training and technical assistance in these area should be provided to local SWM authorities.

There are other possible options for private sector involvement beyond the contracting out of municipal SWM and recovery activities. One option is to encourage involvement of those segments of the private sector that have a vested interest in achieving efficient waste management and waste recovery -- for example, the tourism industry. In other countries, commercial sponsorship has been successfully introduced into certain aspects of waste management and recovery activities, such as providing waste storage and sponsoring educational and publicity campaigns. The possibility of further involving the private sector in waste management in Kathmandu bears further exploration.

Public Education

Environmental and social education programs should be implemented in order to maximise the effectiveness of the revised system. Education programs for local residents
should focus on the environmental and economic importance of waste recovery, and what is expected of residents participating in the waste recovery scheme. Specific information to be communicated includes: scheduling of organic and inorganic waste collection, storage requirements, arrangements for waste separation for household collection, scheduling and location of pick-ups for recyclables, and social concerns regarding waste.

**Future Research**

The analysis of the informal waste recovery system in Kathmandu highlights a variety of research questions to be asked. Among the subjects requiring further work and theorization are:

1. **Health implications for workers in the informal waste recovery sector.** If improvements are to be achieved in Kathmandu’s waste recovery system, particularly in ensuring better working conditions for workers in the sector, it is essential that the health implications of recovery work be better quantified. Such information would ensure the safety and welfare of the informal waste workers community.

2. **Pricing strategies to sustain improved SWM and informal waste recovery.** Both formal SWM and waste recovery activities are cost intensive. In planning SWM improvements, more emphasis should be placed on questions of financing, pricing and cost recovery. In particular, research should focus on pricing schemes based at the community level.
Strategies to facilitate community education and public participation. Public cooperation is necessary to ensure improved SWM and waste recovery. The research that focuses on how to maximize the effectiveness of public cooperation should be conducted. The questions of the study should address these areas: How to mobilize the public to promote their cooperation? What types of incentives and/or penalties are required to facilitate public cooperation? What types of education programmes are effective?

Strategic planning approaches to promote composting facilities. Strategic planning to establish appropriate compost facilities is a prerequisite for the city’s improved SWM system. Research is required to determine what types of facilities are most suitable and how they should be operated. The possibility of expanding small-scale, community-based composting should be investigated.

Conclusion

By examining the waste recovery activities and the formal SWM system in Kathmandu, this paper attempted to show that informal waste recovery sector holds both economic and ecological potential for improving the city’s solid waste management. Thus, increased attention should be given to the benefits and problems of the informal waste recovery sector. Further, this paper illustrated several important aspects of the waste recovery sector, in particular that the sector is segmented by types of waste materials and that each material has a well defined pathway of recovery; and that there are different economic actors involved. Future analysis should focus on policies for these different parts of the sector: what aspects of informal waste recovery should be actively
supported; what activities must be tolerated because they are important to certain segment
of population, and what aspects must be regulated because of their negative
environmental and health risks.
Bibliography


SWMRMC and GTZ (1985). *Scavenger Activities and Health Hazards to Scavengers* Kathmandu, SWMRMC.


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List of Interviewees

Mr. Abbas, M.J.  
Plant Manager of Khukuri Chappal Industry Pvt. Ltd.

Mr. Bhattarai, S.  
Manager of General Paper Industries.

Ms. Bhuvan, K.  
Administration Officer of United Nations Development Program (UNDP) Nepal.

Mr. Devkota, B.  
Production Manager of Birkiti Pulp and Paper Ltd.

Mr. Gurung, G.  
Chairman of Nepal Plastic Manufacturers Association.

Mr. Khadgi, K.  
Proprietor of Sher Bone Mill Pvt. Ltd.

Mr. Prasad, H.B.  
Manager of Enviro Plast Pvt Ltd.

Ms. Ranjiitkat, J.B.  
Director of Unnati Adhar Kendra.

Mr. Shrestha, S.B.  
Director of Everest Mill Pvt. Ltd.

Mr. Thapa, G.B.  
Desk Officer. Urban Development Through Local Effort (UDLE). Division III

Mr. Thapa, S.B.  
Acting Director. SWMRMC.

Mr. Tuladhar, S.  
Managing Director of Kathmandu Sanitation Department

Mr. Tuladhar. B.  
Technical Director of Nepal Innovative Environmental Services
APPENDIX A

Interview Guide—Dealers and Wholesalers

Name: __________________________
Age: __________________________
Sex: M F
Caste/ Ethnic group: __________________________
Marital Status: Married/ Unmarried/ Widowed
Educational level: __________________________
Occupation: __________________________

Where do you live?
Why are you involved in this job?
Are there any of your family members who are involved in this job?
How long have you been involved in the job?
What were you doing before this job? (waste picking?)
When did you establish a waste dealing business?
How many employees do you have?
What materials do you deal with?
How do you obtain waste materials?
- buy directly from scavengers
- buy from collection dealers
- collect/ buy from institutions
- collect/ buy from households
- other

Who do you sell the materials to? (name and place, if possible)
- Indian exporters
- Industry in Nepal
- Buyers in Nepal
- other

What do you do to the materials you obtain/buy?
- cleaning
- sorting
- manufacturing
- transporting
- other

How many people work at your site? What do they do?

How do you classify materials?

How much do you pay for the different types of materials? For how much do you sell them to your buyer?

<table>
<thead>
<tr>
<th>Item Name</th>
<th>Buying Price</th>
<th>Selling Price</th>
</tr>
</thead>
</table>

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Who decides the selling price?
What is your approximate income (daily/weekly/monthly)?
Do you sell materials to specific dealers/ institutions?
How do you sell the materials?
Do you work with certain scavengers?
Interview Guide—Waste pickers (Dumpsite/ Street/ River), Itinerant Collectors, Municipal Collectors

Name: ______________________
Site: ______________________
Age: ______________________
Sex: M F
Caste/ Ethnic group: ______________________
Marital Status: Married/ Unmarried/ Widowed
Educational level: ______________________

How long have you been involved in this job?
- less than 6 months
- 6 months to 1 year
- 1 to 5 years
- 5 to 10 years
- more than 10 years

Are there any of your family members who are involved in this job? How many?

What are the reasons for your involvement in the job?

Where are you from?
Where do you live currently?

In what kind of accommodation do you live?

What part of waste management are you involved in?
- waste picking from households
- waste picking from dump site
- sorting
- transporting
- cleaning
- selling
- other
Who will do the other parts of waste dealing?
- waste picking from households
- waste picking from dump site
- sorting
- transporting
- cleaning
- selling
- other

What do you do with collected materials? (specify materials)
- sell at the market
- sell to buyers
- sell to industry
- use by themselves
- other

Do you collect materials from other than station sites? If so, where?

What materials do you collect from the waste? per day? per month? (in kg)

<table>
<thead>
<tr>
<th></th>
<th>Per day</th>
<th>Per month</th>
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</thead>
<tbody>
<tr>
<td><strong>Organic</strong></td>
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<tr>
<td><strong>Plastic</strong></td>
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<td><strong>Cardboards</strong></td>
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<td><strong>Glass</strong></td>
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<td><strong>Intact</strong></td>
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<td><strong>Broken</strong></td>
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<td><strong>Metals</strong></td>
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<td><strong>Copper</strong></td>
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<td><strong>Brass</strong></td>
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<tr>
<td><strong>Other</strong></td>
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</tbody>
</table>

What time of the day do you collect those materials?

How many days per week do you collect materials?
Do you have any other job? If so, what is it?
Do you have free access to waste? Any regulations, limits?
Do you specialize in collecting special materials?
Where do you sell them? (who pays for collected materials?)
How much do you earn from these materials?

<table>
<thead>
<tr>
<th>Material</th>
<th>Per day</th>
<th>Per month</th>
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<tbody>
<tr>
<td>Organic</td>
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<tr>
<td>Other</td>
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How much do you make by selling these items, per day?
Is there a fixed price? If so, who determines the price?
Do you have contracts with certain buyers?
Do you work with municipal cleaning staff?
Do you belong to any organization? Or cooperation?
Are there any conflicts within your waste picking communities? Why is that? (caste?)
What are your relations with the buyer and dealer?
What do you hope for the improvement of your work situation?
Above: Cows Eating Garbage in the Street of Kathmandu;

Below: Garbage on the Riverbank
Above: Dumpsite Scavengers

Below: Street Scavengers Picking Up Plastic Material
Above: River Scavengers

Below: Municipal Street Sweepers
Above: Itinerant Collector Buying Empty Bottles

Below: Working Places of Small Dealers
Above: Working Site of Large Dealer with Scale

Below: Wholesaler of Plastic Waste Material
Above: Wholesaler of Paper Waste Material

Below: Washing Empty Bottles at Glass Collection Centre
Above: Working Site of Metal Wholesaler

Below: Working Site of Plastic Wholesaler
Above: Reprocessing Buffalo Bones Into Bone Meal

Below: Community- Based Compost Making