

DISCERNING THE SOLID WASTE ECONOMY

A case study of Jabalpur urban agglomeration.

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I hereby affirm that the work of the dissertation *DISCERNING THE SOLID WASTE ECONOMY: A case study of Jabalpur urban agglomeration*, being submitted as part of the requirements of the M.Phil Programme in Applied Economics of the Jawaharlal Nehru University, was carried out entirely by myself and has not formed part of any other Programme and not submitted to any other institution/University for the award of any Degree or Programme of Study.

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Kamna Lal

Abstract of the dissertation

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Urbanization has been a growing phenomenon the world over. It is marked by concentration of population and resources. This study is on the partially spent solid resources or what are called solid wastes. Handling of solid wastes and more importantly their proper disposal is central to the concern of maintaining the quality of life offered by a city. It is also a topical issue in a developing country like India, as the witnessed urban growth is skewed. Primate cities are still amassing a major portion of the rural migrants along with growing at a national average, which is high for India. This concentrates the problem of resource consumption and disposal in these cities.

The magnitude of solid forms of waste indicates the inefficiency in product design as well as the intensity of resources usage in a society. A way to recover this consumption has been arrived at in the technologies of using the solid forms of waste. The study terms this as the solid waste economy. Within the above, two categories of agencies are identified which are the formal and the informal solid waste sectors. Informal solid waste sector is a widely marked urban character in the developing countries, which due to its activity, partially eases the solid waste management burden of the formal sector. We attempt an understanding of the solid waste economy, its actors and the prospective options available for the same.

One dimension of the understanding is attempted at the point of exploring the vulnerability of the solid waste stream to the variables related with urbanisation. Our results indicate that the magnitude of the solid waste increases once a nation achieves a higher degree and stage of urbanisation, visible in the demographic shift of population and structural change in the economy. It is also found that the total quantity of solid wastes decreased with an increased environmental awareness. Another exercise, at the city level for India, brings out the contribution of migrant population and the number of working females to the solid waste generated in an urban area. Further to that the study looks at the arrangement of solid waste handling activity within a city. The above is detailed with the help of a primary survey of Jabalpur, with this we sketch a picture of a class one-size non-metro city in India, a maiden attempt. The study reports no difference from the reported structural accounts of the sector, however we trace the evolution of the informal solid waste economy with the process of urbanisation and discuss the variable attributes of the agents. In this study we also discuss the options available to the formal sector and the informal sector. We propose a new role for the Non Governmental Organisations and a shift in the materials policy followed in order to address the issue at the core.

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INTRODUCTION

One of the in built characteristics of present day human society is generation of enormous quantities of waste. The higher a human being is in the socio-economic ladder the higher is s/he in the consumer chain and greater the quantity of waste generated. Rubbish, in a sense has become an index of high living standards.

T. N. Khoshoo

Foreword "Wealth from Waste" (TERI, 1996)

Economic progress and rising environmental awareness has brought the logical consistency of the phrase "Environment and Development" into intensive theoretical/academic debate, culminating best in the cliché 'sustainable development'. The deteriorating health of our ecological surroundings as (end) a consequence (of the pipe) of the progress model adhered to have become a liability which we pass on to the next generation. The above quote bares the cause and effect link between economic progress and the mass of non-product output, also termed as waste. Generally waste is understood to be undesirable and useless. The present study explores the economy latent within the solid forms of waste especially in a developing country context.

With time human civilisation has evolved into more organised and increasingly complex habitations, at the pinnacle of which stands the modern day city. Hunting gathering gave way to villages which were gradually replaced by cities. Early nineteenth century witnessed a rapid growth of cities¹. The rate at which earth has been urbanising is phenomenal. In 1950, the world urban population was a total of 734 million of which 448 million were in the developing countries, in 1980 this figure rose to 1.8 billion, the developing country contribution was 958 million. By the end of the 20th century, world urban population was more than 5 billion, of which the developed country share was around 2 billion while the developing country population crossed the 3 billion mark². Increased population concentration and

1 Huriot and Thisse (2000)

2 UN, World Urbanisation Prospects (1990)

economic activity puts local as well as global ecosystem under stress. The crossed limit of these stress results in what we call as an environmental problem.

According to the World Development Report (1999-2000) economic growth and urbanisation are closely related trends. As indicated earlier urbanisation stimulates environmental problems. This implies that a high rate of economic growth and urbanisation results in increased environmental problem. Thus we can see an evident link between the three, namely economic growth, urbanisation, and environment degradation. The effect of urbanisation on environmental largely depends on its type and distribution. It is best exemplified in the environmental problems of the North-and South, which for the former originate in their profligate lifestyle, while for the latter causal links can be traced to their lagged start in the race of progress and the soaring population levels.

The study concerns itself with the category of environmental problems, which can be best, defined as aggravated environmental discomforts. In particular we single out the environmental problems caused by waste, which are solid in form. Waste as such is an inevitable output of the twin economic processes of production and consumption. Materials transformation is accompanied by a complementary qualitative transition of bound energy (low entropy) into free energy (high entropy). The implications of the process become clear once the cognisance of earth as a closed system is realised. Worth mentioning is the "spaceship earth concept of Boulding in which earth is compared with the environment of a spaceship in which resources are finite and waste disposal is constrained by the space available.

In principle the ecosystem is already equipped to manage the waste that is generated in nature to quote Khoshoo (1996) "*...in an undisturbed ecosystem, waste of one species is food for the other*". The problem arises when the ecosystem is not able to do this, either due to an imbalance in the its constituents (absence of species as a result of loss of habitat) or when the environment is expected to perform beyond its carrying capacity (increased stress). This is reflected in the rising piles of waste and the increasing complexity of it, which makes the natural degradation difficult and results in the interruption of materials cycle. In order to restore that cycle we need to treat the residuals and release them back into the materials cycle, simply put we need to manage wastes.

In a developing country urban environmental problems can be traced to the fallacious developmental strategy adopted. The issues identified with the problem of solid waste in a developing country context are a microcosm of all the questions the trail of economic progress has left behind. In these countries, urban environmental problems are not a priority due to lack of mass environmental awareness and absence of a regulatory regime that incorporates environmental concerns.

Solid waste has become a topical issue in view of rapid urbanisation taking place world over, more so in the case of developing countries where the world's largest urban populations are located. In these countries the demand for basic services in urban area has been met with a shortfall, as the demand generally exceeds supply capacity. In comparison to other forms of urban environmental pollution, solid waste generates a divided opinion and action from the public as it is not an immediate problem like water or air pollution. The effect of solid waste pollution is lagged and due to this there is a tendency to put the action off. The immediate effect of solid waste pollution is on the aesthetics of an area, which is reflected in the decreasing land rents. The second is in terms of the air and water pollution it facilitates. It is thus very clear that management of solid wastes is critical to the maintenance of living standards in an urban area.

Another dimension presented to us in the solid waste scenario of the developing countries is in terms of its recycling. Allegedly, this activity is done by, what we have come to know in the literature, as the informal sector. On observing this sector it appears as scattered and disorganised but studies reveal that the functioning within this sector is organised along tacit codes of conduct and the efficiency of the sector is unquestionable. Literature also terms the activity of this sector as solid waste economy. This is appropriate in view of the fact that millions of people in the developing world sustain on this activity. In addition to that the bulk of waste is reduced by sieving off the valuables (reusable and the recyclables), while meeting the materials demand of the industries by recycling glass, paper, iron, plastic etc. In this way they come through as a dynamic sector which at a time addresses a social, administrative and more importantly environmental need.

This study is an attempt to delve further into the functioning of this sector, placing it under the dual concerns of urban governance and environmental desirability. The presence of informal solid waste sector and its contribution to the city economy

cannot be ignored. The study therefore attempts to comprehend the functioning of informal solid waste sector in the light of the ongoing debates regarding its role as a stakeholder in urban governance process, and the methods suggested for achieving such. On the centre stage are the methods of participatory approach to urban service provision, which are viewed as the means of providing an effective public service as well as the way to reduce exploitative exchanges that mark the informal sector. In the present study we make an endeavour to understand this notion, making a distinction between solid waste economy and solid waste management operations for developing country, particularly India.

The study discusses all the raised issues in the following chapters with a case study approach for a clearer understanding of the informal sector role and functioning in an urban area. For the purposes of which Jabalpur, a non-metro city is chosen. The choice of the city for the study enables us to sketch the solid waste economy scenario of a non-metropolitan class one-size city in India, making it a maiden attempt.

The study is organised as follows. Chapter two provides a background of the solid waste problem and the related institutions of solid waste management. It also delineates the concept of solid waste economy.

The third chapter placing the problem of solid waste up front looks at the process of urbanisation and related environmental modifications. The trend of urban growth in India is discussed along with a brief assessment of Indian urban environment. The Indian solid waste scenario follows this, in which we look at the institutions attached with the management of such in India. This chapter also presents the framework in which we situate our study.

Chapter four is dedicated to the understanding of the solid waste stream, and finds its justification in the absence of well documented forces of influence on solid waste stream, which as a consequence affect the solid waste management as well as solid waste economy of a place. We examine the factors at two levels of regional aggregation, that is, at the country level and subsequently at the city level. While the former, according to us captures the impact of higher economic growth on the solid waste stream the latter is a discussion of the localised factors that stand to influence the solid waste stream.

Chapter five introduces the case study city, Jabalpur. We focus on the nature of urbanisation experienced in relation to the influence on the solid waste economy. We also discuss the solid waste management mechanism of Jabalpur. Chapter six presents the informal solid waste sector active in Jabalpur city, based on a primary survey. Informal solid waste sector is examined in relation to its agents, its evolution in response to the urbanisation experienced. Also the chapter examines how likely is it to be a participant in the process of solid waste service delivery given its structural and functional properties.

Chapter seven is a discussion on the role of informal sector in solid waste management and solid waste economy of an urban area with special reference to Jabalpur. The study builds up an argument in favour of the autonomy of the informal sector and proposes a modified role for the non-governmental institutions, which have emerged as the catalytic agents in the urban governance scenario. Finally in chapter eight summary and conclusions of the study is provided.

II

THE PROBLEM OF SOLID WASTE

Introduction

It is a commonplace notion to term anything useless as waste. In our view waste is one of the widely misused and misunderstood words in the modern vocabulary, for non-requirement or non-desirability are variable yardsticks which are society specific. As introduced earlier the study is on solid forms of waste. We therefore need to take into account the intensity of resources use in different societies, as solid wastes and concerned issues are linked with production and consumption activities. Following this we survey the existing knowledge of waste, solid waste classifications, and the options available for its management. The present chapter thus is an exposition on what we term as the different facets of solid waste study. Progressively we build up the concept of solid waste economy and discuss the various agents involved in it. The chapter is arranged in two sections. The first section introduces the terms waste and solid waste with its various classifications; we chronologically trace the definitions and the associated changes in the study of waste with the help of these definitions. The second section sets forth the concept of solid waste economy, which we review in a developing country context. Alongside the above a documentation of prevalent management practices and agencies involved in solid waste economy is also featured. Furthermore in our study, the mention of informal sector involved in the solid waste scenario gains prominence.

I

2.1.1 The concept of waste

Waste is called the metabolic product of the cities (Gupta and Asher, 1999) and can be aptly termed as an externality of anthropogenic activity. As understood, urbanisation is accompanied by a concomitant rise in the level of income (as a result of extended market and high return for skills) empowering the purchasing power of urbanites and increasing their consumption levels. An urban area characterised by a high concentration of population implies intensive resource use, and consequentially waste generation, which adversely affects the abiotic (air, water, soil, noise etc.) and biotic (high levels of urban morbidity, destruction

of habitat and loss of species) factors of the local ecosystem. High population density hints a concentration of *resources* for consumption, and *waste*, post consumption. Environment functions as a recipient of partially spent resources, and undertakes the assimilation and treatment of waste, a property¹, that has been compared with that of a capital good². The environmental envelope of earth can be effectively summarised as a supplier and sink of resources. *Prima facie* we distinguish between renewable and non-renewable resources, the latter being circulated in the ecosphere with the help of the local ecosystem mechanisms. Economic activity, the growth engine of human civilisation to attain development, is highly hinged on the provision of these resources by nature³.

There are three forms of matter and likewise wastes too can take the shape of gas, liquid or solid. Sectors of environment, atmosphere and hydrosphere act as receptacles of gaseous and liquid waste respectively. The rising levels of global warming and deteriorating levels of water availability as well as purity exhibit the impact of overload experienced by these sectors. Lithosphere, acts as a recipient of spent resources, which are solid in structure. The impact of "throwaway attitude" of the urban lifestyle is reflected in the increasing piles of unattended waste that marks any developing country city and in the shrinking landfill spaces of western cities. The problem of solid waste assumes importance in an urban environment as its improper handling stimulates pollution in other two environmental media and in urban areas land limits the menu of alternatives available making the situation acute. The most obvious environmental implication of solid waste is aesthetics; the other is the problem of leachates⁴.

As explained earlier high density of population as a result of metropolisation and macroubanisation⁵ has a detrimental effect on the local ecosystem. Solid waste crisis occurs

1 Each ecosystem has a finite capacity to break down the biodegradable wastes. Although most wastes arising from production and consumption are biodegradable each ecozone or water body has a finite capacity to break down such. (Faber Niemes and Stephan, 1987; Ayres, 1999)

2 For a formal representation of the argument see Faber, Niemes and Stephan (1987).

3 See Pearce *et al* (1977) for a good discussion of the types of resources, and their classifications, extraction cost curves and impact on economic activity.

4 Lechate is the liquid that has travelled solid waste or other medium and has extracted, dissolved or suspended matter from it (Indian Stastical Institute, 1981), usually this seeps into the lithosphere and contaminates the subsurface water

5 Metropolisation is the migration from small towns and cities to larger cities and capitals and macro-urbanisation is the migration of people from rural villages to towns and cities.

when ecosystem functioning⁶ is hampered by an overload in the carrying capacity of the city due to the sheer bulk and rising complexity of waste. Unplanned human settlements, rapid resource use and improper disposal of wastes exacerbates the situation for developing nations. As the urban trends world over reveal that macro urbanisation would continue especially in the developing countries, solid waste is a problem that calls for attention for the maintenance of quality of life⁷ of the urban citizen. As earlier said the qualification of any material into waste and not, is sensitive to culture. In this condition we need to find the characteristics which mark solid waste, almost universally. Thus we deem a discussion of the definition of waste and solid waste from the literature important in the course of the present study.

2.1.2 Defining solid waste

Before broaching the subject, we need to understand what waste connotes? In general waste is defined as a worthless or useless by product (Webster's, 1984). Environmental literature, however, gives more specific definitions. Gilpin (1976) defines waste as a matter liquid, solid, gaseous or radioactive which is discharged, emitted or deposited in the environment in such a volume, constituency or manner as to cause alteration of the environment. The definition is further extended by Allaby (1979) who defines it as any substance solid, liquid or gaseous for which no use can be found by the organism or system that produces it⁸, and for which a method of disposal has to be devised. The concept is given another dimension by defining it as unwanted material intentionally thrown away for disposal (Hoornweg, 1999). Waste is also termed as a resource, especially by those who believe that materials recycling and efficiency in material use is the key to ease the load on the environment⁹. We note that there exists a wide range of definitions. One common thread that runs through all of them, however, is the redundancy of the material generated for the process by which waste is generated and the need for its rightful disposal.

The problem of solid waste gained prominence in the literature owing to the environmental awareness initiated in the seventies largely by Rachel Carson (1971) through "Silent Spring."

6. Ecosystems are engaged in two basic functions, materials recycle by degrading waste and energy cycle via food chain.

7 US public health services identified 22 human diseases that are linked to improper solid waste management (Hanks, 1967 as is cited in Hoorenweg, 1999).

8 Kemp (1998)'s definition resembles the earlier two in defining waste as any material solid, liquid or gas that is no longer required by the system that has been using it or producing it.

9 See for example Young and Sachs (1994).

The resultant awareness was quick to take cognisance of the problem caused by empty aluminium cans, plastics, automobiles etc. One of the initial definitions of solid waste was coined by World Health Organisation (WHO) in 1971 as "waste arising out of man's activity, which is not free flowing". One among the existing definitions found in the literature is Gilpin (1976 and 1996). He defines solid wastes as 'all material of solid and semisolid character that the possessor no longer considers of sufficient value to retain'. Parallel to this line of thought there are works highlighting the *reusability* of once discarded material, that is to say the approach of "resource recognition".

To quote Rangers and Meadows (1973);

"...the part of waste that is irretrievably lost is considered to be pollution (waste in the form of air and water), what one calls solid waste is the part of society's waste that is retrievable/recoverable. As long as the material remains solid it is possible to recycle it, only when it ends up in the pollution category is recovery no longer possible."

The definitions are further specialised with solid waste being classified according to sources of origin into industrial, hospital and municipal solid wastes. The present study deals with the municipal solid waste (MSW) which is defined as "society's detritus" by Hoornweg (1999). In the context of developing countries it is defined to include waste generated by residential, commercial, industrial, institutional, construction, demolition, processing activities and municipal services. As said earlier wastes are defined largely in the socio-cultural domain, and therefore considerable ambiguity clouds the literature with these definitions varying across diverse studies. Often only residential waste, all solid wastes generated in a community except for industrial and agricultural wastes, is referred to as municipal solid waste. It generally includes discarded durable and non-durable goods, containers and packaging, food scraps, yard trimmings and miscellaneous inorganic debris, including household hazardous wastes, construction and demolition debris, sludge and ashes generated by sewage treatment plants and MSW incinerators (Beede and Bloom, 1995).

Solid wastes can also be classified into hazardous and non-hazardous categories with its basis on toxicity of materials in waste. This can be attributed to the increased chemical sophistication in product composition and public awareness towards the same. Wastes need not have different sources; the same process might be producing both hazardous as well as non-hazardous wastes. However municipal solid wastes are largely the non-hazardous

components of the above. It includes non-hazardous wastes from households, commercial establishments, institutions, markets and, industries (Cointreau-Levine, 1999).

The present study will be examining the case of urban municipal solid waste. We define it as solid/semi-solid non-hazardous waste generated by the residential, institutional and commercial establishments which needs effective disposal. In what follows we briefly document the existing categorisation of the sources and types of municipal solid waste, which help us identify generators of solid waste within an urban system.

Municipal solid waste classifications

The literature provides diverse classifications of municipal solid wastes. The one provided in table 2.1 is a comprehensive showcase of different varieties of solid wastes, which are generated in an urban area by varied sources.

Table: 2.1:Sources And Types of Solid Wastes

SOURCE	TYPICAL WASTE GENERATORS	TYPES OF SOLID WASTES
RESIDENTIAL	Single and Multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (bulky items, consumer electronics, batteries, oil, tires), and household hazardous wastes
INDUSTRIAL	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants	Housekeeping wastes, packaging food wastes, construction and demolition materials ,hazardous wastes, ashes and special wastes
COMMERCIAL	Stores, hotels, restaurants, markets, office buildings etc	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
INSTITUTIONAL	Schools, hospitals, prisons governmental centers.	Same as commercial
CONSTRUCTION & DEMOLITION	New construction sites, road repair, renovation sites, demolition of buildings	wood, steel, concrete, dirt etc
MUNICIPAL SERVICES	Street cleaning, landscaping parks, beaches, other recreational areas, water and wastewater plants	Street sweepings, landscape and tree trimmings, general wastes from parks, beaches and other public places, sludge.
PROCESS	Heavy and light manufacturing, refineries, chemical plants, powerplants, mineral extraction and processing	Industrial process wastes, scrap materials, off specification products, slag
ALL THE ABOVE SHOULD BE INCLUDED AS MUNICIPAL SOLID WASTES		
AGRICULTURE	Crops, orchards, vineyards, dairies, feedlots, farms	Spoiled food wastes, agricultural wastes, hazardous wastes(pesticides)

Source: Hoornweg (1999)

It would be apt to point out that even though this is an exhaustive account of the sources and types of solid wastes, there are a few shortfalls. For example, quite not fitting is the inclusion

of industries and process wastes as sources, which are mainly industrial in nature (the two categories might not be mutually exclusive or be better if clubbed together). There is an overlap in types of solid wastes as categories repeat in some and terms like "special wastes" are not explained. Added to that is the inclusion of hazardous wastes which would ideally not feature in the same category as municipal waste. The point made is simple: there are no tightly demarcated sources and types of municipal wastes as one would ideally like to have.

The ambiguity regarding the categorisation of unwanted solid matter has its bearing on the efficacy of disposal options, elsewhere than in the place of its design. More importantly the categorisation of waste has a bearing on the hazardous scrap trade. A potentially hazardous substance can be exported to a country, in which it is considered to be non-hazardous. However first we examine the global solid waste scenario to generate a picture of the global bulk and its distribution.

2.1.3 Global Solid Waste Scenario

An estimate by Shaw (1989) suggests that by the end of 2025 developing countries would be contributing more to the global bulk of solid waste than the developed countries, irrespective of any significant change in their comparative economic positions. It was estimated that the global burden of municipal solid waste amounted to 1.3 billion metric tons in 1990 or two thirds of a kilogram of waste per person per day, the bulk of which was contributed by the developing nations¹⁰. The interesting question in the global solid waste scenario¹¹ is not the mere bulk but the toxicity of solid waste, owing to the increased environmental costs associated with it. The important question then is what is the regional distribution of hazardous solid wastes¹² in the world and its future trends.

10 Beede and Bloom (1995).

11 Disposing of waste is a distributive issue as are the creation of waste and the provision of sink function at the global level. (Redclift, 1996, pp-123).

12 In spite of the Basle convention the export of hazardous material from developed to the developing countries continues under the pretext of materials intended for recycling or as foreign aid in the form of recoverable materials (Redclift, 1996 pp-88).

As income has always been piqued as an important factor exerting influence over the quantity of waste (Ravichandran and Poongoodi, 1999¹³), we expect the per capita rate to be highest in high income countries.

Table: 2.2:Per Capita Solid Waste Generation Rates in Select Countries

COUNTRY	GNP per capita (1995 US\$)*	SOLID WASTE PRODUCTION kg/capita/day **
HIGH INCOME GROUP		
Switzerland	40,630	0.66
Japan	39,640	1.47
United States Of America	26,980	2.50
Singapore	26,730	1.10
France	24,990	0.77
Netherlands	24,000	0.71
Canada	19,380	1.64
Italy	19,020	0.56
MIDDLE INCOME GROUP		
Korea	9,700	1.59
Malaysia	3,890	0.81
Thailand	2,740	1.10
Philippines	1,050	0.52
Indonesia	980	0.76
LOW INCOME GROUP		
India	340	0.35
Mynanmar	240	0.45
Vietnam	240	0.55

Source: * World Development Report (1997) ** Hoorenweg (1999)

A cursory view of the per capita rates of solid wastes generated (please see the table 2.2) seems to adhere to that notion. The emergent picture is a reflection of the income inequality that exists across nation states in the world. The table gives per capita solid waste rates of selected countries, with their respective GNP. As we can see the link between income and per capita rates is not a strict one, there are countries which in spite of having a high per capita income generate waste in the middle income country order (for example Switzerland and France). Similarly countries like United States, Thailand, Japan, Korea and Canada fall in the highest per capita generation bracket but are drawn from the high and middle order income groups. Thus solid waste externalisation rates cannot be attributed to income alone, what

13 ...the open question is whether it is population growth per se or income levels /lifestyles causing the menace. For example USA disposes of more than 4,50,000 tons of municipal wastes /day. While Indian cities generate about 3,00,000 tn/day which is 1.5 times lower than US, while in terms of population India is three times bigger than US

governs it is something beyond mere purchasing power of the population. For one it can be the attitude towards consumption or a consensus on a restrictive materials utilisation policy: it remains an open question. The bottom line is that income- rich nations generate a large quantity of waste per capita as compared to the low-income countries. However in terms of bulk developing nations precede the developed as they generate large quantities of waste *in toto*, due to their high population level.

The global solid waste scenario is also highly skewed when viewed in terms of material throughput. It is noted that residents of industrialised world comprise only 20% of the global population, yet they consume 86% of the world's aluminium, 81% of its paper, 80% of iron and steel and 76% of timber (Young and Sachs, 1994). Non-biodegradable proportion dominates the waste from high GNP/developed part of the world¹⁴; the converse applies for developing nations. A study using data from twenty seven countries found a negative and statistically significant correlation between packaging waste and food waste: an additional kilogram of plastic packaging waste was associated with 1.1 fewer kilograms of food waste, and an additional kilogram of paper packaging with 0.7 fewer kilograms of food waste (Beede and Bloom, 1995). To that extent the waste streams are different. The differences in the developed and developing countries is exhibited in the waste stream which is highly skewed in both quantity as well as quality, the materials consumption however being higher in the developed countries. The differences in the waste stream determine the waste disposal options and in this way characteristically set the contours of solid waste economy. We now discuss the term solid waste economy.

II

2.2.1 Solid waste Economy

In the previous section we discussed the magnitude of solid waste problem in a global scenario. In this section we approach the concept of solid waste economy. In an urban area, the activities of generation, actors involved in the management and ultimate utilisation of solid residuals constitutes what we term here as the solid waste economy. Returning to the alternative definition of wastes as unrecognised resources, the focus is on various

¹⁴ In industrial countries packaging contributes about 30% of the weight and 50% of the volume of household waste (Pollock, 1987).

management options for solid wastes, which activate the solid waste economy within an urban area. For the present study --- *an activity performed by an individual or a society which profitably utilises the solid residual of a production or consumption activity generating a product and/or economic benefit which accrue to the individual and the society as a whole*, operationalises the solid waste economy.

Solid waste management constitutes the most obvious fraction of the solid waste economy and it is this that has been at the centre of concern in most studies. In the course of our study too we shall be discussing the various tools of managing solid waste, actors and the related institutions attached with it.

At the outset the agents associated with solid waste economy can be dissected into the formal and informal. We identify these groups owing to the formal endorsement of the agency of action in different contexts. To clarify, we can classify a formal system for countries where reclamation of waste, is a conscious materials policy undertaken by the respective federal government. In other countries this is a dispersed private initiative, or what we term as the informal sector. We can in a loose way also interpret the divide as that between a developed and the developing country. In the former there is a firm legal structure supporting the reclamation programs, in such countries we expect a great deal of environmental consciousness¹⁵ as the programs of resource recovery are publicly funded. On the other hand, in developing countries, citizens with varied backgrounds (mostly disadvantaged) undertake this activity. In the course of this they bridge the resources gap in their countries, generate their livelihood but lack a formal recognition of the same from the Government. As Furdey (1992), points out "...Asian cities have extensive *waste economies*", and thousands of people are earning their living through collecting and selling rags, valuables, paper etc.

Actors in the waste economy

Irrespective of the classification the country belongs to, at a point the economy has the following set of actors who are stakeholders in the solid waste economy.

- ◆ **Government:** It is clear at the outset that the Government is a key player in the solid waste economy. The primary role identified for it is in fostering the reclamation {reuse-recycling} practice, primarily by providing the legal framework for doing so. This

¹⁵ Reclamation processes are not very profitable, the marginal private benefit is lower than the marginal private damage cost.

includes making secondary materials use mandatory¹⁶, encouraging the use of secondary material by levying a higher tax on primary material while subsidising the secondary. Making the society aware of the possible benefits of secondary material use and widening the tax returns for public funding of alternative facilities like incinerators and composting units. The motive for acting in this way is clear when we compare the social costs of primary and secondary material use and the role of the Welfarist State.

- ◆ Industries: They exert an important influence on the solid waste economy by the means of stirring up demand in the system. They utilise the recovered resources, which helps in reducing the cost of production. Solid waste economy relaxes the resource constraint faced by industries. As the minerals become scarce the cost of extracting them rises and thus the marginal costs of production increase. Thus the use of secondary material helps the industries to reduce the total costs. This can also take place in several ways and depends on the scale of operation. If the firm is large and vertically integrated then a closed loop recycling¹⁷ can be practised to the advantage of the concern undertaking it. In countries where informal sector is the mode of solid waste economy operation industries are understood to be the provider of the stimulus for the functioning of the same. In this scenario they also emerge as the prime beneficiaries.
- ◆ Civil society: The role of society is multifaceted, firstly they are producers of residential municipal solid waste in an urban area. In this sense they one of the producers of waste economy, they are also the consumers of the waste economy as a large amount of recycled material gets utilised in the lower income strata of the city. The society plays an important role in the initiation and sustenance of secondary material markets¹⁸. Awareness of society also stands important when it comes to willingness to pay for solid waste management alternatives and compliance to the rules and regulations also depends on factors like education, awareness and culture. Another facet of society is evident when we look at the developing countries where solid waste economies provide a means of

16 US requires its federal government, the world's largest consumer of paper (300,000tn/yr) to purchase only paper containing 20% or more post consumer waste (Young and Sachs, 1994, pp-37).

17 Closed loop recycling is practised in vertically integrated firms usually refers to the practice of the processing of residuals in order to recover and reuse the material in the same production activity (Beukering, 1994 pp-107)

18 In many developing countries the use of secondary materials is not culturally acceptable, in such society's it is rather difficult to establish use of secondary materials.

subsistence for a large number of people constituting the economically disadvantaged groups.

Agents: The agents identified in solid waste economy are the above discussed, actors involved in the formal and informal groups are dealt with, in the section on waste economy agencies where we describe the composition of the sector and its functions. Before approaching the section, we examine the management alternatives available, which as we define initiate the solid waste economy.

2.2.2 Solid waste management

Solid wastes are important to manage as they reinforce the pollution of other environmental media. A proper solid waste management should ideally lead to the social benefits, which are inclusive in the definition of solid waste economy. There is a possible case where a solid waste management program followed in the city might not lead to solid waste economies but if a city has a vibrant solid waste economy then it would necessarily imply that a part of the solid waste management is being done. This is the typical condition of a developing country city. Operationally solid waste management is defined as a planned system of effectively controlling the production, storage, collection, transportation, processing and disposal or utilisation of solid wastes in a sanitary, aesthetically, acceptable and economic manner. It includes all the administration, financial, legal and planning functions as well as the physical aspects of solid waste handling (Gilpin, 1976).

The options available for managing wastes can be largely grouped into

(A) Technical: This option refers to the use of engineering insight in order to upgrade technologies presently employed for treating solid waste. The options available under the above include manufacturing of Refuse Derived Fuel (RDF), Mechanical composting, plastic to fuel conversion (pyrolysis), microbial research into composting and biodegradable packaging plastics etc

(B) Managerial: This is the broadest bracket of available options. It views the institutions and market as the target channels of intervention. Included in this approach are the options of integrated solid waste management, extended product responsibility and incentive schemes (example deposit and refund schemes, bottle bills etc). However there is a world-wide emphasis on the integrated management of solid wastes. This is defined as a system based on

the combination of various methods of disposal aimed at causing the least damage to the environment. It includes all forms of disposal -sanitary landfilling, recycling, reusing, incinerating and composting- with relative proportions varying locationally and temporally to suit the climatic conditions and customised to the nature of waste stream. According to U.S. Environmental protection Agency (EPA) Integrated solid waste management involves the following combination which need to be optimised regarding their applicability to the local waste stream.

- i) Waste Reduction
- ii) Waste to Energy Combustion (Incineration)
- iii) Recycling Reuse and Composting
- iv) Landfilling

Waste reduction (also known, as source reduction) is a strategy, aimed at reducing the amount of materials entering in the waste stream. EPA¹⁹ defines source reduction as the design and manufacture of products and packaging with minimum toxic content and minimum volume of material and longer useful life. The option of incineration, defined as, a process of reducing combustible waste to an inert residue by high temperature burning (WHO), is feasible in the context of a waste stream which has plenty of combustibles²⁰. Recycling and reuse are measures taken to lengthen the life cycle of a product. Recycling not only relaxes the resource constraint but it is environmentally beneficial. However recycling alone cannot solve the solid waste dilemma but it can divert a significant portion of waste stream from disposal in open dumps or landfills.

19 Kreith (1994).

20 This process has been successively used for generating electricity, in the course of which the volume of solid waste is reduced by 50-70% (Hershkowitz, 1986) thus achieving a reduction in landfill space.

Table: 2.3:Environmental benefits of recycling

Environmental Benefit	Aluminium ²¹	Steel	Paper	Glass
Reduction of	in (%)			
Energy use	90-97	47-74	23-74	4-32
Air pollution	95	85	74	20
Water pollution	97	76	35	-
Mining wastes	-	97	-	80
Water Use	-	40	58	50

Source: Adapted from Pollock (1987).

The extent to which materials or energy recovery is practised in an economy at a point of time is a function of the cost of recovered materials *vis-à-vis* the market price of primary materials²². The next option is that of composting, which is defined as the separation of organic wastes and its adequate exposure to microbial process, converting waste into manure while in the process generating methane (if the composting is anaerobic) which can be commercially tapped. Compost contains micronutrients and slows down the process of soil erosion, improves water retention and has been received well in the market²³. Landfilling is the necessary and sufficient option that is most widely practised. In the integrated solid waste approach landfilling mentioned denotes a sanitary landfill (SLF) which is quite costly to construct and maintain. SLF is defined as a method of disposing off refuse on land without creating nuisances or hazards to public safety by utilising the principles of engineering to confine the refuse to the smallest practical volume and to cover it with a layer of earth at the conclusion of each days operation or at such more frequent intervals as may be necessary²⁴.

21 Recycling aluminium requires only 5% as much energy as producing it from bauxite, and each recycled beverage can saves the energy equivalent of half can of gasoline. One ton of remelted aluminium eliminates the needed for four tons of bauxite and 700 kilograms of petroleum coke and pitch, while reducing emissions of air polluting aluminium fluoride by 35 kilograms. By doubling the world-wide aluminium recovery rates over a million tons of air pollutants including toxic fluoride would be eliminated.

22 The costs are in turn affected by the technology of production process, technology of materials and energy recovery the technology of new inputs and various other governmental policies like tariffs, depletion allowances, severance taxes etc (Bower, 1977)

23 In a test of corn plants in Minnesota, fields treated with both compost and fertiliser achieved yield rates higher than fields spread with commercial fertiliser alone (Pollock, 1987, pp-24). In India however, the cultural conditioning of farmers has prevented form making compost a commercial success for example in Madras the municipality had to subsidise the compost for the local farmers.

24 American Society of Civil Engineering (1976).

We now come to the managerial alternatives designed to manage waste. Keeping in line with the main principle of "polluter pays" some successful market based interventions have been the schemes of *pay as you throw* (unit pricing method) and the *deposit refund* in which the consumer pay a surcharge on the packaging while buying the product which is reimbursed once they deposit the packaging after use in authorised centres. At the industrial policy level the market-based interventions are visible in the instrument of Extended product responsibility (EPR). The principle behind EPR is to assign some measure of responsibility of reducing the adverse environmental impact of a product at each stage of its life cycle it passes some fraction of the disposal cost to the producers. We see the example in the Green Dot program endorsed by Germany. Such market based instruments have proven to achieve a socially optimal outcome as they provide incentives which steer the compliance trajectory into a much favourable direction than is seen to be achieved by the command and control instruments. In a developing country context it is difficult for the Market Based Instruments (MBI) to replicate the results of a developed country, much due to the reason that the market setting is not conducive for such a measure. When the issue is global then we need a different kind of institutional intervention. Unlike the management of municipal or hospital waste, hazardous (radioactive and other potentially toxic) wastes stimulate global concern. It is in such a backdrop that the need of a world-wide consensus was felt. Agreements like the Basle ban convention (1995) have nonetheless served to address the problem of Hazardous wastes, its effectiveness, however hinges on the committed compliance by the nations. With the NIMBY (not in my backyard), NIABY (not in anybody's backyard) and NOPE (not on planet earth) syndrome gaining ground all over the world, it is increasingly being realised both by the Government and market forces that there are serious costs associated with the disposal of wastes.

2.2.3 Waste economy agencies

Waste economy as we define it, depends extensively on the options utilised by the society to manage the solid waste, which technically hinge on the solid waste stream, generated in the society. It is the ingenuity displayed by the formal sector in recognising the economical potential of these alternatives of waste management and devising proper policy environment (MBIS or command and control approach, pricing, marketing secondary materials etc) to create the formal solid waste economy. In the developing country context as we shall see, this initiative is taken up by the informal sector.

Formal Solid Waste Economy (FSWE)

As implied in the preceding discussion the level and quality of waste generated in a society is inextricably linked with the level of economic activity (Hoorenweg, 1999). The nature of waste stream and urban setting in developed countries is such that it lends itself to easy handling by capital intensive management and disposal options. Scale factors in operation reduces the average costs with the extension of service. Thus, this acts as an incentive for active participation of the private sector. On the other hand the biodegradable nature of waste, climate and cheap labour; figure out in support of the more labour-intensive approaches of solid waste management for developing countries. Contingent on the waste stream, the disposal options vary, the non-biodegradable portion mainly comprising of paper, plastic and aluminium etc are suitable for recycling and incineration. Denmark and Switzerland recycle 80% of their domestic waste, Japan 70%, UK less than 15 percent. Estimates suggest that about 5% of Japanese, 15% of European and 10% of plastics are recycled while European Union recycles 49% of its glass (Barrow, 1995). The industrialised countries have a comparative advantage in generating electricity or recycling wastes, such options are non-economical for the developing nations.

Developing countries due to a strong primary sector base and low levels of income have an overwhelming proportion of biodegradable materials in their waste stream which makes composting and sanitary landfilling as the most practical full cost measures of solid waste disposal. The management infrastructure in these countries is rudimentary and primarily labour intensive. Much to contribute to the disinterest of the private sector are bottle necks associated with collection, a low willingness to pay by the residential sector and an absence of market for recycling products. A lot depends on the materials policy followed in these countries, which subsidises the primary material production²⁵. The failure of managerial system is evident, as developing countries are not successful in creating a market for compost, a primary input for the farming sector, owing to the absence of a facilitating policy environment.

In the developing countries the factors of inefficiency in solid waste management reinforce each other. For example a low capacity overstuffed transport vehicle litters the waste along the route it takes to the disposal ground, thereby increasing the collection costs associated

²⁵ For developing countries which are rich in mineral reserves subsidised extraction and export of minerals is seen the assured way of earning the much needed foreign exchange. (Ouano,1993)

with that route. Developing countries display low collection averages, irregular coverage, crude open dumping and burning without air or water pollution control²⁶, municipal solid waste is often disposed off with ash, human waste --where sewage systems do not reach substantial portions of population--medical waste and industrial waste. For this reason, municipal solid waste in developing countries is sometimes more harmful to human and ecological health than it is in the industrial countries (Beede and Bloom, 1995). A technical constraint in developing country is the lack of overall plans for solid waste management at the local and national levels (Ogawa, 1998). Corrective measure taken are often limited to improvisation in collection and transportation, such a compartmentalised approach to upgrade the services is ineffective. In the absence of research and development there is a strong likelihood that the option of treatment/disposal is not suited to the climatic conditions, financial and human resource capabilities and social and cultural acceptability of the nation.

As a low priority is given to the sector the institutional capacity of local Government agencies involved in solid waste management is generally weak. Particularly in small towns and cities, where local ordinances /by-laws on solid waste management are not well developed, the incentive to economise the operation is either non-existent or difficult to sustain (Ogawa, 1998, Kala and Khan, 1997). Added to that the responsibility of managing the solid wastes is often fragmented between various governmental departments for large cities. A lack of co-ordination in their efforts is a major cause of the inefficient public service administered. Another reason is the lack of funds, as the taxation system is inadequately developed therefore the financial basis of public services is weak. It is found out that local level Government's exhaust 90% of the allocated budget in the first quarter of the year (De souza, 1991, Hoorenweg, 1998). The costs associated with collection and transportation is 90% of the allocated budget, but only 50-70% of the waste generated is collected and less than 50% of population is served (Cointreau, 1991; Schertenleib and Meyer, 1992). The disposal of collected solid waste is also not done in an environmentally sound manner. Following is a summary of disposal practices followed in some selected countries in Asia, notice the largest proportion of open dumping practised in all the countries²⁷.

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26 Controlled sanitary disposal requires more space, higher financial commitments and organisation than uncontrolled dumping and therefore is not widely applied (Schellas, 1982).

27 Exceptions Japan and Singapore, which can be attributed to (a) income differential and (b) lack of space in these two countries. It is clearly visible, as the alternative chosen by them is incineration, which is, known to reduce the volume of waste to be landfilled by 50 to 70%.

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Table: 2.4: Disposal Methods for Municipal Solid Waste in Selected Asian Countries

Country/ Territory	Disposal Method (%)			
	Land Disposal	Incineration	Composting	Others
Bangladesh	95	-	-	5
Hong Kong	92	8	-	-
India	70	-	20	10
Indonesia	80	5	10	5
Japan	22	74	0.1	3.9
Republic of Korea	90	-	-	10
Malaysia	70	5	10	15
Philippines	85	-	10	5
Singapore	35	65	-	-
Sri Lanka	90	-	-	10
Thailand	80	5	10	5

Source: Adapted from Einsedel (1999).

The functioning of the formal solid waste economy constituted by the formal sector of waste management is constrained in developing countries. The reasons for such have been briefly commented upon in the earlier sub section. As the emphasis is on the developing countries we further our discussion by documenting the informal solid waste economy, a characteristic feature of developing countries.

The Informal Solid Waste Economy (INSWE)

Another feature of the developing nations, is the presence of a large recycling sector. We term it as the informal solid waste sector, due to its unmonitored markets and ease of entry. Furdey (1992) defines them "as waste economies, which are structured through itinerant waste buyers, waste pickers, small waste shops, second hand markets, dealers, transporters and a range of recycling industries". There is a variety in organisational structures and relationships, and it is clear that there exists a hierarchy in the informal networks within which different groups have differential access to various types of wastes (Cointreau, 1987 and Baud and Schenk, 1994).

The actors of the sector are identified as

The collectors {waste pickers and itinerant buyers}: they form the first link in the chain of actors. Waste pickers collect valuables from solid waste that is littered on public spaces for example from streets, dumps, and commercial zones and sell it to the traders. In this process

they make a living. The role of the waste pickers is not given its due importance and is socially looked down upon, however their role can be summarised as

1.They absorb part of the otherwise state covered social costs of modernization through self-employment in the urban informal sector.

2.They shoulder a part of the economic costs of development through collecting and processing wastes which otherwise the state would have to pay for in terms of waste transport and disposal.

3.They contribute highly to the formal sector as they provide raw material from recycled waste at comparatively low prices²⁸.

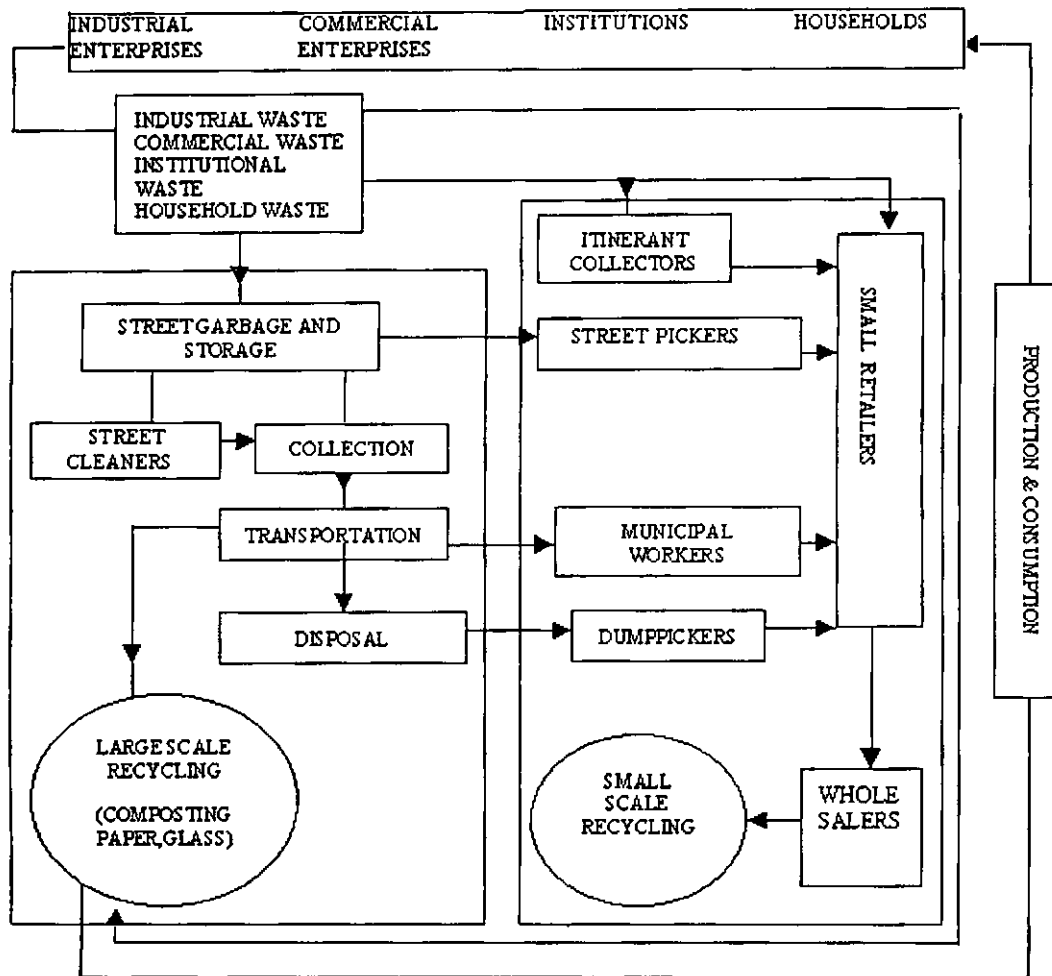
The other category is that of itinerant buyers who buy waste from institutions as well as residential sector and sell it to the retailers. The two classes of actors comprising this group are differentiated not only in terms of mode of procurement but also on the basis of the quantity and quality of waste, collected.

The traders {Retailers and Wholesalers}: also called the middlemen (Bhattacharya and Kundu, 1998), they act as suppliers to the waste recycling units. Usually the group of trader comprises of retailers and wholesalers, depending on the amount of material aggregation and the range of supply. This group stands the chance of making huge margin of profits as they benefit from both sides of the exchange.

Recycling units: these are processing units, which exert the demand in the activity sector. They utilize secondary materials to manufacture either finished goods or intermediate goods. Wholesalers pass on the waste material to them.

Diagram 1 graphically represents the working of the sector and the inter linkages between the formal and the informal sector. It comprises of the sources shown in the form of household, institutional and industrial sectors and traces the formal and informal waste economy routes.

Diagram 1
INTERLINKAGES BETWEEN FORMAL AND INFORMAL RECOVERY OF SOLID WASTE



Source: Baud & Schenk, 1994

2.2.4 Formal informal linkages in waste management

The presence of informal sector is replete in almost all the developing nations. In some countries having recognised the potential of this sector, the formal sector utilises their services in the upkeep of the city. For example in Bandung, Indonesia city officials are working with a local Non Governmental Organisation (NGO) employing a group of scavenger families.²⁹ A Company in Mali called GIE BESEYA turns municipal solid waste into compost with the participation of local scavengers. In Manila the women "Balikatan" (shoulder to shoulder), movement has capitalised on a similar network of scavengers, in conjunction with the junk dealers both to improve the recovery of solid waste and to, promote

²⁹ International Council for Local Environment Initiative (1991).

community development. Metro manila has a program called Linnis Ganda or "clean and beautiful". The baseline thought of which is that although secondary materials industries have imperfections both economic and environmental, but they have the potential to create new jobs and as seen they have established an ability to sustain themselves, even in widely fluctuating markets and damaged environments (Young and Sachs, 1994)

A still more decentralised process is used in Cairo by the *zabbaleen* (they are the traditional waste collectors), a group which survives by collecting garbage from wealthy neighbourhoods charging certain fee to the household owners. They use waste as feed for pigs, which are raised, in enclosed courtyards throughout the city. The *zabbaleen* provide manure and other organics to a local composting facility, as the manure is partially decomposed, composting time is greatly reduced to a week or two, the resulting compost is consumed by farmers within a 100-150 kilometre radii of Cairo, who pay for it's delivery. It is reported that *zabbaleen* are very efficient, some have been aided in their work by the provision of tractors to pull collecting carts, they recycle almost, 80% of the household waste generated (Gardner, 1997;Barrow, 1995).

People's Republic of China has considerable experience in waste recovery and recycling, in Beijing roughly 13,000 people find employment in such activities (Barrow, 1995). In Santos, Brazil, on calculating that the scavengers were collecting about 1,200 tons of recyclables per month as compared with city's 200, authorities began to pay scavengers to collect recyclable, the scavengers also share in the profits from sale of the materials. In Dakar, Senegal officials have divided the city into collection zones with sub-sector and invite companies to bid for contracts to collect waste from a maximum of three zones, companies are directed to subcontract in each sector with community groups that collect garbage from inaccessible areas and educate the neighbours. The new system costs less, covers 80% of the city and provides 1,000 new jobs (State of the World, 1999). These examples from different parts of the world indicate the mutual benefits extended to formal and informal sector by merging operations. The approach is well articulated by Young and Sachs who say that "*as a policy approach, instead of incurring costs both in financial and ecological terms for commodities to be extracted, refined, fabricated and transported from afar, cities should reclaim and reprocess materials locally, salvaging some of the value that has already been added to them,*

in the process of which they would be creating jobs for local people, in fields ranging from aluminium processing to market research for secondary materials”³⁰

Sum up

The chapter is a tool of familiarisation with the issue. In relation to this we list the varied ways in which solid waste has been defined and note the ambiguity regarding them. Subsequently we view the global solid waste scenario and the differences in waste streams. Further to this we introduce the concept of solid waste economy, and detail about the agents, agencies and their functioning. It is in this context that we distinguish between the formal and informal solid waste sector. We conclude the chapter with the documenting the informal and formal linkages in waste management evident in the developing world.

In the next chapter we shall look at the process of urbanisation and the rationale of focussing on the issue of solid waste. We discuss the urbanisation experienced by India and the related environmental problems suffered by the same, particularly in the Indian context.

30 Young and Sachs (1994, pp-48).

III

URBANISATION AND SOLID WASTE

Introduction

In the context of urbanisation¹ the subject of resources generates a different meaning as it relates not only to resources exhaustion or depletion but also equally to its underuse, overuse and misuse². Similarly the issue of solid waste generation and management has to be viewed in relation to the urbanisation process. The problem of solid waste requires an understanding in the canvas of larger environmental change that takes place during urbanisation. The present chapter is an attempt in the following direction. The chapter is arranged in four sections. Section one is a contextualisation of the issue in urban space, in this section we also review the urban growth of India. Following which in section two we explore the link of environmental change with the advent and evolution of urbanisation, with special reference to India. Third section portrays the Indian solid waste scenario, and a survey of the formal informal institutions attached with the management of such. We conclude the chapter in the fourth section with the need for the study and the analytical framework in which the problem is posed.

I

3.1.1 The spatial contours of economic growth

By its very nature economic growth poses a challenge to the environment's capacity to provide sufficient resources and absorb wastes without serious degradation³. Since cities are

1 There is considerable amount of ambiguity regarding the exact definition of an urban area. It is an extremely heterogeneous and dynamic entity, constantly mutating under the influence of the general social and economic forces therefore has been defined in different ways by the numerous streams of knowledge. For the purposes of our study however we shall be referring to the standard definition, as articulated in the Census of India, 1991 according to which an urban area is one with a local administrative body like a municipality, corporation, cantonment board or notified town area etc. and a place which satisfies the following criteria

- ◆ A minimum population of 5,000.
- ◆ 75% of the male working population of the area engaged in non-agricultural pursuits.
- ◆ Density of population is at least 400 per sq. km or 1000 per sq. mile

2 Mathur (1994)

3 World Resources Institute (2000)

an important creation and channel of economic progress achieved by mankind⁴, it is important to know about the process of urbanisation when dealing with an urban problem. More importantly from a planning and management angle of urban service provision it is important to note the structure of cities. Since solid waste management service is classified as a dispersed congestable local public good (Hochmann, 1977; Fujita, 1989), it is important to plan interventions which would suit the spatial structure of the city and the settlement within it.

In the developing country context due to their colonial past the structure of the cities differs widely from what we see in the developed countries⁵. The management of waste, too is carried out differently in the two categories owing to the differences in the waste stream, and the technology used for its disposal. In the developing countries solid waste management as a provided basic service is differentially consumed by the society⁶. Added to that there are several inefficiencies in the way the formal system (responsible for providing the service) functions. Often solutions are visualised in terms of utilising the developed country options, usually in terms of the fixed capital in the collection as well as the disposal options. The use of developed country solid waste management hardware⁷ in the developing country context proves a failure, firstly due to the difference in the composition of waste stream and largely due to the spatial incompatibility⁸. In essence the reason why solid waste becomes an issue in the urban context is two folds firstly because of lack of space to treat the waste⁹ and due to the increasing toxicity of materials in the waste stream. In this context too the siting of waste disposal sites also require a spatial approach to the issue. In order to know the gravity of solid waste situation we need to relate it with the phenomenon of urbanisation in the country. As

4 According to the World development report (1999/2000), urbanisation and economic growth are trends that show parallel movement.

5 It is widely reported that urbanisation and structure of cities in post colonial states is different from that of the developed country nations, for a discussion on this see (Qadeer, 1989 pp-14-39).

6 Coexisting with the planned, serviced portion of the city, economically integrated but totally segregated in infrastructural and social terms are the vast unplanned non-city of the poor. This duality between the planned city and the unplanned city is universal throughout urban India (Buch, 1993).

7 Hardware includes equipment and processes for on site storage, collection, haulage processing or disposal of solid waste. (Ogawa, 1998).

8 The machines used to haul waste are too large to reach the small alleys of the developing country city.

9 Of late this has become even more difficult due to the rising environmental consciousness of the society which is averse to the location of waste treatment facility in their neighbourhood (what we know as the NIMBY syndrome).

we know regional economy shapes up the structure of the city, which has implications for management of the urban environment.

3.1.2 State of India's Urbanisation.

The rate of urbanisation although steady in India is still low compared to the world average. In comparison with other developing countries India is still ruralised with three-quarters of its population living in rural areas and two thirds of its workforce engaged in agriculture. The urbanisation trend in India reveals that there has been a steady growth in the percentage urban population of the country beginning from the Census year 1901. Before Independence 14% of the population was urbanised, the fraction has in the recent census increased to about one fourths of the population. The annual rate of gain in percentage urban population has been steadily increasing, the decennial growth rate plummeted in the decade of 1951 at 41.42% and again in 1981 with 46.14%. The trend in urbanisation is associated with the change in the structure of the economy as is shown by the share of manufacturing and services sector which is continuously increasing. The recent National Sample Survey (NSS) 55th round shows that for the first time in the country the percentage of workforce participating in agriculture has declined below 60% (Sundaram, 2001). Urban areas contributed 29% of GDP in 1951, in 1981 their share had increased to 43% and was estimated to be about 47% in the 1991 census.

There is but an imbalance in the pattern of economic development and urbanisation in India at the regional level as well as in relation to the high concentration of urban population in a few large cities. It is seen that the most developed and industrialised states have high levels of urbanisation and are now experiencing slower urban growth rates, while the less developed industrialised states are now rapidly urbanising.

Table: 3.1: India: Growth of Urbanisation

Decade	Class 1		Class 2		Class 3		Class 4		Class 5		Class 6	
	No. of towns	% population	No. of towns	% population	No. of towns	% population	No. of towns	% population	No. of towns	% population	No. of towns	% population
1951	76	44.3	91	9.96	327	15.72	608	13.63	1124	12.97	569	3.09
1961	102	51.42	129	11.23	437	16.94	719	12.77	711	6.87	172	0.77
1971	148	57.24	173	10.92	558	16.01	827	10.94	623	4.45	147	0.44
1981	216	60.42	270	11.63	738	14.33	1053	9.54	739	3.58	229	0.50
1991	296	65.2	341	10.95	927	13.19	1135	7.77	725	2.6	185	0.29

Source: Anon1991, provisional population tables: rural urban distribution, series 1, paper-2 of 1991, Census of India, Ministry of home affairs, Government of India, New Delhi, pp30-32: cited from State of India's Environment: the 5'th citizens report, Statistical Database, CSE New Delhi.

Table 3.1 reveals that over the decade there has been a steady growth in the number of towns. The imbalance is visible when we notice that there is a steady increase of population percentage in class one towns over the decades as compared to other class towns. As Misra, Ramanathan and Rajan (1999) argue "The situation in India is unilateral in the sense that large urban settlements are growing faster over the years and there is least addition of new-born urban settlements". Distribution of urban population over different size towns shows that the concentration of urban population in bigger size towns is thriving faster over time at the cost of smaller towns. Size 1 towns have shown an increase from 44 in 1951 to 65.2% in 1991, while other size towns have lost their share. The amount of population shifting from the existing urban settlements of any class to its immediate higher class is faster compared to new additions of lower class size urban settlements. There have been no new additions to the number of urban settlements that would accommodate the growing urban population¹⁰. Such an abnormal growth with improper distribution of urban population poses a threat to urban living conditions. Overcrowding in cities tends to disturb the resource equilibrium of the cities. The following section is an update of the environmental status of urban cities in India.

¹⁰ For a further discussion concerning urbanisation in India see (Mathur, 1994).

3.2.3 India: State of the Environment

India is the second largest country after China, of which 26% is urbanised in 1991. It is expected that by the end of 2020, India will have 47% of its total population urbanised¹¹. Concentration of population in an area leads to stress on the ecosystem, which results in a malfunction in the longer term. Environment constitutes the neglected component of investment in India, the services¹² of which are not acknowledged by the planners. The state of urban environment in India is a consequence of the industrialisation policy adopted for urban growth and a lack of conscious urban planning and its implementation. Indian cities are not adequately equipped to handle the problem of rapid growth in Industrial land use, and a lopsided mix of industrial¹³ activity results in a capricious urban pollution scenario. The reasons can be debated upon but what we see on the urban landscape of India today, is crisis.

It is worth noticing that two fifths of the urban population is below poverty line and in what seems to be the trend, the urban poverty over the last three decades has risen compared to rural poverty. The situation is made worse by the lack of basic services in urban areas. According to a survey by National Institute of Urban Affairs 44% of the sample urban households had access to treated water supply, while only one fifth had the wastewater collected and treated. The above information points at the sectors of environment that get affected as a consequence of the inefficient living standards in the urban areas of the developing countries.

Cities are also facing a severe problem of air pollution owing to the rampant increase in the vehicular population and insufficiency of the public transport system. An absence of awareness and monitoring about the environmental degradation, industrialisation can cause has led to the uninhibited release of industrial effluents and municipal sewage in the major rivers of India. As a result the major rivers in India today are reduced to streams of bacteria

11 World Urbanisation Prospects 1990 (UN, 1991).

12 The ability of the environment to dissimilate waste has the property of a capital good. Man can influence this property negatively by the amount of wastes and its constituents, and positively by investments in environment (Faber, Niemes and Stephan, 1987).

13 Industrialisation is synonymously used with urbanisation, as the former results in population concentration, one of the prime characteristics defining the latter.

and harmful chemicals, supporting little biological life. Attempts of mitigating urban damage has been met with apathy of the urban population and although there are laws to regulate water and air pollution recently joined by the hazardous waste management law, there is a serious want of better enforcement to effectively control the pollution in these fronts¹⁴. The section briefly sketches the urban environmental crisis that India is facing. There is a neglect of both the hydrosphere as well as atmosphere. In the continuing trend of overcrowding, the cities have deteriorated considerably in terms of the quality of life they foster. Solid waste problem also impacts the deterioration of urban living environment, an aspect that we discuss next.

III

3.3.1 The problem of solid waste in India

In India the per capita quantity of solid waste ranges from 0.35-0.65 kgs/day. Waste stream has a large proportion of compostables¹⁵. Over fifty years the per capita rate of solid waste generation has more than doubled as shown by the following table 3.2, with the population increasing more than four times. The problem of solid waste has magnified due to the increasing population over these years. The following table summarises the basic variables related with solid waste management for India.

Table: 3.2 : Solid Waste Figures over Fifty Years in India¹⁶

PARTICULARS	1947	1997
Urban population (millions)	56.9	247
Daily/capita waste generation (gms)	295	490
Total waste generated(million tons)	6	48
Area under landfills	0.12	20.2
Annual methane emissions(Tnns) from landfills	0.87	7.1

Source: Management of municipal solid waste, *Central Pollution Control Board; Ministry of Environment & Forests (2000)*.

14 For a more comprehensive discussion see (State of India's Environment: The Fifth Citizen's report , 2000)

15 Decomposable organic matter is the highest component of municipal solid waste and constitutes nearly 70-80 % of it (Kala and Khan, 1994 pp-18).

16 The data used in context of India from the above source is subject to inconsistencies. For a discussion on data see Hoornweg 1999).

As pointed earlier there is an excess of compostables in solid waste. The putrescible nature, combined with tropical climatic conditions makes necessary that solid waste be removed as soon as possible from the place of its generation as well as accumulation. Thus, solid waste services in India need to be frequent and efficient. For a developing country urban area it is seen that even though the municipal authorities spend almost 70 to 90% of the budget on collection, the municipal service picks up only 50-70%¹⁷ of the refuse and serves less than 50% of the population¹⁸. The reason prima facie appears to be resource constraint; the following table 3.3 presents the solid waste management situation in the cities of class one and two sizes in the country. It also furnishes data on the mode of collection, which is visibly skewed showing that half of the waste in class one and more than 75% of total waste externalised in class two cities is manually handled.

Table: 3.3: Summary of solid waste variables for class one and two cities of India.

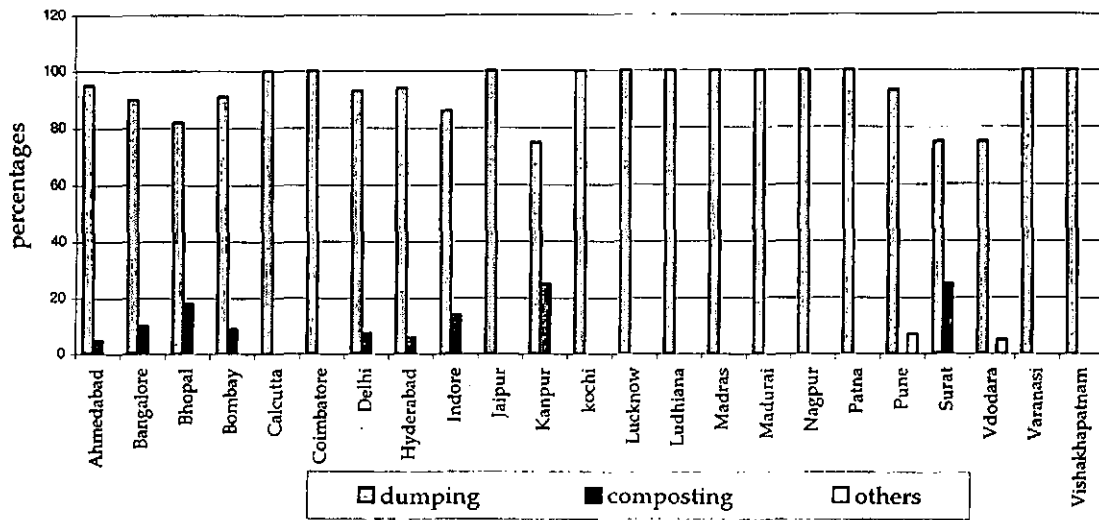
Cities	Class1	Class2
Number of cities	299	345
Total Population	1281138655	22375588
Waste Generation(MT/d)	48134	1454
Mode of Collection(%)		
Manually	50	78
Trucks	49	21
Others	1	1
Disposal(%)		
Dumping	94	93
Composting	5	6
Others	1	1

Source: Status of Municipal solid waste generation, collection, treatment, and disposal. Central pollution control board, April (2000).

17 On an average 83% of waste generated in metropolitan and 59% of waste generated in class -I and class-II towns is collected. (Kala and Khan, 1994)

18 Schertenleib and Meyer (1992, pp-55).

Graph 3.1-Disposal options in twenty three metropolitan cities of India



It is also shown that more than 90% of the waste is dumped in both classes of cities. The graph 3.1 gives a picture of the method of disposal in the twenty three metropolitan cities of the nation which shows that even in cities with a million plus population the popular way of disposing waste is via, open dumping. This method of disposal has implications for environmental and health conditions offered by the city. As earlier mentioned, solid waste has adverse impact on the aesthetics of the city, which impedes its future growth¹⁹.

The table below summarises the differences in the nature of waste stream generated in Indian cities according to the population size. It is a manifestation of urbanisation phenomenon on nature of waste.

¹⁹ Poor visual appearance of these cities will have a negative impact on official and tourist visits and foreign investments (Ogawa,1998).

Table: 3.4: Physical and Chemical Characteristics of Refuse from Indian Cities

CHARACTERISTIC(IN %)	POPULATION IN LAKHS			
	2	2-5	5-20	20
Ash & Fine Earth	46.60	39.97	41.81	31.74
Carbon	12.56	12.51	11.95	15.32
Glass	0.29	0.34	0.44	0.76
Metals	0.51	0.39	0.64	1.03
Nitrogen	0.60	0.61	0.50	0.58
Paper	3.09	4.76	3.8	7.07
Phosphorus	0.70	0.71	0.67	0.59
Plastics	0.57	0.59	0.81	0.86
Pottasium	0.70	0.73	0.72	0.70
Total Compostable Matter	33.41	39.76	40.15	41.69

Source: Adapted from Dayal (1994)

Notable are the percentage content of carbon and total compostable matter increasing with the city size, showing the putrescible nature of the waste feature of waste in developing countries. The fraction of plastics is seen to increase, with the increase in the level of population (high use of plastics in big cities). Increasing alongside rather sharply are the respective proportions of paper, metal and glass. The content of ash in the waste also registers a dip as we move from small city to a big city, indicating the type of fuel used which shifts from biomass base to a fossil fuel base. As the city increases in size the waste stream shows a proportional increase in the non-biodegradable proportion. The settlement pattern of cities and nature of waste generated make the collection and transportation difficult. At the same time disposal is necessary due to climatic conditions, which cause a rapid degradation of waste. As the population trends indicate a further addition of population, in the already overcrowded Indian cities, urban environmental problems especially that of solid waste treatment and disposal calls for immediate attention. The provision of clean environment is directed constitutionally to the municipalities as articulated in the 74th amendment to the constitution. This amendment also gives a considerable degree of autonomy to the local level government to design and

implement measures for the provision of basic services which include sanitation and garbage removal.

3.3.2 Solid waste Management: The formal set-up

In India, the responsibility of solid waste management service is delegated to the Medical Officer in small and medium sized cities. In large sized city Engineers (Baud and Schenk, 1994) manage the task. Role of Ministry of Urban development, Government of India is largely limited to advising the local urban bodies, supporting research and development, and providing technical assistance to the states and urban local bodies. There is no law or procedure specified for solid waste management and disposal, except otherwise stating that waste will be removed and processed by the local body, the local body will identify places for treatment and final disposal. Local administrative bodies, which are already overburdened with other priorities like the provision of civic amenities (health, education, clean drinking water etc.) tend to put waste disposal at the lowest in the priority list (Kala and Khan, 1994).

Added to that is an inclination to adopt developed country solutions, which often fail to work in developing country situations. The costs incurred in collection takes up 80-90% of municipal solid waste management budget for low income countries, middle income countries spend almost 50-80% of their budget on collection (Cointreau,1994; Hoornweg, 1999). The costs of disposal in the menu of alternative disposal methods given by Cointreau (1999) indicate that open dumping of waste is the most favoured disposal option due to its low cost. The formal set up has no incentive to dispose the waste in an environmentally benign way, unless directed and enforced by the law. Indiscriminate dumping emerges as the most cost effective method in the short run, which, as scientifically known is the most dangerous and polluting way to dispose waste. Service provision by the formal set-up is constrained not only by a narrow resource base, but also by differences in the nature of wastes, structure of the city and compliance of the society to articulated byelaws with regard to littering. Now coming to the other institution providing solid waste management via recycling and reuse, we discuss the informal solid waste sector.

3.3.3 The formally informal

It is reported that the informal sector is sizeable and the estimated number of waste pickers in the country is around a million²⁰ (Kalra, 1994). The important role this sector plays in reducing the load on the landfills, in the use of secondary materials and creating jobs for the urban poor is undeniable. In Pune the waste pickers are estimated to be handling almost 225 tonnes of waste generated in the city prior to its transportation thereby saving the municipal Corporations of Pune and Pimpri Chinchwad, the sum of Rs.60, 000 per day (Chikarmane, 2000). Usually agents active in this sector are people who come to the city in search of employment, unable to do so or to supplement their incomes (Bierbeck, 1978, Kundu and Bhattacharya, 1998) they resort to waste picking. As littering is a cultural malpractice abundant in our country, there is ample scope of this activity. A survey undertaken by Centre for Science and Environment in the 5th citizens report, found that 68% of waste by households was discarded in public spaces by the respondents (rest of the 23,263 households dispose 22% in a depot and 5% to the sweeper).

Studies have pointed out the excess of women and children in the waste picking activity (Chikarmane, 2000; Dhanalakshmi and Iyer, 1999; Nodal research centre, 1996; Baud and Schenk, 1994). In context of India as there is no recognition of the sector and its activity by the local, state or national Government there is a marked overlap of legality in activities of the agents.

Informal Sector morphology²¹

The lowest rung of this sector is formed by the ragpickers. Working in the most hazardous conditions, daily they cover an average distance of 15-20 kms and earn around 30-35 rupees (Chikarmane, 2000; Iyer and Dhanalakshmi, 1999, Expert committee of Supreme court on solid waste management of class one cities in India, 1999; Baud and Schenk, 1994; Aziz, 1984). Entry in this tier is easy²² as there is no initial investment.

20 In Delhi alone a study estimated the number of ragpickers to be 80,000 (Kansal *et al*, 1998).

21 Discussed in detail earlier in second chapter.

22 Studies have pointed out that, recently this sector has developed competition and entry is no longer easy, this has aggravated the practice of territoriality among the rag pickers (Iyer and Dhanalakshmi, 1999; Chikarmane, 2000).

Another category of people engaged in collecting wastes are known as itinerant buyers. This group is followed up by the group of traders, which can be split into small, medium and wholesalers depending on the scale of activity. Wholesalers are nodes which deal with only specialised waste, and further add to the value of the material by modifying it through a technical process i.e. either it is compressed, further segregated or pellitised (as in the case of plastics). Heading the hierarchy are the recyclers who convert the material into a marketable and usable form. Another category of actors involved are reusers.

The informal sector transcends the bounds of poverty in the upper rungs: recycling factory owners and wholesalers are economically secure and realise a profit margin of about 15-30 percent. Wholesalers fall in the high income tax payee bracket and are found to have annual audits (Baud and Schenk, 1994). The above structural description is not strictly followed everywhere, and as earlier mentioned is determined by differential access of actors to waste. The level of stratification among actors depends on the size of the waste and the working pattern also records a change with the degree of assimilation of waste. Traders and wholesalers are found to employ workers at a regular or a daily wage basis, in addition to them the other set of agents who find employment are the ones responsible for the transport of scrap from one level to the next up. This informal sector is unique in the sense that there is a gradient of activity classification from informal to formal (bottom up). Even though all the agents are a part of the large industry, there is massive heterogeneity in terms of their social acceptance. Informal sector comes through as an interesting parallel to the efforts of the formal sector. Its hierarchical stratification and operation are features, which have attracted studies and that, is why they have been a subject of much speculation in the studies on waste management issues.

Studies undertaken earlier in the domain of informal handling of wastes have focussed on the various aspects of the sector, the pioneering work was done by Aziz (1984) in India. A large number of his findings are replicated in the consecutive studies on other metropolitan cities of India (Baud and Schenk, 1994; Joseph, 1994; Nodal Research Centre, 1996; Iyer and Dhanalakshmi, 1999). There are few points with regard to earlier studies, which need mention. Firstly it is found that they have focussed on agents in isolation (often taking the central position are the waste pickers who due to the nature of vocation have been in the

forefront of social concern). Secondly provision of public service has been the core issue for the researchers, while some view informal system as a wasteful activity.

The conclusions of these studies summarise the current state of solid waste services in Indian cities. These studies report that formal system of waste collection and disposal has increasingly failed to cope with the rising amount of waste. Extreme poverty prevalent in large sections of urban communities and the relative high value of recyclable materials, are the two basic conditions under which majority of informal sector agents survive; their large numbers adversely influence their per capita income. A limited number of buyers, wholesalers, and entrepreneurs of recycling enterprises in the complex chain of actors in the recycling business control market prices. Absolute profits are considerable resulting from the oligopolistic position of the buyers. Recent changes in international trade are expected to have an influence local recycling trade. There is a slow and steady invasion of Asia by the industrialised countries who are dumping their waste under the guise of recycling, "social rights" of those who depend on waste picking for their livelihood is under threat due to this indiscriminate dumping.

IV

3.4.1 Need for the study

Although the studies in this issue have been comprehensive in their approach, following gaps were noticed.

1. A majority of the studies focus on a metropolitan city, which forms a category of class 1 cities housing only 32.5% of the urban population (1991 census) while the rest of the 300 towns and urban agglomerations are left uninvestigated.
2. None of the studies bring the nature of urbanisation in picture and how that affects the functioning of the waste economy. We try to fill this gap by analysing the vulnerability of the waste stream to the factors of influence originating in the process of urbanisation and economic transformation.

3.They lack a clear articulation of the desirability of a joint solid waste service provision by the informal and formal sector. The joint provision could impact the INSWE and its agents. In the present study we discuss this issue with the help of a case study.

There is enough evidence in the literature to prove that waste economy is flourishing in the large cities of India. One imagines, what is the state of affairs in a non-metro, class I size city? What are the management measures the formal system has taken up? Is there an informal sector thriving in these cities too?. If yes then, is there a similarity in the working patterns or are they fundamentally different? Are there any backward linkages of the industries in the metrocities with the towns and cities in the hinterland?²³ In essence what is the zone of influence of the mega city solid waste economies²⁴. These are some questions that this study hopes to address.

3.4.2 Framework

The studies pursued in this field have viewed the issue of solid waste management with a public goods framework, as garbage disposal has classically been an urban planning problem (Baud and Schenk, 1994). It is termed as a dispersed local public good²⁵ (Fujita, 1989; Hochmann, 1977). One can identify that the issue cuts across the domains of public goods (Cointreau, 1982), urban economics (Fujita, 1989) and environmental economics. As the issue chosen relates to the notion of urban sustainability we look at the public goods angle. Theoretically conditions, under which public provision of services is considered essential, are (a) where natural monopolies exist, (b) where increased production is associated with decreasing costs, (c) where substantial externalities exist and which do not get reflected in the account of private suppliers. (d) where it is difficult to charge for a service or to exclude those who do not pay (e) where merit goods are involved²⁶. According to the above garbage disposal qualifies to be publicly provided. Recent studies on the institutional arrangements for the provision of services show that the urban services market is neither public run, nor formal,

23 An issue mentioned in Chikarmane (2000).

24 Zone of influence: of a particular activity, the zone is usually found to be stretching beyond the physical bounds of the city (Kasarda and Berry, 1977).

25 Local public good is defined as a public good available only to users located in a specific location. Dispersed local public good is one which is distributed throughout the residential ring (Hochmann, 1977).

26 In its micro social interpretation solid waste management is viewed as a merit good that should be freely available to all (Bloure and Fuanan, 1994).

nor even homogeneous rather it constitutes a complex mix of differentiated arrangements in which, together with public institutions some private sector institutions are also engaged (Gouri, 1992).

We delineate the focus of present study in the common core of these viewpoints and explore the available alternatives. The approach in present study is, eclectic and one can trace strands of ideas related to the strict frames of public goods, environmental and ecological economics along with economic geography. The divergence attempted here with respect to earlier studies is treatment of the problem in terms of its origin and its relation with urbanisation while taking stock of the INSWE agents and their contribution to the local economy.

Proposed frame of the study

As a fallout of post Independence growth strategy of industrialisation, cities became the focal point of all dynamic activities and attracted people in large numbers. Social aspects of rapid urbanisation, which included problems, like squatter settlements and large-scale poverty and unemployment were seen as temporary pressures, which would pass with time²⁷. However it is becoming increasingly evident that the local governments in third world cities have not been able to provide their citizens with proper housing, sanitation or basic services²⁸ like health and education. This rising disenchantment with the Government role requires a complete rethinking of its mode of governance (Mehta, 1999). It is in this context that the participatory mode of Governance assumes importance.

Participatory form of urban governance can be best described as governance involving the co-operation and collaboration of all the stakeholders to manage the urban society. Over the years the need for and understanding of the concept of participation, has undergone various changes owing to the broad areas now featuring in the concern arena for example environmental and gender issues. There is an increased awareness of the alternative development strategies²⁹ in governance, with an instrumental role for the third sector;

27 Moser (1978, pp-1042).

28 In developing countries only 44% population has access to sanitation of which 78% are urban and 25% rural.

29 Alternative development: In this view the people centred development must remain authentic by focussing only on the community or the people and completely negating avoiding the state and political action. However this view was widened when focus areas like women and environment were included. The role of the state is seen form the evolving mechanisms to empower the excluded majority.

basically the non-government organisations and community based organisations. This is facilitated by the state, which now has a role of evolving necessary structures and procedures for partnerships among the stakeholders. One of the concerns under the paradigm of alternative development is that of urban environment. For which an alternative development approach was advocated by the International community as reflected in the Agenda 21³⁰. Adopted in the Earth summit Agenda 21 recognises the role of the indigenous groups also called "informal sector" in the delivery of such. It suggests a joint working of the formal and informal sector for capacity building under the focus area³¹ of maximising environmentally sound waste reuse and recycling. To quote:

Enabling local and municipal authorities to mobilize community support for waste reuse and recycling by involving and assisting informal sector waste reuse and recycling operations and undertaking waste management planning that incorporates resource recovery practice.

In order to understand the governance form proposed and further channels the devolution of organisational hierarchy in service provision, we need to understand the nature of the informal sector and how it works. An association of the formal with the informal without prior knowledge of the dynamics of the latter result in inefficient outcomes and often failure of the benefits targeted in the policies. The literature is full with accounts of how the methods of regularisation of informal in the formal have failed and how such endeavours become difficult on a large scale (Lowder 1986; Harper, 1999)³².

Our frame thus is constituted of the alternative development paradigm in which we situate the problem of solid waste for an urban area in a developing country. In case of solid waste issues the informal sector is accredited with not only providing sustenance to urban poor but also in

30 In Agenda 21 we see convergence of two strands of alternative development namely emphasis on basic needs rather than just growth maximisation and the notion of outer limits in relation to the planet's resources and its environment to sustain such growth.

31 The four program areas recognised in the Agenda 21 are minimising waste, maximising environmentally sound waste reuse and recycling; promoting environmentally sound waste disposal and treatment; and extending waste service coverage.

32 Lowder (1986) reports about the efforts of Senegalese government to regulate the vegetable vendors in Dakar, which failed owing to a failure of understanding of the complex interlinkags in the informal sector and high degrees of corruption. Similarly Harper talks about the forerunner of Linnis Gnda program in Metro manila which failed due to non-cooperation by the informal sector and corruption in the formal system.

aiding the materials cycle in the urban environment. We examine the latter prevalent assumptions in the literature in the course of this study.

Sum-up

Dynamics of economic growth have brought cities to the forefront of any discussion on human settlements. In the light of the rapid population growth experienced by the cities especially in the developing countries, one of the major issues in context of urban sustainability facing the authorities is that of the provision of basic services like clean drinking water and sanitation services to the residents. One of these services is that of an efficient collection and disposal of solid waste. In the specific context of developing countries with relation to the provision of solid waste management two important institutions are identified. They are local level sanitation department (formal sector) and the set of agents involved in the recycling of materials salvaged from waste dumps (informal sector).

Embedded in the midst of all the above discussion are the questions related to the provision of the basic services for an urban area. The role of the formal sector in such, and the gamut of issues which raises larger developmental concern of equity. Above all there is the question of urban sustainability, as cities are growing rapidly and the pressure on local Governments is mounting to provide basic services. The passage of the seventy fourth amendment in 1992, which emphasised the devolution of power from the state to the level of local administration granting them a higher degree of autonomy, fitted the frame of the alternative development paradigm which envisaged a larger role of the stakeholders in the planning and development process. Particularly for solid waste management services the informal sector has been cited as one of the promising collaborative agencies. As the literature is replete with ideas of a working relationship between the two for the improved management of solid waste, the study examines this view. This chapter lays the frame for the examination of the problem from the point of view of urban governance, which shall be subsequently picked up in the later discussions.

Next chapter is based on the objective of investigating the influence of general socio-economic variables (a part of urbanisation) on the solid waste stream. As waste stream

determines not only the vibrancy of the informal solid waste economy of a place but also affects the options of its management, what we define as the formal solid waste economy.

SOLID WASTE GENERATION: THE INFLUENCES

Introduction

Solid waste management is an engaging area of research for both the developed as well as the developing countries. A major impediment in the way of a thorough understanding of the issue is the ignorance of solid waste generation as well as externalisation factors¹. The literature reviewed leads us to conclude that socio-economic factors affect solid waste generation in an economy. Invariably the studies frame urbanisation, industrialisation, climate, and income as the causes. However a clear definition, exhaustive mention or investigation of the same is not available. The trajectory of research in the issue of solid waste management has had a solution oriented bend rather than investigating the issue from its core. This chapter of the study intends to address this gap.

In light of growing consensus on source reduction and altering consumption attitudes (reduce, recycle and reuse) as the long term solution, it is essential for an economy to unearth the nexus of generated solid waste and its miscellaneous socio-economic factors. As solid waste has been defined as society's detritus²; one can assess the overall state of an economy by examining the quality and quantity of waste it generates. As pointed out earlier there is a conspicuous void in the literature regarding the identification and direction of influencing factors. We are of the opinion that further investigated this might prove to be the key to the puzzle of differential effectiveness of managerial/disposal alternatives when applied/emulated in different context.

In the beginning of the chapter (Section 1), hypothesising the factors of influence we propose two frameworks for addressing the problem, which are in essence two distinct directions of approach to the factors of influence. Followed in section 2 is an analysis making use of one of the proposed frameworks, at two levels of spatial aggregation.

1 Conceptually we differentiate between the term generation and externalisation. Externalisation =difference between generation and reuse/recycling. In our view it is erroneous to consider the two synonymously, the point is clarified later.

2 (Hoornweg ,1999 pp-2)

4.1.1 Influencing factors: The ignored issue

In the literature waste generation is understood to be affected by socio-economic development, degree of industrialisation, climate, price and income variables, percentage urban population, population density and frequency of collection (Beede and Bloom, 1995; Hoornweg, 1999). This study points to the lack of their proper delineation, for an investigation into the generation mechanisms is equally important as the efforts to improve the waste disposal alternatives. A macro picture of influencing factors is instrumental, to piece together the maze of solid waste options and their desired applicability. Therefore what are the factors, which affect the waste generated at the level of a nation and city? Is the influence unidirectional and of equal leverage? If *not* then what are the characteristics of these influences, if yes then what is the synergy? We hope to address this issue in the present study.

Influencing Factors: A conceptual proposition

There is a logical link between socio-economic factors and the solid waste generated. Within this basic premise we recognise a subtle distinction between the manifestation of cultural factors and economic influences. There is a distinction between the amount littered (as in net waste externalised) and amount of solid waste generated by a person³ or an economy (the two might be the same in economies where there is no significant reuse or recycling, but this is quite unlikely⁴). This is an important distinction, which bisects the mass of literature on solid waste roughly into two main themes of

1. studies, which focus on difficulty in coverage/collection of littered garbage, and / or compliance of society with the policy measures that is . the problem, situates in the cultural domain⁵.

3 As total municipal waste generated in the system is largely an aggregation of per capita rates an understanding of the per capita externalisation is warranted. As that is not the objective here we abstain from a further discussion on this, however the point is motivated for directing the course of further research.

4 For the above distinction to be pronounced we stress the need of proper data collection by the responsible agencies. Data not only needs to be collected on the amount of waste that is generated in the economy but also on the rates of recycle and reuse practised in it. See annex 1; Hoornweg, 1999 for a good discussion on solid waste data.

5 Any effort to resolve the problem of solid waste is a matter of altering the institutionalised behavioural patterns (Larkin, 1986)

2. studies in which resource consumption is the base line focus, basically emerging from the economic behaviour of the society.

Though these are two distinct domains they are not mutually exclusive consequentially influencing factors also are a mix of both.

Led by literature we can place the case of developing countries, largely in the cultural domain. Littering in the context of developing countries is the factor, which raises the cost of collection, explaining its disproportionately high share in the budget allocated for Municipal Solid Waste Management⁶. Littering is economically explained under the paradigm of common property resources. Since public places are open access resources as well as sinks, cost of dumping waste for individual / household is negligible compared to the cost of segregating the waste prior to dumping or modifying it. In absence of a communication between two households concerned, prisoner's dilemma game sets resulting in the disposal of waste on the street⁷. Developing countries, are also characterised by the absence of regulatory structure for waste handling and control coupled with dysfunctional and in some cases non-existent markets. For these countries knowledge of waste generation mechanism is important to add to the understanding of the problem specific to the context.

As the technical feasibility needs to be complemented by the economic feasibility⁸ of the disposal alternative a study of the influencing factors assumes importance. In order to take stock of the above we need to focus on the general economy which would have an influence on the solid waste generation of the society. In order to discuss the influence of socio-economic variables we propose two frameworks of reference, which are the two dimensions of the issue namely quantity and quality. In our view we can make a distinction between the variables which affect the quantity and the quality of waste.

⁶ In developing countries, municipal authorities allocate 90% of the municipal budget towards the collection of solid waste, but are able to provide service to just 50-70% of the population (Cointreau, 1991)

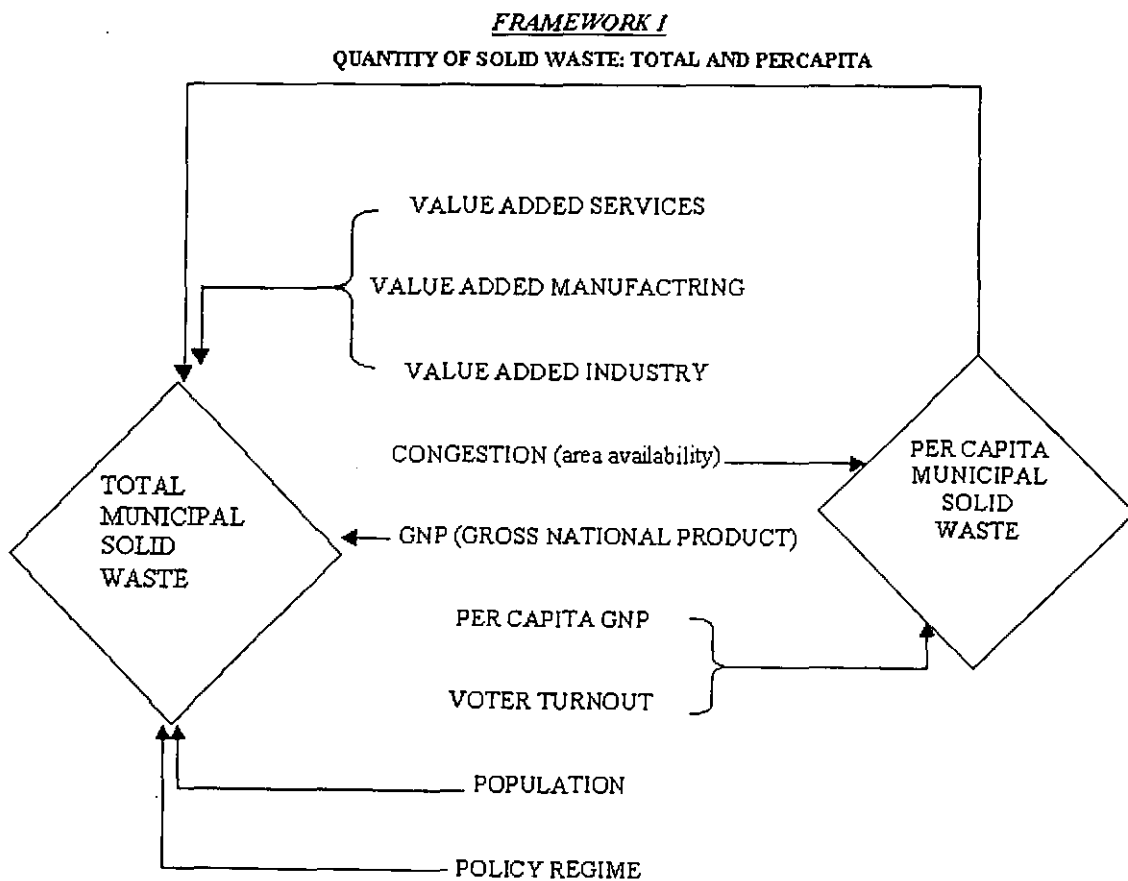
⁷Anand (1999, pp-162)

⁸ To clarify economic feasibility of the disposal option hinges on the demand for service and supply of its complementary raw material (in the case of composting it is the municipal waste, and in case of incineration also it is the amount of combustible waste). Waste stream fluctuations (seasonal, yearly etc) and shift in the nature of waste (due to diversifying production activities of the city) generated, demands a change in the disposal option, affecting the installed infrastructure.

Agents of Influence: The probable variables

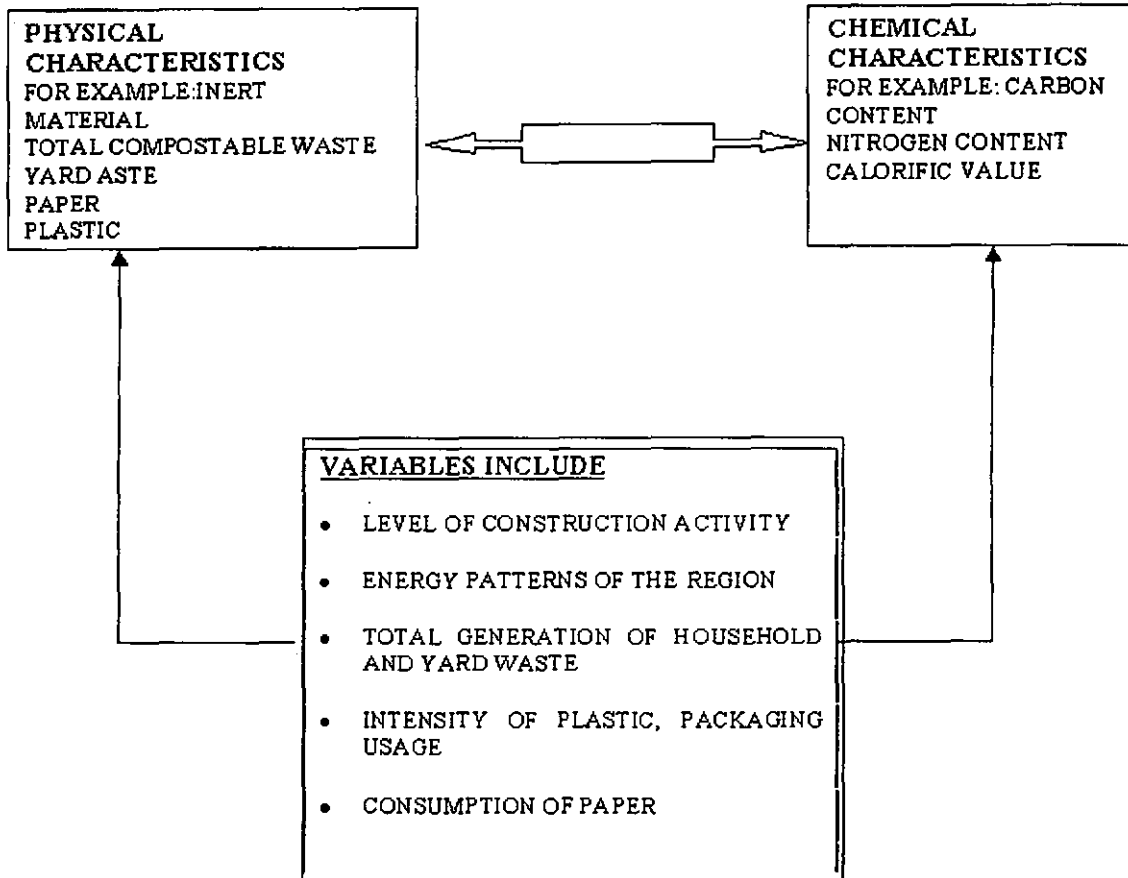
Following variables are common to both the frameworks. The inventory of variables given in box-1 is used in only one of the frameworks.

Policy Regime: It is one of the multidirectional variables of influence. Policy regimes available include, command and control (CAC), market based (MBI) and the much-celebrated participatory approach. The design of instruments under the regime influence both quantity as well as quality of solid waste.



FRAMEWORK II

QUALITY OF SOLID WASTE: PHYSICAL AND CHEMICAL



Gross National Product (GNP): Income empowers consumption, therefore more income would result in more generation of waste. Along with this non-biodegradable proportions are found associated with high levels of income. Thus both attributes of quantity and quality stand to be influenced.

Percentage Urban Population: Urban lifestyle is synonymous with a “throwaway attitude”, owing to the lack of time and space for solid waste internalisation. Instrumental is the lack of incentive due to low private costs. Therefore a large urban population would imply a large bulk of waste, largely packaging and plastics to be handled.

Environmental Consciousness: Attitude towards waste management in a country is an important variable to be reckoned. In the absence of an indicator which would prove to be a

measure for the above we take voter turnout. It is one of the indicators used in literature as a proxy for the same

Climate: The climate of a place would affect the consumption of goods to a large extent. For example the usage of more clothes /woollens, the amount of food that is canned and bottled etc. for temperate regions The variable is important in both the frameworks, as the choice of disposal option would depend on its suitability to the local climate. For example in composting a certain amount of temperature has to be maintained and the desirability of a waste to energy facility (incineration) in temperate regions.

Value Added by Manufacturing and Industry in Gross Domestic Product (GDP): This would determine the amount and quality of solid waste entering the waste stream. This is extremely sensitive to case context. For example in industrialised countries, where adequate stress is placed on industrial solid waste management, this variable would reduce to value added by manufacturing in the households. In a third world country, the absence of regulatory norms and/or low compliance suggests that all these categories of wastes are being released in the common waste stream.

Box1: An inventory of probable variables

Measure of Construction Activity: This gives an idea of the amount of inert material that comes out of construction activity undertaken in an economy. It affects the physical characteristics of a waste stream, therefore features as a variable in the second framework.

Consumption Patterns: The share of food and non-food consumption expenditure would determine the quality of solid waste in the waste stream. This factor goes in as a determinant of the disposal option for the economy, considered in the second framework.

Congestion: A variable in the first framework it is an indicator of the congestion level within the unit of inspection. A proxy can be found in the public space availability the assumption being that it acts as an incentive for people to externalise more waste. It comes under the category of exerting influence on the littering behaviour. In the diagram as it is shown the per capita finally connects to the total quantity of solid waste, it is a bi-directional variable that can be studied separately for the per capita as well as the total quantity of waste.

Energy Patterns: Amounting to an important variable of influence in the waste stream considered in the second framework, the energy pattern of an area is an important variable to reckon with. The use of biomass fuels like coal, dung cakes amount to a presence of ash in the waste stream and might be a criteria to reckon with in choosing a disposal option.

Population: This has a direct bearing on the total amount of waste generated, as it is a reflection of per capita rates.

Concerns

An initial hindrance in the line of such an inquiry is the availability of data. Another facet is the summation of the effect. Does the factor solely generate the visible effect or is it in interaction with some other factor? When one is ambitious enough to attempt an inter regional or temporal study the gnawing question of data comparability and methodology arise. Aware of these limitations the present study proceeds with the analysis of inter regional of factors, influencing waste generation.

4.1.2 An Inquiry into the Causes and Release of Waste

The study assumes that the factors of influence governing the exterralisation as well as generation of solid waste are largely localised. In order to characterise the pattern of influence a micro level study is most appropriate. However it is also necessary to identify variables in the macro economy, which exert an influence on the waste stream quantity. This helps us in the taxonomy of global solid waste scenario. Therefore we trace our analysis from a macro level (country) to micro (city) level. We take a look at the effects on the total quantity of waste generated in an economy as a whole (the country level), then we step into the micro-picture, that is intra country level and look at the variables specific to cities.

Inter Regional Analysis

From the literature we know that developed countries, generally produce more waste per capita than the developing countries. There is a marked difference in the composition of waste stream also which reflects the income effect. However, there is no strict linearity observed between waste generation rates and the composition proportions (see graph 4.1). The graph reveals that countries have varied waste stream, even while their income (refer to table 4.1) and per capita rates are comparable. The following tables summarises some of the generation rates recorded in developed and developing country situations and the subsequent graph gives an account of the variability in waste composition proportions across continents. Literature reports that high income countries generate waste in the range of 1.1 to 5.07 Kg per capita per day, with the GNP dropping to the middle income range, the per capita waste generation rates range from 0.5 to 1.1 kg per day⁹.

⁹ Hoornweg (1999)

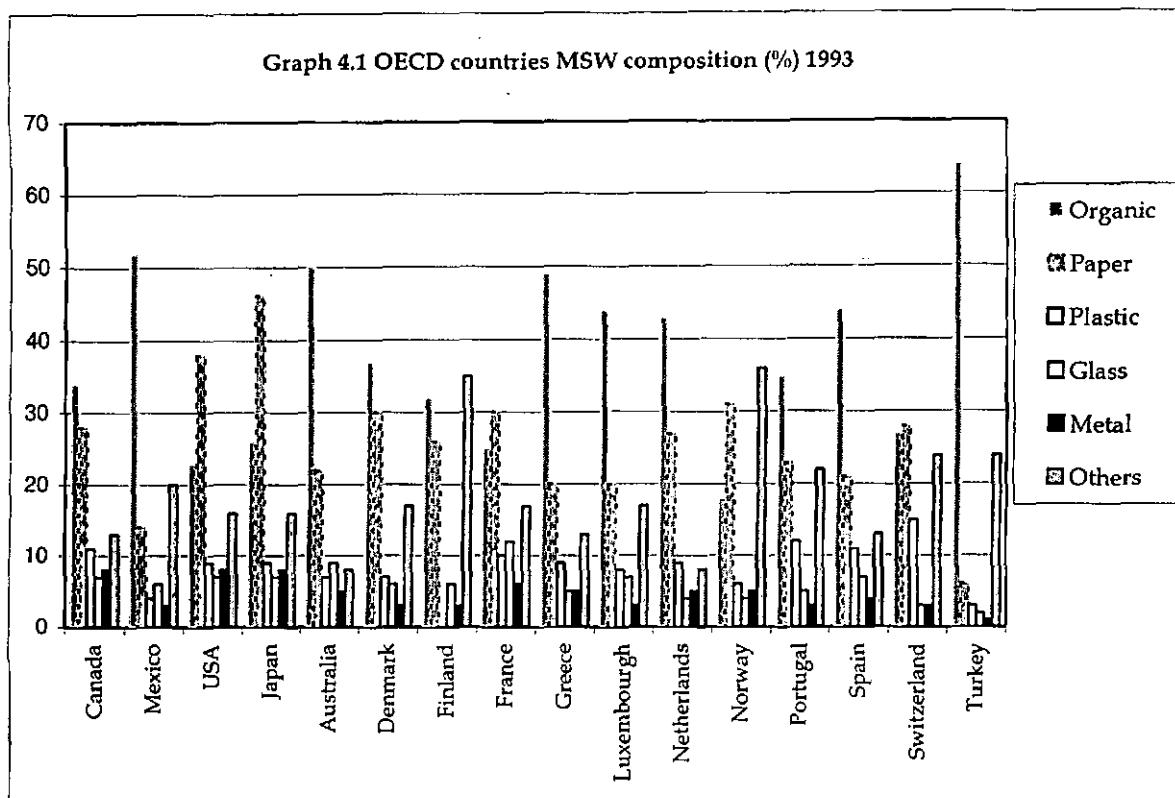


Table 4.1: Solid Waste (SW) Generation Rate in some OECD countries

COUNTRY	SW GENERATION kg/capita/day	GNP 95(Per Capita) (b)
Italy	0.56	19020
Japan	0.56	39640
Switzerland	0.66	40630
Netherlands	0.71	24000
France	0.77	24990
United Kingdom	1.0	18700
Canada	1.64	19380
United States of America	2.50	26980

Source: Dayal (1994); (b) WDR(1997).

It is evident from table 4.1 that comparable incomes do not ensure the same rate of waste generation. The rates of waste generation within the high-income group countries vary quite significantly, with a minimum of 0.5 to a maximum of 2.50 Kg/capita. The above table points at the relevance of economic theory (Engle's Curve), which suggests that proportion of

income spent on the consumption of food (necessities) items is inelastic to income but positively associated with it (Beede and Bloom, 1995). While the propensity to consume non-food (durable/luxurious) items increases with an increase in the income. Therefore the increase in income does not result in a correspondingly high consumption generating municipal solid waste. The effect of extra cultural effect is seen in the cases of Japan and USA where the incomes are comparable but the per capita solid waste generation is very different. We explore this trend in our sample set, further in the chapter.

Low-income countries, which have the lowest percentage of urban populations, record the lowest waste generation rates, ranging between 0.4 to 0.9 Kg per capita per day. All of the countries that have a GNP per capita less than US\$ 400 produce under 0.7 Kg per capita per day¹⁰. In order to check the above we compare the rates for some Asian cities. The following table presents the figures.

Table: 4.2:Waste Generation Rates for Some Asian Cities, 1993

City	Solid Waste Kg/ Capita/ Day	Gross City Product / Capita (US\$ 93)
Bombay	0.5	275
Lahore	1.2	428
Bandung	2.5	739
Colombo	0.5	1036
Shanghai	0.8	1832
Manila	0.7	2134
Jakarta	2.6	2843

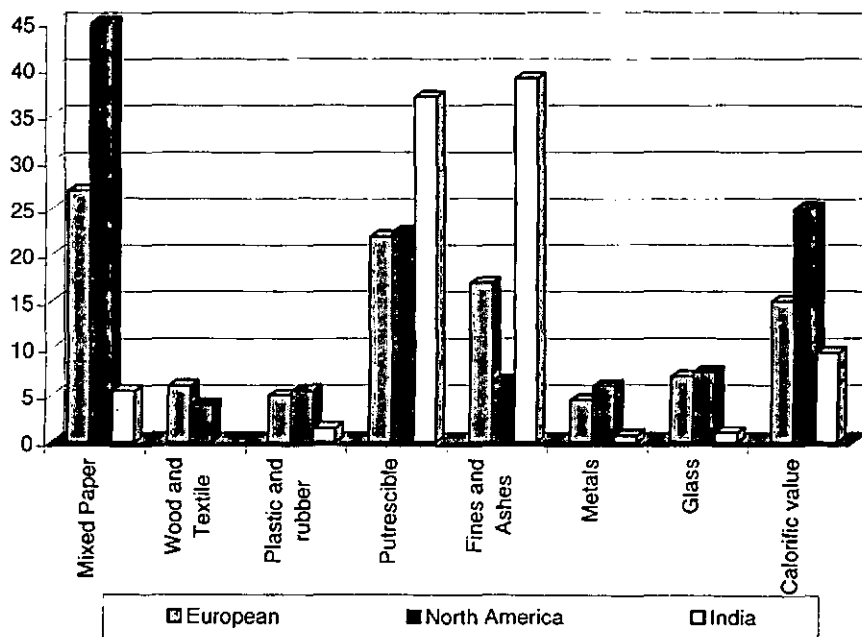
Source: City level urban characteristics, World Resource Institute (1999).

The above table 4.2 features some of the most prominent cities in South East Asian region. A glance at the figures reveals that the range of solid waste at per capita level is in the range of 0.5 to 2.6 kg/capita/day. This is comparable to the average country statistics that we witness for OECD countries. What attracts our attention is the similarity in the per capita levels of

¹⁰ *Ibid*

Jakarta and Bandung which is close to the national average of USA (Table 4.1). The commercial city of China, Shanghai is fourth in the table with per capita value of 0.8 kgs /capita. The surprising case is that of Lahore which has a comparatively low gross city product per capita but records a high value for waste generation. The purpose of the above two tables was to drive home the point that income necessarily does not determine the quantity of waste, and that it works in combination with other socio-economic factors. Increasing income effect according to us is best exhibited in the composition of waste, which is visible from the graph-4.2. However on the whole it could be said that income would empower more consumption, the effect of which is evident in the waste stream composition.

Graph 4.2 Comapitive Picture of City Refuse Composition in three Different regions of the Globe



Pointed out by Coad (1973), we know that when we move from small, poor traditional and illiterate community to a large rich moderate and literate one, the refuse weight and volume increases. It is also noted that food preparation wastes reduce, paper and packaging fraction increases along with particle size. We shall further examine this with the aid of graph 4.2¹¹.

¹¹ The stacks represent the mid-point of the range of percentage composition of the waste category. The Calorific value is given in hundred to be read as hundred kilojoule/kg. The graph has been adapted from Roy, 1988.

The graph shows that American cities have the highest share of paper, packaging materials and metals with European cities coming second. Although the two are comparable in climate and income, materials use is more intensive in American vis-à-vis European cities. The above graph adequately brings out the difference in the waste stream across the continents. Taking cognisance of the waste stream composition we initiate the exercise first at the macro level, that is at the country level. Of the above discussed two frameworks, we choose to follow the first and study the agents of influence on total quantity of solid waste.

Analysis

For the macro level analysis data was taken from the World Development Report (1997) and Human Development Report (1999) and Hoornweg (1999). The size of the total sample was twenty-eight which comprises of 19 OECD and Asian countries.

An earlier work by Beede and Bloom¹² concludes that the generation of municipal solid waste per capita does not vary with population size among countries with comparable per capita income. This was checked for the sample and the results are reported in the following table.

Table: 4.3: Coefficient of Variation for income and solid waste per capita in the sample

COEFFICIENT OF VARIATION	QURT 1	QURT2	QURT3	QURT4
INCOME	0.65	0.63	0.12	0.19
SW/CAPITA	0.24	0.25	0.19	0.20

Note: QURT = Quartiles according to the income per capita.

With the aid of table 4.3 we note that the coefficient of variation for per capita solid waste is in a range of (0.19 to 0.25) while the income records a relatively larger range, from (0.12 to 0.65). Quartile 3, which records the lowest variation in income, also reports lowest variation in per capita solid waste, which is in congruence with the generalisation of Beede and Bloom (1995). The variability in per capita solid waste is comparable across the quartiles indicating that the quartiles are more heterogeneous in income than in per capita solid waste quantities and that the generalisation of Beede and Bloom does not strictly follow. When tested for sub samples we conclude that the Asian sub sample is more heterogeneous than the OECD group,

12 (Beede and Bloom, 1995, pp-113)

which is the reflective of the larger structural differences that exist among the Asian countries in general. On the other hand the OECD group can be taken as a relatively homogeneous group.

Further to that, in agreement with the effect of income variability on per capita variability of waste, we check for the responsiveness of total waste stream to the varied socio-economic stimulus from the economy. In their analysis, Beede and Bloom conclude that the solid waste stream is inelastic to income¹³ but more than unit elastic to population. Our sample corroborated this finding (please refer the appendix table 1). However, as already established solid waste is an urban problem, therefore magnitude of municipal waste would bear a relation with the process of urbanisation.

We are aware that urbanisation is marked by the manifestation of structural changes in the economy. Two prominent indicators of such are the percentage urban population, indicating the degree of urbanisation and the growth of tertiary sector (namely the service sector) indicating the stage of urbanisation. Thus, we estimate the responsiveness of solid waste stream to the variables of value added by the service sector and total urban population. Since municipal waste stream is linked with consumer behaviour and in the recent decade's citizen's activism has become an important agency in bringing about environmental regulation, we introduce voter turnout¹⁴ in recent elections as a proxy for environmental consciousness. The expected sign of its coefficient is negative. That is, with an increased voter turnout the quantity of sold waste is expected to decline. Value added by services as well and total urban population are expected to show a positive association.

We estimate the elasticity of total quantity of solid waste generated within an economy with respect to selected economic and demographic variables, derived largely from the above discussion. In addition to this, a dummy variable is used to examine whether there is any difference between OECD and Asian countries. The dummy takes the value zero for Asian and 1 for OECD countries. Table 4.4 provides the estimated elasticities. The model gives a good fit with a high R^2 (0.95) and all the coefficients have expected sign. It is observed that the solid waste stream is more sensitive/elastic to value added by service than to the total

13 Analyses across countries and over time reveal that the generation of municipal solid waste is positively related to variations in per capita income (Beede and Bloom, 1995).

14 Voter turnout may reflect the likely strength of formal regulatory pressure (Pargal and Muthukumar, 2000).

urban population. We also get a significant coefficient for voter turnout leading us to conclude that environmental consciousness has a negative impact on the total size of the waste stream. The coefficient of dummy variable is not found significant suggesting there is no notable difference in the behaviour of OECD and Asian countries.

Table: 4.4: Estimated elasticities of solid waste with respect to selected indicators

VARIABLE	COEFFICIENT	t-VALUE	P-VALUE
Constant	-0.96147	-1.779	0.0883
URBPOP	0.348351	2.061	0.0507
SERV	0.629969	3.723	0.0011
VOTER	-0.57727	-3.988	0.0005
DUMMY	-0.04396	-0.247	0.8065
R-Square	0.952	Durbin Watson	2.35
Degrees of Freedom	27	F-statistic	114.58

Note: URBPOP: total urban population of the country.
SERV: absolute value added by service sector.
VOTER: total voter turnout in the recent elections.
WASTE: total solid waste generated in the country.

The above analysis leads us to point out that total urban population as well as the structural change of economy from a primary/secondary base to tertiary sector is positively associated with total solid waste quantity across countries. The single factor working against this is the consciousness of the citizens, which is found to be negatively associated with the dependent variable. This result is placed in the dual concerns of planning for as well as monitoring of solid waste stream along with economic development. Along with the general factors of income and population, it is the quality and maturity of urbanisation, which has an impact on the bulk of waste generated in a system. Concerned with the global scenario we report that under the assumption of other things constant highly urbanised countries are responsible for generating more solid waste in the total bulk of the waste stream generated in the globe. We next approach the intra country level for which we shall be looking at the cities within India.

II

4.2.1 Intercity Analysis: the Indian Case

Beginning with the premise that solid waste management is a localised problem and should be studied with local level variables, we focus on an inter city analysis. India is a developing nation solid waste stream has an excess of putrescible matter in the waste (a favourable C/N ratio). This makes composting the most likely option for solid waste disposal. Presently as revealed from NEERI (National Environmental Engineering Research Institute) findings, 91% of the solid waste is disposed via open dumping in the nation.

The situation for India is becoming more peculiar as the urban growth rate is slowing down, even though the rate of urbanisation for the class 1 towns is on the rise. In the absence of reliable source, we review the available literature for data on the problem. To begin with, the quantity per capita of waste generated in India is approximately 400-500 gms per day of which 50-55% is moisture, 35-45% fruits and vegetable biomass, 8-15% inorganic with a calorific value of 800-1100 (Dayal, 1994). The Physical and Chemical characteristics of refuse in Indian cities as reported in the Solid waste Management strategy paper by NEERI are reported in table 4.5 and 4.6.

Table: 4.5: Physical Characteristics of Municipal Solid Waste in Indian Cities.

Population In Millions	No. of Cities	Paper	Rubber, Leather & Synthetic	Glass	Metal	Compostable Matter	Inert Matter
0.1-0.5	12	2.91	0.78	0.56	0.33	44.57	43.59
0.5-1.0	15	2.95	0.73	0.56	0.32	40.04	48.38
1.0-2.0	9	4.71	0.71	0.46	0.49	38.95	44.73
2.0-5.0	3	3.18	0.48	0.48	0.59	56.67	40.07
5.0+	4	6.43	0.28	0.94	0.80	30.84	53.90

Note: All values are in % and calculated on a wet weight basis.

Source: Report on solid waste management in class one cities constituted by the Supreme Court (1999) March.

The above table 4.5 provides us with an overview of the composition of waste that is discarded every day in the Indian cities. The important constituents demanding attention are paper, glass and metals these materials show an unprecedented jump in the composition value

increasing to almost double the amount for five million plus cities from that recorded for a city having population between 2-5 million.

Important to note is that these cities are the metropolitan cities (4 cities surveyed) and are peculiar in a lot many ways from their smaller sized (in terms of population) counterparts and therefore not strictly comparable. The percentages reported for rubber, glass and synthetics are higher for the smaller cities than million plus cities. In fact they drop down characteristically for the bigger cities. The compostable matter drops down considerably for the metro cities. An urban lifestyle of metro cities might provide an explanation for the drop in the compostable matter and a rise in the inert material proportion.

Table: 4.6: Chemical characteristics of municipal solid waste in Indian cities

Population in Millions	Nitrogen	Phosphorus As P_2O_5	Potassium As K_2O	C/N Ratio	Calorific Value Kcal/Kg
0.1-0.5	0.71	0.63	0.83	30.94	1009.89
0.5-1.0	0.66	0.56	0.69	21.13	900.61
1.0-2.0	0.64	0.82	0.72	23.68	980.05
2.0-5.0	0.56	0.69	0.78	22.45	907.18
5.0+	0.56	0.52	0.52	30.11	800.70

Density varies between 30-560 Kg/Cubic meter

Source: Report on solid waste management in class one cities constituted by the Supreme Court (1999) March.

Table 4.6 is a representation of the nature of materials that is disposed every day in open dumps by the cities. The following discussion is based on tables 4.5 and 4.6 which yields following observations. Table 4.6 shows that the calorific value of waste in the metro cities is the least, which records the high C/N ratio. In contrast to this is the relative total compostable matter percentage given in the previous (also by the same source) which is the least for metro cities and which has a highest inert material ratio too. Paradoxically the 1-5 lakh cities not only record waste having the highest compostable fraction (C/N ratio), they also records the highest calorific value too. The information needs to be viewed with the other existing information about the chemical and physical nature of solid waste in India, as nothing can be conclusively established about the cities from this data.

In what follows we try to sketch a picture of the twenty-three metropolitan cities of India. The data for the above exercise was provided to us by the central pollution control board, and was accessed through indiastat.com. Data on solid wastes are supplemented with other socio economic variables as published by the Census of India, 1991. Variables for inter city analysis are listed below.

Additional Variables Identified for Cities

The phenomenon of urbanisation implies certain patterns of lifestyle, which although not always true, can be taken as broad generalisations. Proposed hypotheses have underpinnings of such. In addition to the variables identified earlier in the inter country analysis the variables identified are¹⁵

Total Female population in the main activity: As more women transfer their production and management skills to commercial enterprises, demand for convenience products in the home continues to grow more. Carry out meals and frozen, canned and vacuum-packed foods are frequently substituted for homecooked meals. Such prepared dishes do cut down on household organic wastes. In absolute terms the waste stream is enlarged by the packaging and materials used in advertising (Pollock, 1987).

Total Migrant Population: derived from Susan Chaplin's argument that the migrants have a greater tendency to be negligent about sanitation, or display lack of interest in activities related with the treatment of local issues at large (Chaplin, 1998).

Distribution of main activity in the city: The intensity of manufacturing would tend to increase the amount of waste generated in an area, likewise the intensity of services like construction would tend to increase the bulk of the problem, in this regard this variable becomes important.

¹⁵ Along with these variables, data for population, work participation rate, residential density, literacy, growth rate was also collected of which only those variables which show a correlation with the dependent variable are discussed here.

Analysis

The data assembled was examined to check for association between selected variables and the total solid waste externalised in the city. Scatter plots revealed that population, income, total female working population, residential density and the main activity distribution of population into manufacturing in household, manufacturing other than household, construction, transportation, trade and commerce show a positive association. Following which a correlation was done, the results are reported in the following table.

Table: 4.7: Correlation and Partial Correlation Coefficients for the variables

Variable	Correlation Coefficient	Partial Correlation Coefficient
Population	0.974**	
Total migrants	0.967**	0.702**
Growth rate	-0.230	0.050
Services value added	0.950**	0.311*
Total female population in manufacturing and services	0.194	0.42**
Residential density	0.664**	-0.617**

Note: (**) significant at 5% level, (*) significant at 10% level.

The correlation matrix revealed that population was highly correlated with all the variables other than growth rate and female population, thus to check for the effect of variables independent of the impact of population a partial correlation, controlling for population was done. The partial correlation's calculated when population was controlled for actually reveals the significant leverage that population exerts on the other variables of the economy. It can be seen that total female population in manufacturing and services, which is insignificant in the correlation matrix, turns significant in the partial correlation and the direction of influence exerted by growth rate is reversed, although it still remains insignificant. The coefficient of total female population [engaged in services and manufacturing] is in conformation to the expectation articulated by Pollock (1987). It tells us that with the increased levels of education among women and with their increased participation in the job market, would actually result in much externalisation of waste from the household sector thereby

contributing to the waste stream of the city. Another hypothesis confirmed is that of Chaplain's who relates a lower hygiene performance of a city to the population constitution, in particular to the proportion of migrants. Residential density also varies negatively with the solid waste variable, hinting that area availability [congestion] has an important role to play in the total solid waste generated in an urban area.

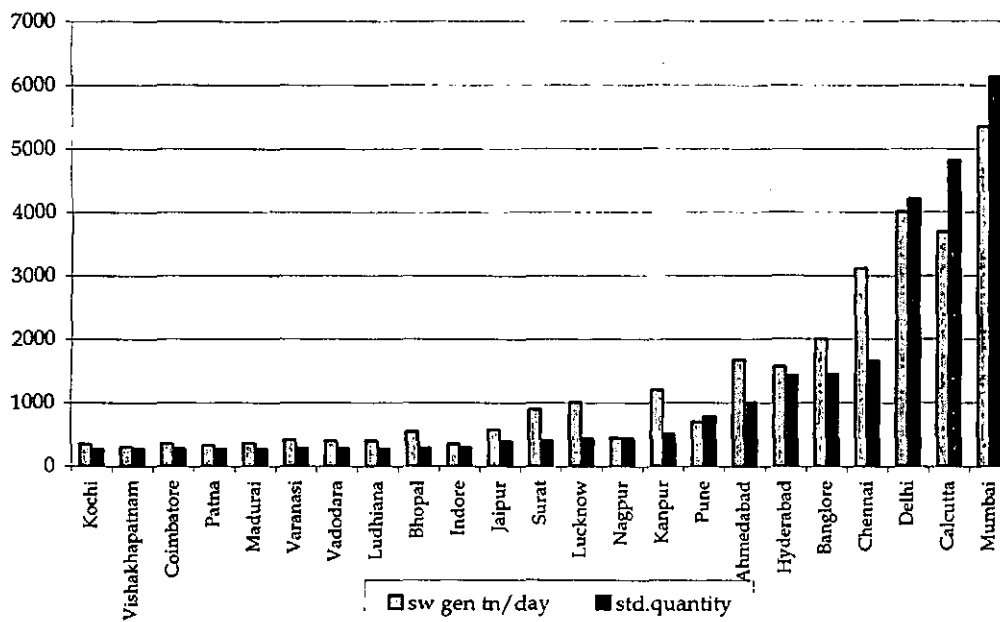
Faced with multicollinearity among the variables we attempt a descriptive analysis that would throw light on the Indian situation. The cities were sorted on the ascending values of population and were divided into four quartiles, it was observed that the bulk of waste increased as we navigated down the list of cities (see appendix table 3). That established we now move to the description of other variables, which were considered in the above analysis. The cities are widely distributed with respect to solid waste generated with the range of 300 to 5355 metric tonnes/day. On the other hand the sample was homogeneous in literacy which had the least standard deviation. The sample was highly variant with respect to the total population engaged in manufacturing this we can understand, as the functional classification of the cities differ, while services sector was on an average was found to employ more than a third of the total working population. The first obvious thing that there is a marked segregation of the per capita rates into two groups. Quartile 1&1 show a comparable figure of 0.41 kgs/capita while the quartile 3 and 4 have a common rate of 0.48 kg/capita (please refer appendix table 4).

The cities of Pune and Nagpur are an anomaly, which feature, in the fourth quartile but record the lowest per capita solid waste generation (0.3kgs/capita) in the total sample. Also note the city of Surat which shot into notoriety for it's famous bubonic plague episode in the early nineties actually features in the second quartile but generates waste which is highest in the group. We intend to show through these two examples that in case of solid waste, since the core of the problem lends itself in the economic as well as the socio-cultural domain, the solution is to be sought in societies which emerge as exceptions to the exhibited rule.

Another interesting exercise was also done to compare the standard amount of waste that would be generated in a city with the reported amount. The standard amount was estimated by finding the product of population with the average kg per capita figures for cities of

different population sizes given by NEERI¹⁶, in their solid waste management strategy paper, 1996. The graph 4.3 of the two series shows that, of the four major metropolitan cities, cities of Pune, Nagpur Calcutta and Bombay are generating waste less than the standard value while Delhi and Madras are generating more waste than standard. Apart from the mega cities it is seen that cities, which show a very high rate of growth are also the ones which have a greater difference in the amount reported and the standard amount generated.

Graph 4.3 Standard and reported amount of solid waste generated in the 23 metropolitan cities of India



However a plausible explanation in order to explain this can be visualised in the disparity in the power to consume and generate waste which links with the notion of city size and the intra urban income distribution. Due to increases in returns to capital (human as well as

16

Population range in lakhs	Average waste in gms/capita/day
1-5	210
5-10	250
10-20	270
20-50	350
50+	500

Source: Expert committee, constituted by the supreme court of India March, 1999

physical): a result of agglomeration economies, income inequality in the city gradually rises¹⁷, thus the purchasing power determining the capacity to consume and generate waste is concentrated in the hands of a few people. Another reason could be that these cities are internalising waste, which can be assumed true for Pune¹⁸. For the other cities however more waste being generated indicates that the income distribution is more or less even and this is also supported by the fact that of the 23 metropolitan cities 10 cities have gained the metro status in the last decade. As such nothing can be conclusively said about the behavior of overt consumption witnessed in the Indian metropolitan cities. As noted earlier socio-cultural factors exert a high leverage over the solid waste quantity, there fore a micro level study prove to be more illuminating.

Sum up

The above exercise was done in order to arrive at pointers determining the waste stream of a region at two levels of spatial aggregation. The exercise at the country level provides us insights into the widely held misconception that income determines the bulk of waste. What we find instead is that any factor in isolation cannot be said to affect the solid waste stream. Population along with income has an equally important role to play so does environmental consciousness. Our analysis has helped us to predict the elasticity of socio-economic variables to the total quantity of waste. In our sample we find that Asian countries are widely variant in terms of not only rates of solid waste generation but also in other factors utilised. While OECD countries paint a homogeneous picture and it can be said that the cities adhere to the overall trends. The reason for this homogeneity might be the degree of urbanisation that is large in OECD countries and the samples are basically drawn from these cities to generate the overall picture of the nation. In the case of Asian countries it is the contrary as the pattern of urbanisation is primate, thus the rates are calculated for some of these primate (metro) cities and then generalised for the whole nation, so for Asian countries a city-wide or case study approach is better to determine the trend. One can make use of the results from our exercise for planning and management of solid wastes. We have arrived at the extent of responsiveness in the waste stream to the general factors exhibited by the economy, which in

17 Societies that develop a surplus are said to allocate that product largely in terms of the distribution of power within the society. These societies will have an elite who continue to take the absolute (not the relative) share of wealth produced by the economy. (Cutright, 1970)

18 Graph 3.1 gives us the disposal practice of the twenty-three metropolitan cities of the country.

our sight is a significant input lacking in the present decision making process. The city wide analysis for India helped us to check the present status of Indian cities and the NEERI estimates help us to hint the urban disaster that looms ahead for the growing cities of India. An idea of these influences is also necessary in determining the impact they have on the solid waste economy as the composition of the waste stream determines the scope of its functioning.

As articulated earlier a micro level study with regard to solid waste issue is important and substantive. In the next chapter we introduce the case study chosen for the present study, and detail its socio economic characteristics. We document the process of urbanisation and in the subsequent chapter see its impact on the solid waste economy. We also discuss the formal and informal agencies involved in the waste handling.

Appendix

Table: 1: Model for estimating the elasticity of total sold waste, with GNP, Population and dummy variable. For the exercise the dummy takes the value one for OECD countries and zero otherwise.

Variables	Coefficient	t-value
ln GNP	0.207461	5.378
ln Population	0.8006	18.311
Dummy	0.053533	0.422
Constant	-2.81581	-8.083
R squared	0.9739	
Adj. R squared	0.9706	

Table 2: The Quartile wise distribution of metropolitan cities

City	Solid waste generation (Tn/Day)	Growth rates of cities	Tot female population engaged in manufacturing & services	Population density	Other Services	Migrants	Population	Per capita solid waste generation
Quartile 1								
Varanasi	412	28.77	15979	6442.894	57320	74210	1030863	0.4
Ludhiana	400	67	23005.05	7742.927	48492	474240	1042740	0.384
Vishakhapatnam	300	74.3	41161.37	13495.7	105571	453218	1057118	0.4
Bhopal	546	59	26282.29	3730.33	107936	425736	1062771	0.514
Madurai	370	20.49	76526.02	23109.47	70467	274198	1085914	0.392
Quartile 2								
Patna	330	19.6	18843.05	10269.4	128648	337036	1099647	0.307
Coimbatore	350	23.38	57740.44	10423.73	76719	305010	1100746	0.429
Indore	350	33.13	27361.45	6714.633	91859	355119	1109056	0.321
Vadodara	400	49.7	23480.24	4507.296	92995	482791	1126824	0.389
Jaipur	580	49.18	24807.88	7576.023	136053	442598	1518235	0.398
Surat	900	66	33578.61	6100.201	68462	739983	1518950	0.6
Quartile 3								
Nagpur	443	36.24	45343.62	7662.228	127490	303602	1664006	0.273
Lucknow	1010	62.97	24334.75	5382.793	179801	464991	1669204	0.623
Kanpur	1200	28.81	25159.68	7609.991	160208	399569	2029889	0.312
Pune	700	47.38	90341.26	17069.24	213164	684765	2493987	0.64
Ahmedabad	1683	29.4	59462.53	17733.25	214591	1115129	3312216	0.585
Quartile 4								
Banglore	2000	40	166177.8	32806.1	320055	1185168	4130288	0.484
Hyderabad	1566	67	184994.8	25158.89	348021	1123185	4344437	0.382
Chennai	3124	25	153392.1	31160.83	497287	1498195	5421985	0.657
Delhi	4000	46.18	292110.2	17768.15	885926	3290708	8419084	0.475
Mumbai	5355	33.43	370951.1	21284.21	752411	4436167	9925891	0.436
Calcutta	3692	18.73	230870.7	59452.6	780296	2617626	11021918	0.383

Table 3: Summary of considered variables in quartiles.

	Solid waste generation (Tn/Day)	Growth rates of cities	Total female population engaged in manufacturing & services	Population density	Other Services	Migrants	Population	Per capita solid waste generation
Quartile 1	405.6	49.912	36590.74	10904.26	77957.2	340320.4	1055881	0.418
Quartile 2	485	40.165	30968.61	7598.547	99122.67	443756.2	1245576	0.407333
Quartile 3	1007.2	40.96	48928.37	11091.5	179050.8	593611.2	2233860	0.4866
Quartile 4	3289.5	38.39	233082.8	31271.8	597332.7	2358508	7210601	0.4695

PROFILE OF JABALPUR URBAN AGGLOMERATION

Introduction

Solid waste is a localised issue¹ and any investigation related with the above needs to be taken up at a " city" level, the basic unit identified in an urban system. In light of this insight, we in this chapter describe the city of Jabalpur, which forms our case study area. This chapter aids the discussion on INSWE, in the following chapter. The chapter is arranged in three sections, in the following section we discuss the criterion for selecting the case study. Section two is a profile of the solid waste stream of Jabalpur. It also lists formal solid waste management efforts in the city. The next section mentions the formal and informal solid waste economy in the city.

I

5.1 Why Class-one Cities (Why Jabalpur)?

As we know from the earlier discussions, informal solid waste economy is an unmonitored activity. Therefore its study is constrained by the availability of secondary data. The understanding of the INSWE functioning has to be supplemented with primary data. Literature provides an extensive account of solid waste issues for four megacities, in India. There is some presence of the rest 19 metropolitan cities also, but there is no mention of informal solid waste activity in a non-metro city. The study addresses this gap in the literature by choosing to study a class one² size non-metropolitan city. As noted from the third chapter, class one size cities are growing at a fast pace. They are expected to house the majority of the Indian urban population, thus form the appropriate category to be studied.

1 Fujita (1989).

2 The percentage growth in towns and urban agglomerations over the last three decades has been 53.7 (1961/71), 51.3 (1971/81) and 67.8(1981/91) respectively. The decadal growth of urban agglomerations (UA)/ towns has been 32.80percent with the total number of UAs and towns increasing from 3,378 in 1981 to 3,768 in 1991.

As we understand, informal recycling of solid waste is not a particular phenomenon to be found in metropolitan cities alone, the actor class emergence is in a very innate way related with the process of urbanisation, to that extent informal solid waste recycling is essentially an urban phenomenon. As earlier stated a tacit assumption in the literature has been that INSWE in non-metro cities is non-existent. This proposition seems a little unreasonable in the light of the knowledge of the quantities of waste circulated in the scrap trade carried out in metro cities. Such high quantity cannot be procured solely from these cities. This highlights the neglected and uninvestigated backward linkages of this activity. The facilitators of informal solid waste economy in an urban area can be resolved into demand for reusable/ recyclable objects, mass of unemployed people and ineffective urban governance. Needless to say Indian cities, as other developing country cities conform to the presence of such. Having established that cities are a fostering ground for informal sector activities, we move to narrow down our case study area.

Madhya Pradesh (henceforth M.P) counted among the BIMARU states has been relatively less documented, especially in regard with its urban problems. The proportion of population urbanised is close to the national (23.18 *vis-a-vis* 25.72) average. Thus we choose to study a city within this state. There are twenty-three class one size cities in M.P, among them two, Indore and Bhopal are counted in the metropolitan city category with the population well above the one million mark as per 1991 census. The other twenty-one cities of M.P form the target set from which to select our case study. For the sake of logistics we chose to study the city of Jabalpur, ranked fourth in size (in terms of population) in the state of M.P.

5.1.2 Jabalpur City Profile

Jabalpur City is the foci of Jabalpur district. The city of Jabalpur occupies an area of 162.46 sq. km. inclusive of 28.49 sq. km of cantonment area and a population of approximately 9 lakhs. Situated 22 degrees 48 minutes and 24 degrees 8 minutes in the north latitude and 78 degrees 20 minutes and 80 degrees 58 minutes in the East longitude, Jabalpur has a peculiar topography, which provides it a natural drainage pattern. The drainage is divided into two parts that is. northern portion and Southern portion. The Northern plain gradually slopes from east to northwest while the southern part of town slopes toward east and southwest. The storm water of the city is channelled through Motinallah and Omtinallah, the two drains that pass through city, ultimately draining into

Pariyat a tributary of Hiran river, which subsequently joins Narmada river (Jabalpur development Plan, 1991).

Jabalpur city has one of the biggest and oldest Municipal Corporations of M.P. The city houses an estimated number of 9 lakh people, living in 2.5 lakh dwelling units. Commercially also the town is intensive with over 20 thousand commercial establishments and 110 nursing homes and hospitals (Census 1991). The population of Jabalpur recorded an average exponential growth rate of 1.87 in 1981-91, which was 3/4th of the previous growth rate (2.66) recorded in 1981-1971. The decadal variation in population was less than recorded in the last decade³. Total number of slums in Jabalpur is 328 and the population living in them is 6,44,117 which translates that almost 72 percent of Jabalpur city population is living in slums. The distribution of population by engagement in main activity as given by the CMIE is as follows

Table: 5.1: Distribution of Population by Main Activity

MAIN ACTIVITY	PERCENTAGE POPULATION
Mining	0.40
Cultivation	1.40
Agricultural Labour	1.70
Livestock	2.40
Manufacturing in Household	3.60
Construction	6.50
Transport and Storage	10.30
Trade and Commerce	21.40
Manufacturing & Processing in non Household	25.00
Other Services	27.40

Source: Centre for Monitoring Indian Economy, District Profiles (1999).

As displayed from the table 5.1 the proportions of trade and commerce, non-house hold manufacturing and services combined are the major chunk of activity in the city. A little over 5 % of the population is engaged in mining, cultivation, agricultural labour and livestock put together. As is anticipated the subsidiary activities that is. transport and construction put together constitutes the second major proportion.

³ This is explained by the observation of GOI, which maintains that urban growth in U.P, M.P. and A.P. was caused by more growth than by migration, and for Maharashtra, TamilNadu, West Bengal and Gujarat it was more by migration than growth.

In terms of access to basic facilities we find that of the total 2,22,205 households 67.01% are permanent, 32.14 % are semi permanent and 0.86 % are temporary. The proportion of households having access to electricity, toilet and safe drinking water is 46.38 while those having none of the above is 5.20, almost half of the total households' lack in one or two of these facilities. The location of the city serves to attract many people from within and out of M.P. for the purposes of employment education etc. The total number of migrants (with duration residence of 0-9 years) is 1,38,104. Of which 94,234 are from different districts within M.P. while 42,760 are from other states and 1,110 from other countries.

Jabalpur district: A brief history

One of the first mentions of Jabalpur is found in the rock edict belonging to the reign of Ashoka in 272 BC. It establishes that the district was included in the southern province of Ashoka's empire. It is also mentioned in an inscription belonging to the reign of Kalchuri dynasty in the 7th century. In 1781 Maratha's captured Mandla and made Jabalpur as it's capital which was the then capital state of Gond dynasty. In 1817 British captured Jabalpur and in 1820 Jabalpur served as the head quarter of the new sambhag, which was constituted by merging Sagar and Narmada area. In 1867 Jabalpur was connected by rail with Calcutta and three years later to Bombay. In 1909 Jabalpur tehsil was reconstituted and Patan was given the tehsil status.

Jabalpur district is a principal mining area of the state and in 1956 with 38 sawmills was the biggest centre of forest based industries. It also featured as a textile centre, with all the 304-powerloom establishments in Jabalpur City. Of the 87 handlooms, 81 were located in the city of Jabalpur. Gun carriage factory was established in 1905 followed by the Vehicle factory and Ordinance factory in the decade of 1951/61. Post and Telegraph Department has a workshop in Jabalpur city for the production of postal articles including telephones. As is clear from the above account, Jabalpur city has been the centre of activity in every era, the tradition still continues and even now the city tends to attract people both from within and out of the state.

Table: 5.2: Population Growth in the City Over the Decades

CENSUS YEAR	POPULATION	% GROWTH
1901	90,316	
1911	1,00,652	11.44
1921	1,08,793	8.09
1931	1,25,382	14.53
1941	1,73,334	43.38
1951	2,56,998	44.11
1961	3,67,014	42.81
1971	5,33,751	45.73
1981	7,57,303	41.83

Source: Town Planning Department, Jabalpur.

Jabalpur the Planned area

Jabalpur, a major urban conglomeration of central India is a congregation of Jabalpur city, Jabalpur cantonment and Khamaria township. The development plan for Jabalpur was conceived in 1975-76 and implemented in 1991. The basic postulates included among others, decentralisation of activity zones and optimal use of urban land and efficient solid waste management. However an evaluation of the implemented plan in 1994 revealed that, of the estimated land requirement of 8649 hectares for a population of 11 lakhs in JDP-1991, only 4520 hectares of land was developed and the total population was found out to be 7.65 lakhs. The land utilisation rate which was envisaged to be 3.30 (that is, per thousand population the developed area should have been 3.30 hectare,) [but it] was found to be 2.73 which shows densification. Likewise in all the categories we see that the land use has intensified which is denoted by the negative variation in area and landuse rates.

Table 5.3: Category wise Distribution of Land Use

SL. NO.	LANDUSE CATEGORY	LAND USE 1975		LAND USE 1991		LAND USE 1994		+/- VARIATION	
		Area	LUR	Area	LUR	Area	LUR	Area	LUR
1.	Residential	1503	3.40	3635	3.30	2328	2.73	-1307	-0.57
2.	Commercial	68	0.15	512	0.47	124	0.15	-388	-0.32
3	Industrial	263	0.59	707	0.64	368	0.43	-339	-0.21
4.	Public facilities & Utility Services	511	1.15	1124	1.02	714	0.84	-410	-0.18
5.	Recreational	39	0.09	886	0.81	129	0.16	-747	-0.65
6.	Transportation	645	1.46	1785	1.62	847	1.00	-938	-0.62
	Total	3029	6.84	8649	7.86	4520	5.31	-4129	-2.55

Note: The area is in hectares. LUR is the Land Utilisation Rate in Hectare/1000 population. Variation reported is in between the 1991 and the 1994 figures.

Source: Jabalpur Development Plan

The 1994 evaluation of Jabalpur developmental plan, also revealed that the level of implementation in commercial, industrial, recreational, public facilities services and transportation has declined compared to the estimated level of land use in various categories resulting in densification and substandard social infrastructure. The sectors of residential and commercial areas also show a shortfall of 1307 and 388 hectares of land respectively. The new plan entitled “The development plan for Jabalpur (JDP) 2005” is evolved on the basis of JDP-1991 and envisions a system of self contained city entity to accommodate the future growth of the city population. The population is estimated to be 1.2 lakhs and the future growth of the city is planned towards north –west, west and south direction.

With the aid of the above discussion, we get the idea of population growth, occupational structure and settlement pattern of the city. It also points towards the densification of the city and deficit of planned area in important sectors of housing and transportation in the city. This amounts to congestion and related urban problems, which include the problem of solid waste. The next section is a brief discussion on the waste stream of Jabalpur, this helps us to hypothesise about the informal waste economy conditions.

II

5.2.1 Waste Characteristics in Jabalpur

The composition of solid waste in Jabalpur is expected to be intensive in industrial waste. This is due to the absence of infrastructure for industrial waste treatment. There is no updated data available on the physical and chemical characteristics of waste generated in Jabalpur, the following table helps us to see how the waste quality has undergone a transition according to the urbanisation process as experienced by the city.

Table: 5.4: Selected Physical Characteristics of Waste Recorded for Jabalpur in Different Years⁴

CATEGORIES	1971	1973	1977	1985
Paper	2.02	2.01	N.A.	
Glass	0.35	0.36	0.12	0.12
Metal	0.38	0.39	0.11	0.11
Moisture content (% by weight)	16.6	16.67	16.67	
Nitrogen as N ₂ (%)	N.A	0.64	1.06	0.895
Phosphorus as P ₂ O ₅ (%)	N.A	0.65	1.14	0.5
Potassium as K ₂ (%)	N.A	0.77	0.92	0.5
Carbon (%)	N.A	N.A.	36.78	22.48
C/N ratio	N.A	N.A.	34.7	25.08
p ^H	N.A	N.A.	7.39	7.4
Total Compostable Matter	40	39.87	53.57	63.55
Density 395 kg/m ³				
(*) 19 61/71 (32.36)	1971/81 (30.41)		19 81/91 (20.52)	

Note: N.A means not available. * indicates percentage decadal variation in population

Source: Adapted from Dubey (1985)

It is worth noticing how the proportion of metals drops with the time, as shown by for year 1971/73 to 77/85. It will be helpful to recollect that post independence, Jabalpur went through its stage of industrialisation in the decades of 1951-71. This led to the establishment of two factories in Jabalpur, which is also reflected in the metal proportion of the waste stream in 1971 and 1973. We see a reduction in the metal composition, in the late seventies and early eighties. This is partly explained by the fact that there was no realisation of scrap utilisation by the factories. The observation of 1971-73 is a reflection of the same. Industrial waste was released outside the factory premises in large quantities. It is in this decade that we see the initial setting up of scrap establishments especially in scrap iron (a detailed analysis is followed in the next chapter). The proportion of metals in waste went down drastically after the practice of auctioning factory waste started which is very much evident in the proportions, which decrease 1977 forth. The total compostable matter proportion in the waste continued to show an increase, while the C/N ratio an indicator of the compostability becomes more favourable in the later years. The bulk of total compostable matter is increasing, reflective of the increasing number of population in the city. This is summed up by the average annual growth rate of the population, which was noticeably higher for the 1971-81 period than any other. This discussion has been

⁴ The data is gathered from different studies and we are not sure of the actual numbers but as our interest is

limited to a profile of waste through the years for the want of temporal data concerning solid wastes.

The following table helps us to view Jabalpur waste stream in comparison to other cities of comparable size group. The data quoted here is from a study by Dayal (1994) which gives us the variation in waste stream according to the population.

Table: 5.5: Summation of the Waste Stream Characteristics for Jabalpur and Other Cities Collective

Categories	Cities (Population 5-20 Lakh)	Jabalpur
Ash And Fine Earth	41.81	32.52
Carbon	11.95	22.48
Glass	0.44	0.12
Metals	0.64	0.11
Nitrogen	0.50	0.89
Paper	3.8	3.1
Phosphorus	0.67	0.5
Plastics	0.81	1.36
Total Compostable Matter	40.15	63.55

Note: The year considered for Jabalpur is 1985.

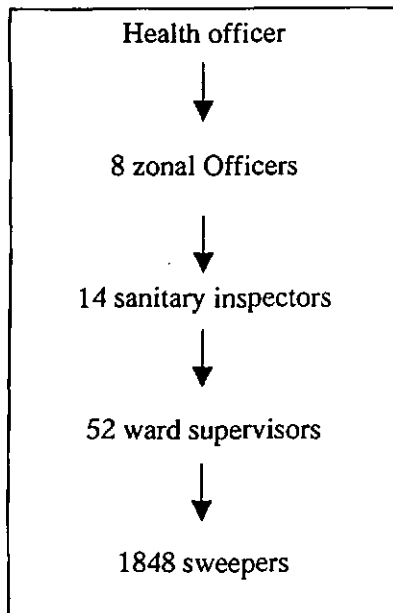
Source: (a) Dayal (1994), (b) for Jabalpur, Dubey (1985)

The above table shows a similarity of paper, phosphorus and nitrogen proportions. In the categories of metals and glass Jabalpur scores less than the expected value while in the remaining it is visibly higher than the other cities. Thus we can say that Jabalpur conforms to the waste stream characteristics of cities comparable in size although not very strictly.

5.2.2 Jabalpur city: The formal system of Waste Management

Public Health Engineering (P.H.E.) department is concerned with the management of Solid Waste in Jabalpur. The health officer is in charge of the management of all the activities concerning health; one of which is solid waste. The city has been divided into 8 sanitation zones excluding the cantonment area, for which there exists a parallel administration which is independent of the municipal administration. The hierarchy of the solid waste department of the municipal administration is as follows.

in the composition of waste these figures suffice as proportions.



Presently 1848 sweepers are engaged for cleaning and collection of garbage. They are paid a monthly salary Rs. 3850. The sex ratio of workers is balanced but there is an excess of women in sweeping. Men alone do the task of collecting and transporting waste (approximately 25) to the dump site. Two zones (16 wards) are contracted out to a private contractor, therefore the total number of wards to be served by the municipal authorities comes to around 44 (the city is organised into 60 wards). Details about the functioning of the private sector concerned were not furnished by the municipality. There is no information on the number of employees, but during the

field survey it was found out that workers are employed @1500/month and there are no women employed.

Solid waste management Operation: Starting from the lowest grade in the hierarchy, the sweepers are responsible for collecting the litter on the streets and depositing them in the community bins provided by the municipality. Work of sweeping 600 kilometres of Jabalpur's urban space is assigned to the sweepers in units called "beats". These are based on residential density, normally ranging between 300-320 running meters⁵. As we can see the norms of work coincide with a high-density area range. However, Jabalpur records a medium density of 430 persons/sq. kms. This indicates to us that there is excess sweeping staff on the roads. Workers are provided with a handcart and broom to collect waste but no orientation is given to them on the methods of handling waste, which is inclusive of hazardous material⁶. Ward supervisors are placed to inspect the work of the sweepers; they have a field job of supervision. They are headed by sanitary inspectors who are in charge of co-ordinating the operations on field, they report to the zonal officers on the

5 The working norms specified for sweepers in the report by expert committee on solid waste management constituted by the Supreme court of India (1999) are

High density area:250-300 RMT

Medium density area:400-600 RMT

Low density area:650-750 RMT

6 There is no facility for treating hospital or industrial waste in Jabalpur, thus the waste stream is expected to be inclusive of hazardous wastes.

status of ground operation. The city has 8 sanitation districts and each zone is headed by a zonal officer who directly reports to the health officer. S/he is responsible for the total activity within a particular zone, which comprises of more than 5 wards each.

Transportation: There are 650 collection spots in the city, 630 dust bins for collection of solid waste and 16 vehicles for transport which include 6 tippers, 2 hydraulic tractor-trolleys, 4 dumpers and 4 old model tractor trolleys. There is no official record on the amount of waste generated. Depending on the load of waste that is collected and the estimated amount which is left unattended, the figure of solid waste generated in Jabalpur works out to be 400 tn/day. Every vehicle takes 6-8 trips per day and according to official estimates only 150 tons of the total waste is collected⁷. Of this the formal system has a vested capacity to transport a mere 150 tn/day, and there was no evidence found to believe that this capacity is fully utilised.

Disposal: The official dumpsite is located centre north of the city where a water body is currently being reclaimed by dumping municipal solid waste into it and a sports complex is planned for the reclaimed area. The method of waste disposal into the water body in this way is harmful to the environment and a continued practice of the same⁸ is going to be disastrous for the city's groundwater. Thus we see that the management of solid waste in Jabalpur suffers in all the three activities of collection, transportation and disposal. Ineffective, unaccountable provision of garbage removal and disposal scenario as evident in the city, provides a suitable condition for the informal solid waste economy. In the next section we take a look at the formal and informal solid waste economy of Jabalpur City.

III

5.3.1 Jabalpur city solid waste economy

Formal solid waste economy: The formal sector of waste handling in Jabalpur does not involve itself in any economic activity, that is to say that in terms of waste economy it is

⁷ There is an inconsistency revealed as capacity and frequency of vehicles transporting waste falls short of the official estimate of collected waste. Capacity utilisation is also understood to dip due to improper maintenance of vehicles and absenteeism of employees.

⁸ According to Jabalpur city plan document, of the 23 water tanks identified under the municipal corporation area of Jabalpur, 14 are lined to be reclaimed by dumping waste. The reason given is the high level of eutrophication in these water bodies which is problematic to the urban environment.

inactive. The opportunity cost of this inaction is actually quite high as is demonstrated by the following table in which calculations based on the calorific value of the constituents are made. The table provides a calculation of the energy savings that could have been made by the formal sector.

Table: 5.6: Energy Savings by Recycling: The Opportunity Cost of Formal Solid Waste Economy

Material(A)	Percentage of component in the waste stream	Total quantity in waste stream	Energy equivalents Mega joules/Tn	Total energy in Mega joules
Polythene	0.25	1.15	75479	86800.85
Glass	0.12	0.552	582	291
Metals	0.11	0.506	17857	89289
Total compostables	63.55	292.33	4215	1232
Total				177612

Source: (a) The proportions of materials for the year 1985 taken from Dubey (1985), (b) energy equivalents taken from Young and Sachs (1994).

Informal solid waste Economy

The city of Jabalpur is conspicuously marked by the presence of a large informal sector active in recycling and reusing of waste procured from within and around Jabalpur⁹. Solid waste activity is visibly intensive in the old part of the city, or what is visibly the core (we detail the discussion in the next chapter).

Sum up

The chapter is an introduction to the case study area and the urbanisation trends associated with it. The development of urban space as envisaged in the development plan has not been commensurate with the growth of the city, this has led to congestion and related problems. The formal sector engaged in solid waste management is profiled which unveils the underemployment of the sweepers working in the city. The disposal of the waste by the formal sector and the future plans in this direction reveals an ecological disaster for the future. Coexisting with the formal sector is the informal sector. We proceed with the discussion on the informal solid waste sector in the next chapter.

⁹ As gathered from the field survey.

INFORMAL SOLID WASTE ECONOMY OF JABALPUR CITY

Introduction

In the previous chapter we presented the socio economic and related urbanisation variables of Jabalpur city. We also discussed the waste stream characteristics and their alteration through the decades. Building on earlier discussion this chapter focuses on the activities that are carried out in the local solid waste market. We also look at the manifestation of urbanisation experienced by the city on the functioning of informal solid waste economy (INSWE). This chapter is arranged in five sections, section 1 provides the theoretical aspects related with the formal informal dichotomy and informal market operation, followed by the method of our survey and its design. Section 2 is devoted to the discussion on the arrangement of the activity within the city and its intra urban location. Section 3 deals with each actor category and discusses some distinct variables for each actor class, this section also contains a case study in each actor category, to build a clear picture of the actors involved. A general discussion on the actors and the evolution of INSWE with the urbanisation process is attempted in the fourth section followed by the summary of the chapter.

I

6.1 Theoretical background

INSWE is the non-acknowledged section of the larger solid waste economy in a city. However the activity has a significant role to play not only in the context of local urban habitat where it proves as a holding sector for the in-migrants (Bierbeck, 1978, Bhattacharya and Kundu, 1998) and provides sustenance to the local poor but also in the larger materials cycle of the ecosystem. In this chapter acknowledging their role we trace the backward linkages of INSWE to its four principal actors and their activity. However before doing that, let us turn to the theoretical frame of reference, to aid the examination of the issue.

Frame of reference

In literature the term "informal sector"¹ was first used by Hart (1971) on observing the market structure of Ghana. This was formally endorsed by the ILO-WEP in the Kenya mission where the characteristics of formal and informal sector were delineated². The following studies made by ILO on informal sector unambiguously recommended the regularisation of the informal, sector. The main assumption being that the negative attitude of the government is the only obstacle to the growth and prosperity of this sector. However such conclusions neglected the complex competitive and subordinate relationships of small enterprises with the large ones³. This brings us to the nature of relations between the formal and the informal sector, a review of the studies reveals that the informal sector has a subordinate relationship with the formal sector which affects the extent of growth prospects⁴ for the sector⁵.

Nature of the informal markets can be understood contingent on their working within oligopoly conditions or not. In an oligopolistic environment the evolution of market passes through different phases where informal sector activities expand or contract depending on the forces of demand, minimum scale of operation, size of the establishments and different scale of operation.

1 ...a loose way to describe a wide range of economic activities by small firms, households and individuals which are to a varying degree integrated with organised sector (Jagannathan, 1987 pp-4)

2 Informal sector is characterised by Ease of entry, reliance on indigenous resources, family ownership of enterprise, small scale of operation, labour intensive and adapted technology, skills acquired outside the formal school system and unregularised and competitive markets (Dipak Mazumdar, 1976).

3 Various implicit or informal contracts through personalised interchanges become methods of circumventing the problem of imperfect information during production and exchange (Jagannathan, 1987).

4 The dynamic change in the informal sector in terms of absorbing the increased number of agents can be *Involuntary*: labour supply occurs in a context of static or very slowly growing output per head and capital accumulation & *Evolutionary*: a rapid output growth and capital accumulation (Moser, 1978).

5 The ingenuity of the informal sector to make a living out of a situation of lack and access to resources and to markets and their capacity of survival under the unfavourable conditions was for the initiators of the discussion on informal sector proof that they have the potential of further developing their activities. The question as to where this potential growth is located and what are the areas to which the policy should be directed are strongly linked to whether the informal sector is a autonomous sector or is integrated with the economy (Bromely, 1978)

For those activities where a trend to oligopoly seems unlikely⁶ (usually service sectors), an expansion is not rapid and income improvements based on changes in productivity are unlikely. As Beinfeld (1975) notes, “if other activities do not pass the benefits of productivity gains in terms of prices then a form of unequal exchange will develop against the service workers (transport, sanitation service providers etc)”.

The service workers include informal solid waste sector actors, which form the concern in the present study. Literature reveals that exchanges in the informal sector are carried out with the help of behavioural relations⁷, which define the rules of business in the market economy. Behavioural relations by creating expected utility can act as sources of wealth generation during either production or exchange. In the unorganised markets, behavioural relations are primarily of two types. They can be either a vertical, patron client (hierarchical) or horizontal (in the same hierarchical level) within the informal groups. Hierarchical relations change with the uncertainties of market exchange. The uncertainties in market exchanges can be traced to informational problems, risk and weakness of legal structure⁸. As displayed in the third chapter there is a hierarchical set up, in the informal solid waste sector within which the expectation of horizontal exchanges are maximised when the actors pool the risks. These exchanges determine not only the extent to which the sector is able to generate wealth but also helps us in formulating instruments of institutional intervention for the sector. Thus we need to discuss the interlinkages in this sector in order to place the efficacy of any alterations advised for these sectoral exchanges. With this background, we move into the description of solid waste sector in Jabalpur. First we discuss the methodology of primary survey and the design.

6.1.1 Methodology Adopted and survey design

Stated in earlier discussions is the unregularised nature of the INSWE, thereby making it difficult to characterise its working with quantitative variables. Added to

6 Within those activities which do not presently have an oligopoly set-up a distinction can be made between sectors which can expect oligopoly markets from those which do not.

7 In the absence of defined and smooth functioning of markets in a developing country “behavioural relations” become important for the transactors in the markets (Jagannathan 1987, pp-3).

8 *Ibid.* pp-11

that, as our intent is to note the influence of urbanisation on the local solid waste economy, secondary data even if available would need to be supplemented with primary information. Keeping in view the heterogeneity and flexibility of actor activity, which is given in the literature⁹, the task was to draw out a representative sample for a statistically meaningful exercise. In order to accomplish this the snowball method was used which was earlier utilised by Iyer and Dhanalakshmi (1998) in their work on Chennai. This method of survey proved to be advantageous because the actors were less defensive in the course of information retrieval, which ensured a better quality of information collected. Each actor was asked to name as many agents as they can in the immediate backward and forward activity group and of these a maximum of five names and a minimum of one name was followed up for investigation. A pilot survey done earlier revealed the following approximations of actor populations involved in the activity: waste pickers (1200), itinerant buyers (800), retailers (150), wholesalers (25). Assuming that the modus operandi would differ more at a higher level of material aggregation (that is. at the retailer and wholesaler level) we aimed at covering 10% of the total population of these actor groups. For the waste pickers and itinerant buyers we do not expect a very different mode of operation therefore we decided on a 2% coverage each of the approximated population. Thus, in total 103 samples were collected of which 100 are being used in the following analysis. For the purpose of the study, four categories of identified actors were inquired about their daily activities. A structured questionnaire was devised for the waste pickers and itinerant buyers. In this, the range of information sought featured their socio-economic status along with their views on co-operation, group selling, exploitation etc. Retailers and wholesalers were not approached with a structured questionnaire as it was thought that this would intimidate them and affect the responses, therefore informal interview as a mode of information collection was deemed appropriate.

In order to ensure congruity of the interviews and a systematised collection of variables respondents were approached with a checklist of variables. The range of information collected includes the general socio-economic information along with

⁹ The classification of actors as given by Aziz, (1984); Furedy (1992).

activity specific variables like choice of location, the impact of scrap import on the trade in the recent decade etc. The actors were also asked to estimate the total size of the agents active in INSWE and the amount of material transacted in the market. A mention here is warranted about the quality of the information collected. In the course of the survey, some amount of information could not be retrieved properly because of the presence of external factors like the presence of retailer or wholesaler while the questionnaire was being administered to the buyers and pickers. Other times it was an unwillingness of actors to talk about the activity. The data is plagued by huge amounts of under-reporting especially by the retailer and wholesaler category who fearing legal action under-report the returns from scrap trade. These we realise have limited the results of the study. Having discussed the framework and the methodology of the survey, we proceed with our discussion of the activity in INSWE.

II

This section gives an outlay of the activity circles and the role of agents in it. It also provides the details of solid waste market within the city and gives an idea of its evolution through the decades.

6.2 Arrangement of Activity

The following flowchart is a graphical representation of the activities and actor levels in local INSWE. The basic idea for this was provided to us in the work of Baud and Schenk¹⁰ (1994). In the following flowchart the agents responsible for enriching waste stream are collectively termed here as "retrievers". Conventionally only itinerant buyers and waste pickers are understood to be functioning as retrievers but in the context of Jabalpur we identify three additional categories, they are

- Private sellers: They channelise the stream of waste from households / shops to the retailer directly, usually members of the households, shop owners etc. This tendency stems from the knowledge of unfair dealings of itinerant buyers and the monetary worth of household and commercial scrap. It is therefore necessary that

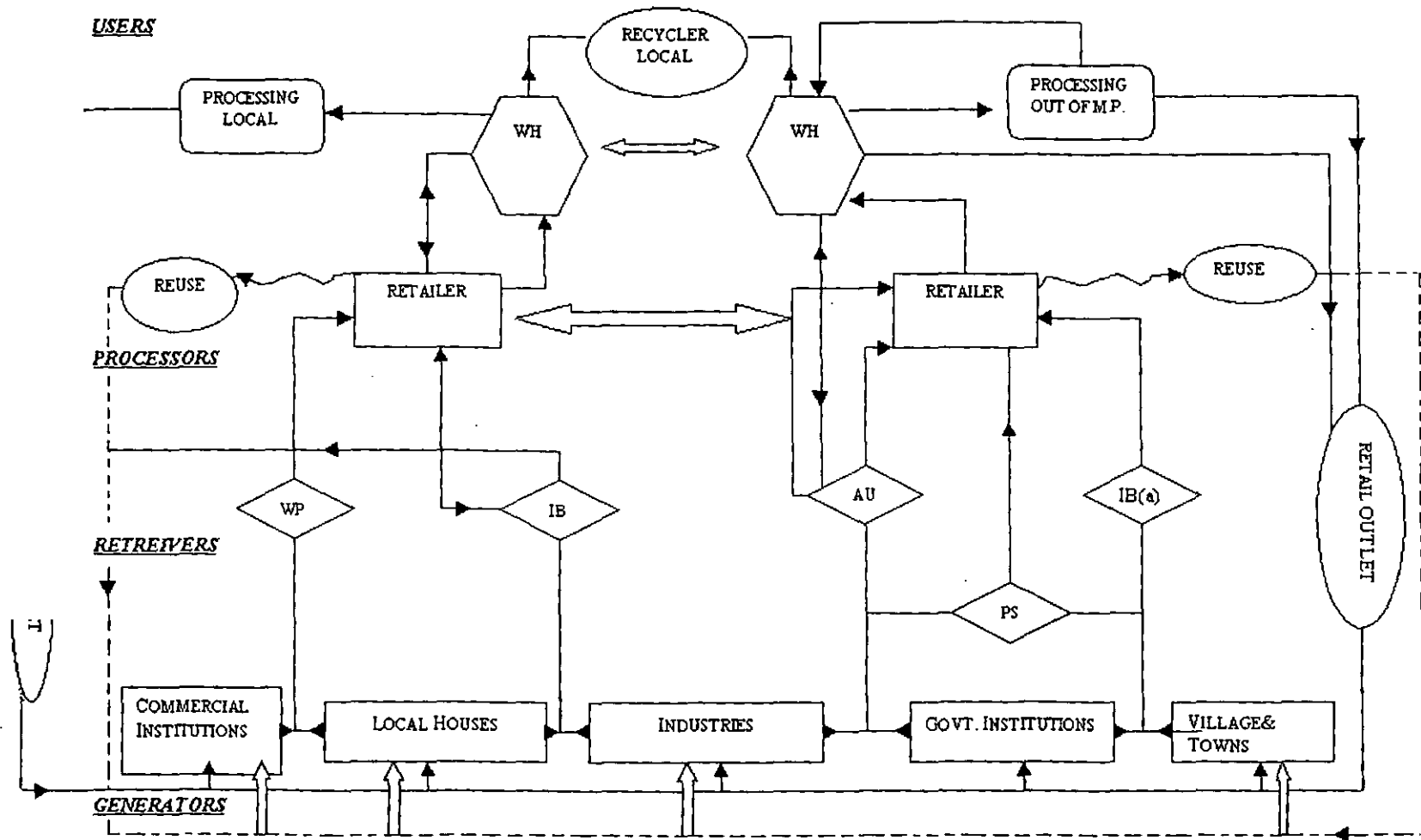
¹⁰ The original diagram is given in the second chapter.

we take into account this set of actors who are important in the trade albeit passive.

- Itinerant buyer (a): This class of itinerant buyers comprises of actors who buy waste from commercial institutions and small workshops, generally specialising in only one category of waste. They are economically of a better standing when compared with other itinerant buyers, in the sense that they have a larger working capital and the days of work may depend on seasons, or it might be a weekly involvement. People who are full timers in some other petty trade in order to augment their income carry out this activity. In the context of Jabalpur they stand to be mentioned, as they are instrumental in bringing the institutional waste in the market along with private sellers.
- Auctioneers: This is the most illustrious category of retrievers, which dominated the scrap iron trade in the earlier decades but now are a rare genre. This is a category with a visible overlap between two activities namely wholesaling and retrieving. Instrumental in the "virtual-extinction" of this category is the decline in the industrial activity of Jabalpur in the recent decades. Industries face a slow death as the Government has curbed the scale of production, which reflects in the decreased quantity of scrap being handed down into the local waste market and also as the open auctions are replaced by closed tenders.

Like the retrievers, retailers are also identified into two separate strata. One group is that of small retailers, generally poor and illiterate, having a rented place (a makeshift arrangement), and the other stratum, which is more literate, own their establishment, and employs more than 5 people. These are some of the evident differences among the two, the other categorical difference and the one for which we are making a distinction is the outsourcing of waste. Some of the latter category retailers are also small time wholesalers, they occasionally supply material to the recyclers / factories (discussed later).

Diagram 2
FLOW CHART OF INSWE IN JABALPUR



The flow cart is arranged in the following order. Activity interactions are shown between four sets of actors namely, Generators, Retrievers, Processors and Users. Local households, Industries, Government institutions (railway junction, state electricity board etc.) and commercial institutions form the localised generator class while the surrounding villages and small towns form the outside generator class. The waste generated by them is collected by the retrievers, that is, waste pickers [WP], itinerant buyers [IB] and private sellers [PS], which is passed on to the processors, (retailers [RT] first) who add value to it by subjecting the material to some initial primary processing etc. INSWE also records reuse, which operates from the level of itinerant buyers' upwards. In the flowchart this is denoted by the zig zag arrowheads. Reuse of scrap (dotted line) is channelled via retail outlets and is utilised by certain industries and low-income households. The retailers pass on this material to be forwarded to the wholesalers [WH], who process the material, either locally or send it outside for the processing. The recycled material again traces its way into the market via the retail outlets and some of the wholesalers themselves are found engaged in the marketing of recycled material. We also note the possible mutability of

(IB \longleftrightarrow Retailer) and (Retailer \longleftrightarrow wholesaler) shown in the flowchart with a similar arrowheads, while (\longleftrightarrow) indicates (horizontal) exchanges between the two actors in the same tier (please see the flowchart attached). We briefly discuss the intra urban location of the activity in order to supplement the discussion of actors taken up further.

6.2.1 Area

Before we further the discussion let us view the intra urban location of the activity. The city area has been divided into 60 wards under the Jabalpur Municipal Corporation (inclusive of the two factory townships) and excluding 7 wards in Cantonment Area. For our ease we divided the city into five zones. Following are the zones identified (see the map1 in appendix)

Zone I (Centre) Ward number 1-15

Zone II (Centre North) Ward number 16-31

Zone III (East and Southeast) Ward number 32-46

Zone IV (West and Southwest) Ward number 47-60

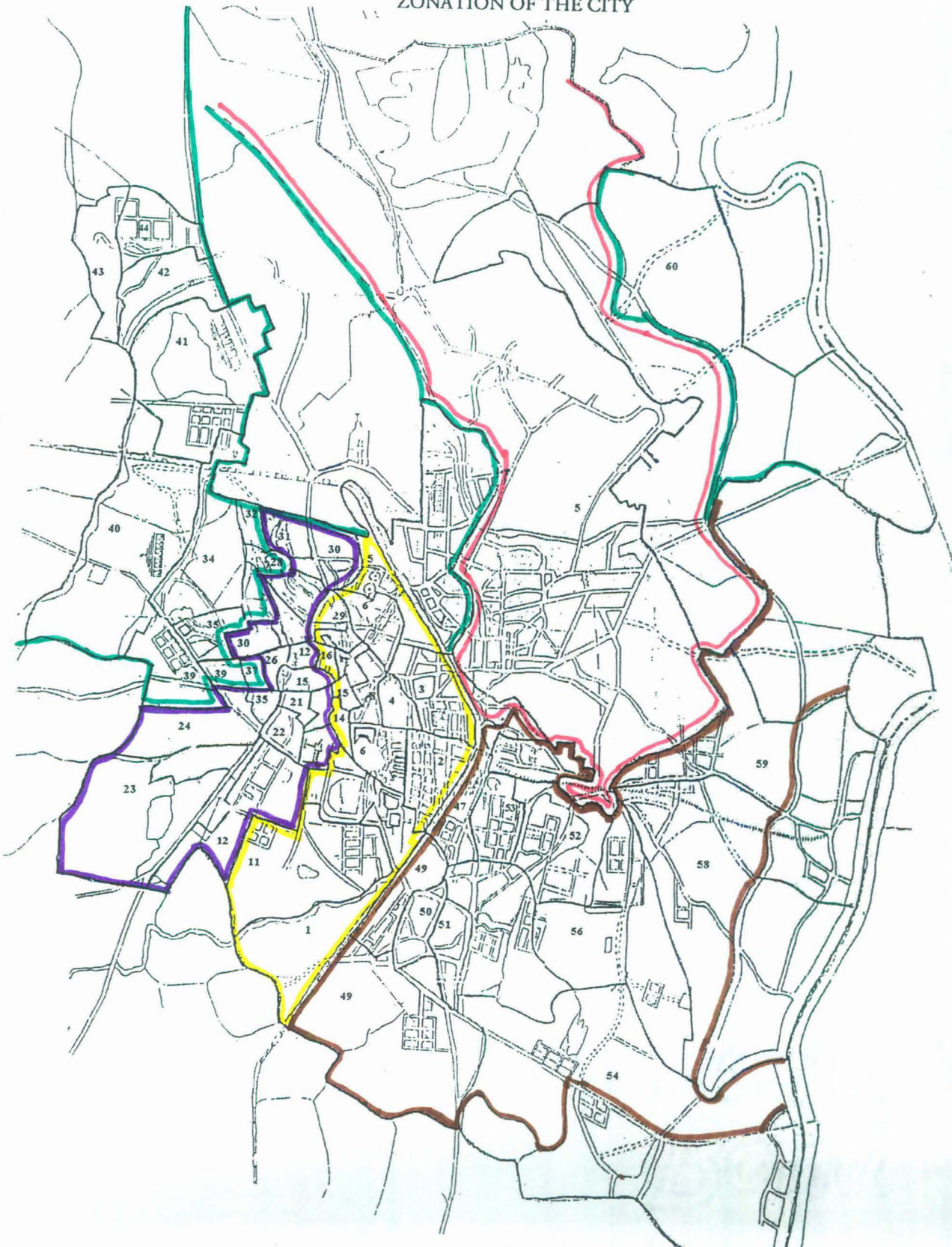
Zone V (Cantonment Area)

This is done to note the areas, which show concentration of actor activity¹¹. As revealed with the aid of the maps, we find a concentration of trading activity as well as high slum population in what can be termed as the city centre (map number 2). The third map gives the slum population of the city.

The waste market, in the last two decades has evolved in response to the change in local economic and social scenario. This evolution has been twofold, firstly trading has become more specialised that is there is a marked trend from generalised to specialised trading. Jabalpur has become a trade centre for different categories of waste and there is an increased flux of agents in the trade. This is experienced at every stratum of the activity chain. The second feature that is distinctly displayed is a dispersal of trading activity, there is an increased fleeing of agents away from the start up area. When traced back with the help of local anecdotes scrap trade can always be located in the main market of Gurandi. Today the scenario in the initial market area is

¹¹ It is seen that the concentration of agents and activity is in support of the urban expansion trend which includes the large influx of poor minority groups towards the centre of cities, while the rich and middle income families move to the sub-urban rings. (Kasarda and Berry, 1977)

ZONATION OF THE CITY



— ZONE 1

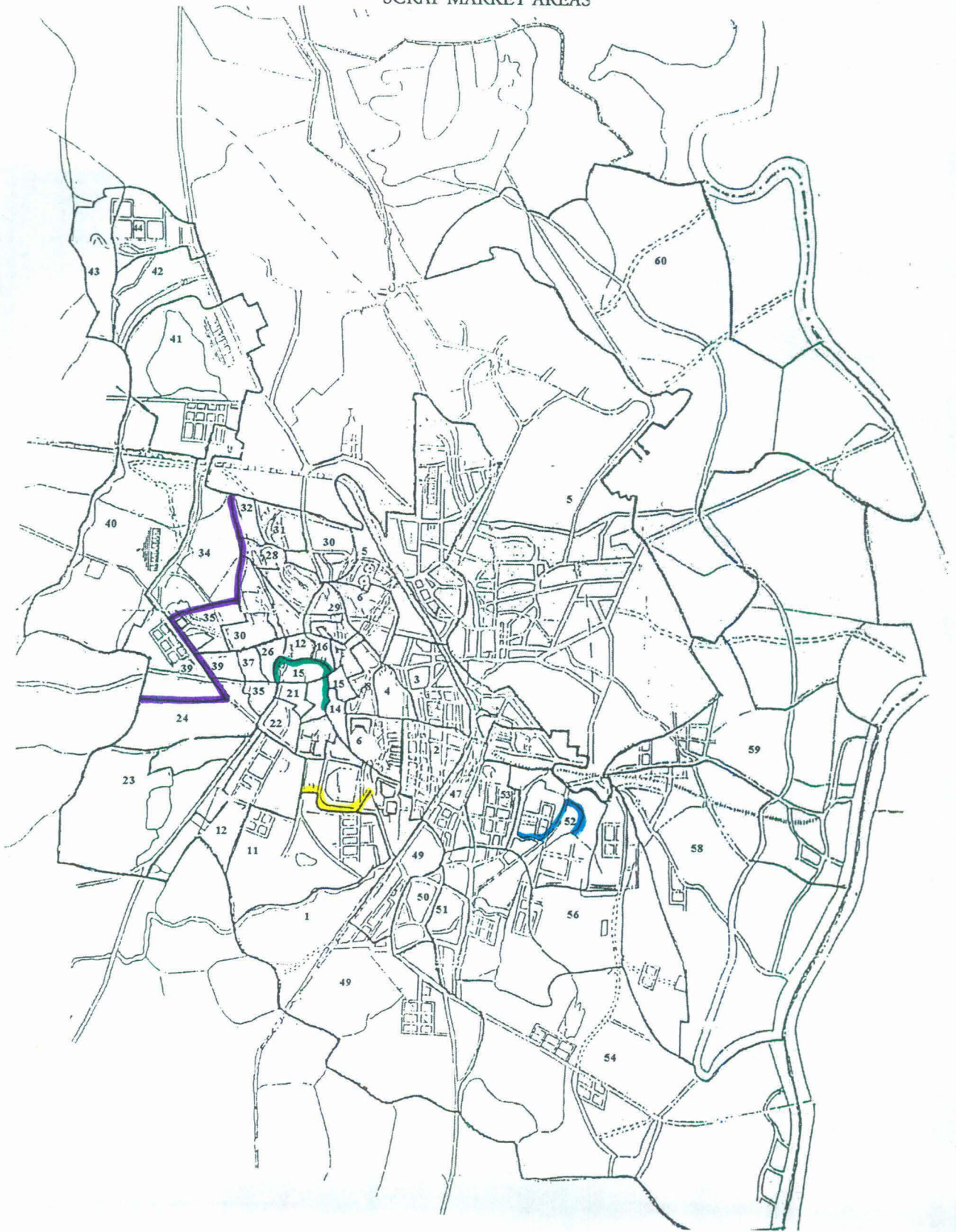
— ZONE 2

— ZONE 3

— ZONE 4

— ZONE 5

SCRAP MARKET AREAS



- INITIAL MARKET
- RANITAL
- MADAN MAHAL
- ADHARTAL

WARDS WITH HIGHER SLUM POPULATION



SLUM POPULATION

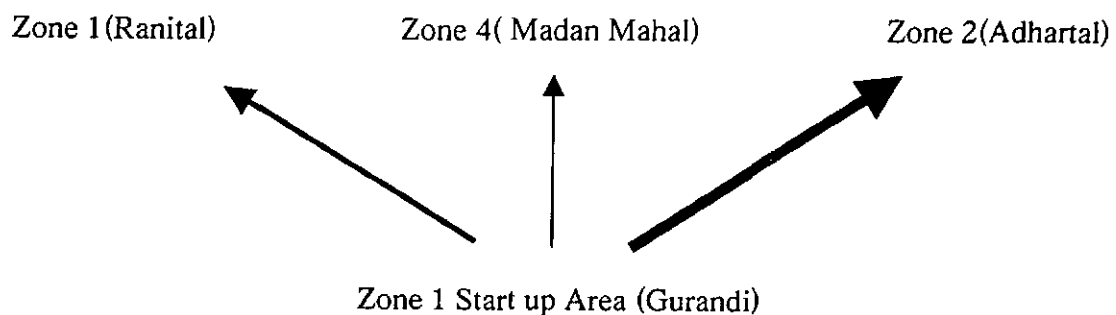
● MORE THAN 10,000

● MORE THAN 25,000

dismal with only a few sheds remaining. One wonders what caused these agents to leave the market?

Partially the process was catalysed by an administrative initiative as a follow up of the Jabalpur Development Plan. In which the area was claimed to be in the category of "inefficient and incompatible land use in central area of the city" and a retail market was proposed to be built on it¹². Prior to the evacuation, the land was mainly occupied by small retailers, however the exodus of bigger players in the market from this area had begun since the late 70's towards the centre north (zone2) which was then a periphery area of Jabalpur and closer to the Industrial establishments. The reason for this movement in the early 80's is largely attributed to land availability and also to the lack of space in the burgeoning main market at the city center¹³. However strictly following the above, the activity area should have moved to the new location that is. Zone 2 (Adhartal) but a fragmentation took place and now the current scenario is that the activity is identified three main areas across the city.

Among the three areas identified, the concentration of activity in the market area of (zone II) Adhartal is the highest and since most of scrap trading is done in this area we choose to mark this area as the principal area.



Attributed to the presence of two factories, electricity board, and railway junction the city has the highest involvement of agents in scrap iron trade. Another interesting

¹² Reference is made to the Jabalpur Development Plan 1991.

¹³ We note the similarity with the conclusions drawn by (Lowder, 1986).

facet of the story is that Jabalpur has a healthy presence of transport agents also, as it is a centre of grain trading. This has contributed much to the growth of the waste economy of the city. Jabalpur is also a channel through which waste generated in the hinterland of the city and the scrap from other smaller urban centres is passed on to recycling industries within the state as well as outside. Thus the waste economy of Jabalpur is responsible for circulating the waste generated in not only its geographical boundaries but also in its area of influence¹⁴. Secondly in this process the economy offers employment to people in these smaller cities as well as to the number of agents involved in transporting the waste. According to us the actual number of people associated with this activity exceeds the number of agents guesstimated in the city alone. The discussion on various actors in the INSWE is taken up next.

III

6.3 Actors

We proceed on with a discussion of each individual category of the actor group, but before going to that some basic demographic variables of the sample are summarised in the following table.

Table: 6.1:A Summary of select Demographic Variables for Actors

Actors	Sample Size	Range of age and averages	Proportion of actors according to gender		% distribution of actors according to religion			Proportion of migrants in each actor class
			Female	Male	Hindu	Muslim	Others	
Waste pickers	30	8-60 (35)	74	26	94	6	Nil	32
Itinerant buyers	14	13-62 (26)	Nil	100	21	79	Nil	17
Retailers	42	21-70 (39)	Nil	100	28	67	5	16
Wholesalers	14	22-70 (45)	Nil	100	36	43	21	21

Note: The figures in parentheses are averages.

Source: Survey data

¹⁴ Area of influence is understood here as the impact of an activity beyond the geographical boundaries into the hinterland.

The above table 6.1 is visibly marked by the exclusivity of male participation in all but picker category. To this extent one can conclude that the local INSWE is dominated by men. The other noticeable feature is the range of actor ages in the table; which ranges from 8 to 70 years, indicating the heterogeneity of actor composition. The average age however has a comparatively low spread between 26 to 45. Note that itinerant buyers' records the lowest average age even though it is the waste pickers who register the youngest actor. This is to say that the active participation of young actors is more in the actor category of itinerant buyers.

It is evident from the religion wise distribution of workers that Muslim community dominates activity in all but one actor group (that is waste picker section). Interestingly the proportion of Hindu's and other communities increases up the hierarchy. Notice the increase in the percentage of others category in the wholesaling section, it is a double of their recorded involvement in the adjacent retailer section. Also interesting to view is the proportion of migrants in each activity class. Waste pickers clearly emerge as the class with the highest number of migrants followed by the wholesalers. To put the picture together we now know that women dominate waste picking, we assume from the literature (Baud and Schenk; 1994; Kundu and Mazumdar, 1998; Chikarmane, 2000) that their engagement in picking is solely to augment the household income, and is not the main activity of the household, which these women represent. The ratio of migrants in this category suggests that a third of waste pickers now active in Jabalpur are in-migrants and not locals. This indicates that INSWE functions as a holding sector quite like any other informal sector in which entry is not restricted. However the same is not being implied for the wholesalers. Coming back to the remaining classes of retailers and itinerant buyers, we find that 70% of the total Muslims in the INSWE sample are concentrated in the above two activity classes. These are in majority local actors (with low levels of migrants) and function at a level of hierarchy, which is not the most rewarding. In what follows we describe the actors in our sample set.

Retrievers: Though we have diagrammatically shown the presence of three other categories in this activity class, a discussion of the itinerant buyers and waste pickers would suffice for the purposes of the study.

6.3.1 Waste pickers

As noted earlier (in table 6.1) the activity class of pickers is dominated by women. The work experience of the actors ranges from 3 to 52 years. The modal class is that of actors reporting 10 to 20 years (39%) of work experience with an equal proportion of actors showing experience of less than 10 years and a fifth registering more than 20 years of work experience. Within the larger homogeneity of gender, the group is marginally heterogeneous; which is shown here with the help of literacy levels. More than 80% of the pickers are illiterate, of the remaining twenty percent, a half have had education upto 4th grade and a third each feature in the middle (till grade 8) and high (till grade 12) levels. Of the 30% of migrant actors a majority were found to be from other districts within M.P. while only a third were reportedly from other states. This indicates that the migrants are basically from other districts within the state and come to the city because of what is known in the literature to be the rural push and urban pull factors.

In order to check the feature of INSEWE as, an adsorbent of retrenched labour the actors were asked, if they were previously employed and the reason for leaving it. It was found that about 25% of the actors were earlier employed and 4/5th of them cited unprofitability of their earlier engagement as the pressing reason which forced them to step into waste picking. When investigated further, a majority of these 25% actors were found to be the traditional bamboo workers of the city. They excelled in making baskets and a range of other accessories with bamboo. With the costs of the raw material escalating and increased substitutes of their produce in the market forced them to shift to some other vocation.

As these workers are aged and not skilled otherwise, they shifted to waste picking. This account not only leads us to conclude that the INSWE serves as a labour absorbing sector but it also points to us that in the absence of any social support the retrenched aged workforce of the city finds its refuge in this sector. Parallel to this we note the decline in the practitioners of the indigenous craft of basket making in the city. Earlier studies (Baud and Schenk, 1994; Kundu and Mazumdar, 1998 and Chikarmane, 2000) report that waste picking by women is a means of augmenting the

income of the households. Our survey results support this conclusion as we find more than two thirds of the respondents having one or more than one earning member in the household¹⁵. We stress this point here because the motive with which these actors work changes their outlook to a lot of operational variables in the INSWE. Majority of waste pickers reported a family size of 5-7 members while a third (35%) has less than or equal to 4 members while the rest have a family size of 8 to 12 members.

On an average 2 people were found to be dependent on each picker. Waste pickers mostly collect in-groups¹⁶ (60%) covering a distance (40%) in the range of 5-15 kms. Rest of the actors (a third each) was found covering a distance of 3-5 and 15-20 kms respectively. The daily distance covered by an actor is influenced namely by the choice of zone for collection, availability of materials, capacity to carry load¹⁷ and economic need. The responses from the sample set revealed that a third of the waste pickers accessed zone 4 while a comparable (29%) accessed zone 1. Given this we can identify which are the target areas for three fifth of the waste pickers. The remaining 40% are found active in zone 2, 3 and 5, actor activity decreasing in that order. The density of waste pickers active in these two zones (4 and 1) is understandable in the light of the fact that the two zones are expected to cast off more valuables (according to waste pickers) as one is a high income neighbourhood (zone 4) and the other, a commercial cum residential zone also considered a rich neighbourhood. The intra urban allocation of actors shows that a little above a third of them reside in zone-1, followed by 29% of the actors in zone 4, this is to say that 60% of the actors were found residing in zones which can be earmarked as waste picking intensive zones. This can also be interpreted in the following way, waste pickers are found to function close to their homes. The remaining 13% were housed in zone 3.

From the sample set we found out the modal earning class to be between Rs.20 to 50 (43%), followed by a third of the actors in the income range of Rs.50-70. Actors

15 We find 25% of the households were female headed, yet reported the presence of one more than one earning member in the household.

16 The modal group size was found to be constituting 2-3 members (72%), a fifth of the actors reportedly operated in a slightly larger group comprising of 3-5 members, while the rest 6% had more than 5 members in their groups.

17 In order to aid the collection the use of accessories was made by a third of the collectors.

reporting a daily income of less than twenty constituted 18% of the total responses while the percentage of actors reporting between Rs.70-100 and Rs.100 plus was 4 and 7 respectively. Average earnings in a day can be assumed to be a function of the distance covered, thus we checked for the relationship between distance covered in kilometre with the daily amount of money earned. The distribution failed to give us any relationship, however it revealed that there is a concentration of actors (72%) in the 5-15-kilometre distance group and 20 to 70 rupees earning class (56%). This is to say that actors covering daily a distance of more than 5 and less than 15 kilometres earn between Rs. 20 to 70 daily. The earning groups do not vary with the hours of work also. The average working hours was found to be 7 with a reported range of 5 to 12 hours.

The presence of exploitative practices like weight and price discrepancy in exchange, and favours asked in return of debt as is commonly understood from the literature was checked with the sample which revealed that 50% of the actors agreed to such. When faced with an exploitative situation we find that only 20% of the actors tried to negotiate with the retailer, while a majority (60%) changed the trader with or without protest while 20% had no inclination to change their situation. Similarly to measure co-operation among the actors group selling was taken as a yardstick. Majority of the actors (60%) were not found practising this even though same proportion of them reported group collection. Half of the actors disagreed with the notion citing severe competition as the main reason along with lack of company registering second (33%) and other reasons (11%). This points to the nature of behavioural relations among the actors¹⁸. The actors overwhelmingly report (60%) no harassment from either the police or the local lords. Of the remaining proportion reporting harassment, named the police as the causal factor (67%).

Case study: Born in 1953, and educated till eleventh grade the profile number 22 comes from a backward community. A daughter of traditional bamboo basket weavers, she completed her education due to the proximity of a mission school. Married off at a very young age to an unemployed alcoholic this woman has lived her life the hard way. Does she like what she does for a living? she says YES, because it gives you bread to eat in a day and age where highly educated people

18while respect for the fellow worker may exist, trust generally does not (Bierbeck, 1978 pp-1176)

suffer from unemployment she is at least able earn her bread off her own hard work. She has managed to educate her six children started a tool repair shops for her two sons, and married her daughters...she saw no reason why she should feel bad about the job that made it all possible. Managing to earn 100-150 rupees a day, after walking 10 kilometres she talks about the first scrap-yard that came up in the city. She also talks about how she used to go alone (but nowadays goes with the younger son who has recently left studies and in the spare time is learning the gadgets repairing technique) and there used to be no problems. Nowadays, she complains, that she has been harassed by the police who often demand money from her, although aware of spatial tension in metro cities she refutes the existence of such for Jabalpur. Is vocal about the abuse of women in this trade as well as the economic exploitation they face, she reasons that in case of women it is compounded as the social stigma attached with the job is reinforced by the gender, thus women are in an absolute helpless position. Does she go to a doctor or take any medicine? No she says her body has become immune to the hazards of this profession. So how much money does she save?

She replied.....*Gareeb ki yehi reet chali aayee;*
Jaab kuch mile taab Dood Malai

This Hindi couplet translates in English as it is the tradition of the poor that 'whenever you get money spend it on good food ...'saying that she is not able to save much and in times of need has to ask the trader for money.

The idea of territoriality¹⁹ used by Iyer and Dhanalakshmi only managed to be confirmed in a small proportion in Jabalpur. Actors in a majority (53%) either refuted or were indifferent to the notion (please see this in the general discussion on the retrievers). We now move over to discuss the second class of actors, IBs in the activity class of retrievers.

6.3.2 Itinerant buyers

This set of actors is functionally different from waste pickers in terms of nature and mode of waste procurement. By definition they buy scrap (not pick it) from households, commercial establishments etc and the waste they pour into the waste stream is of a better quality (that is. not dirty, or adulterated) thereby fetching a higher price in the market. Our sample set is particularly homogeneous in terms of gender (all males) and religion (majority of Muslims), however the range of age of the actors

¹⁹ Iyer and Dhanalakshmi report that in the informal sector entry can be highly restricted if locational advantage happens to be a major determinant of earnings. As the amount of waste has increased in the system, it has increased competition which has resulted in an understanding among actors on the area of operation: this is also understood as territoriality This is a notion that was earlier also articulated by Aziz (1984) in his work on Bangalore and links can be also found in Bierbeck's work on Cali's dump-pickers (1978).

is quite wide, that is from 13 to 62 years. Two thirds of them are married and head their household. The dependency ratio in their case is 3, which is higher to the waste pickers. This indicates that in comparison with the pickers, itinerant buyers are more dependent on the market. The distribution of actors according to literacy is concentrated and more homogeneous than the waste pickers, however a majority of them are illiterate (64%). The actor class has a majority of non-migrant population (83%) suggesting that the actors are local people. Since the location of their residence bears an implication on their occupation (affects the distance travelled) we inspect the intra-urban location of these actors. The picture we get is extremely skewed in favour of zone-2, which is the zone where the main scrap market is located, the remaining actors are found residing in zone-1 (29%). As these areas are the inner city areas the distance to be travelled by the actors while accessing other zones is reflected in our sample set. All the actors covered a distance in the range of 5 to 20 kilometres, more than four-fifth of the sample set reported a daily coverage of 10 to 20 kilometres. The highest proportion of actors (77%) covered a distance of 10 to 15 kilometres everyday, while none of the actors travelled less than 5 kilometres daily.

Similarly the hours of work also shows an increase from the previous category of waste pickers to 8 but the degree of variation in the hours of work is low for the group. This indicates that itinerant buyers more or less spend a scheduled time on the field and are not as free to flex their timings as the waste pickers. Thus with an increased working period and distance covered everyday the distribution of actors according to the zone of accession reveals that zones 1 and 4 are again the highly accessed zones with two thirds of the actor active in them. The zone with least procurement activity is zone 2, while zone 3 and 5 report 13% each actor activity. This is an important point as it establishes that zone 1 and 4 are the most widely sieved zones of the city as they are accessed by a majority of both waste pickers and the itinerant buyers; for the reasons understood earlier. As a corollary, the bulk of waste left to be attended by municipal workers in these zones is firstly less compared to the other zones and secondly more concentrated in organic matter. This can be easily termed as invaluable for the INSWE but not necessarily for the formal solid waste economy (FSWE) as the waste stream here can be effectively composted and waste economically utilised.

It is seen that activity in this actor class does not support a group set-up. To avoid qualms ranging from allocation of working capital to payment calculation at the end of the day, a solo mode of transaction is practised. This weakens the group's collective bargaining position in the market. On the other hand the sample is constituted by actors (42%) who left their previous employment over a misunderstanding with the employer. This tells us firstly that the group is not a homogeneous one especially in terms of their work backgrounds and in that there is a large possibility of uncooperative or non-strategic behaviour by the actor class. When asked about prospective collective selling- all the actors replied in a negative with over two-thirds of them having no reason to suggest so, while a 14% managed to pinpoint competition as a reason. Overall this indicates to the high levels of distrust that exist among the actors and an atmosphere of mental rigidity where the actors are not willing to think beyond the set-up. The selling pattern revealed that more than two-thirds of the actors sell the materials to one trader only, this is the trader from whom they take the working capital each day. However as the set-up is not visibly binding, a third of itinerant buyers are found to be enterprising. They sell the scrap to different traders according to the perceived price differentials (for us what matters is the ability of the actor to think and act beyond the convention). Another thing worth mentioning about the itinerant buyers is that a substantial number of them participate in the *itwari* market, held each Sunday in zone 2 in where they sell assorted scrap from their collection, which was not handed to the retailers knowing that it would fetch a better price in the open market.

In terms of reported returns each day we can polarise the actors into two income groups as equal proportion feature in Rs. 20 to 50 as well as Rs. 70 to 100. While the remaining 23% report a daily earning of Rs. 50 to 70. This is a clear case of either under or over reporting, and is inconclusive therefore to ease the impasse we assume that the buyers are earning in the middle category that is in the Rs. 50 to 70 category per day. When daily income was checked with distance covered, it revealed that actors in the Rs 50 to 70 income range covered a distance of 15 to 20 kilometres and had a work experience of less than 10 to 20 years. This is to say that a greater distance covered did not ensure a better income at the end of the day also it has no relation with the work experience of the actor. One can actually posit a negative relation

between the work experience of the actor. As the actor ages the amount of distance covered by him would decline, this is reflected in the earnings. Our sample shows that 40 % of the actors in the low-income range have more than 20 years of experience and the actors reporting high income levels of Rs. 70 to 100 (38%) have work experience in the range of <or=5 to <20 years.

We also know that market is prone to seasonal fluctuations (during festival times the households discard a larger proportion of waste materials during house cleaning) therefore the actors were asked to recall the minimum and maximum earning in a day over the last year. The responses have been summarised in the following table

Table: 6.2:Minimum and maximum amount earned by an itinerant buyer: seasonality effect

	MINIMUM	MAXIMUM
Range	Rs. 20 to 50	Rs. 70 to 100+
Average value	24	200

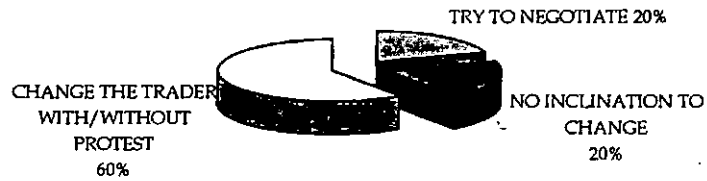
The above table shows that during festival times the average earning of an itinerant buyer can hike upto almost Rs.200 per day. In the fifteen days that the city records the major festival (Diwali) the itinerant buyers can earn upto more than three thousand, and similarly in the slump season that is during the rainfall months the money earned can drop to twenty rupees per day. The above detail sketches for us the vulnerability of the market, or rather the cycles that it goes through and how that translates into the transient prosperity and poverty for the collector class. Almost in consonance with the waste pickers the itinerant buyers also report harassment on the field (78.6%) which in more than half of the cases is reportedly inflicted by the police in the forms of extortion and physical abuse.

General Discussion: Retrievers

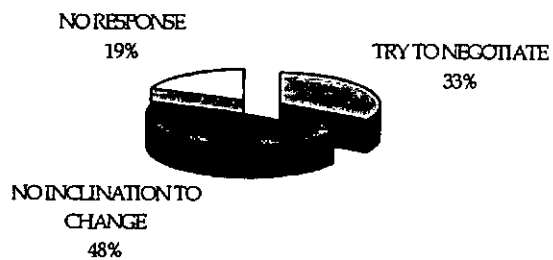
It is clear from the responses that 95 % of the itinerant buyers are subjected to exploitative practices like unfairness in monetary matters, indebtedness, huge interest rates, attached labour etc. vis-à-vis 52% of the waste pickers, but there is a marked

difference in their responses towards it. 19 % of the itinerant buyers chose not to respond to the question the remaining, 48% had no inclination to change the situation, that is a double of the response received from the waste pickers. [Graphs 6.1-6.2].

Graph 6.1-PICKERS RESPONSE TO EXPLOITATION



Graph 6.2-BUYERS RESPONSE TO EXPLOITATION



While changing the trader with or without protest did not feature as an alternative for the itinerant buyers (IB's). A plausible reason for this is the larger indebtedness of the IB's to retailers vis-a- vis the waste pickers, concern over resolving the situation is not pursued by both the agents owing to their motives²⁰. Along with this IBs show a high likelihood for negotiation; which can be probably understood in the light of their better average literacy level and a better position perceived by the society in comparison with the waste pickers. The disinterest of the itinerant buyers is also reflected in their mode of collection wherein a very low proportion (24%) reports the use of accessories vis-à-vis the waste pickers. As they work with rented aids that is. all the devices they use while buying waste the feeling of ownership is not there and hence no incentive to be innovative in their method.

When we juxtapose the two classes of retrievers we get new insights into the social and economic status of the two. We now know that itinerant buyers are in a majority group of literate Muslim men²¹ unlike the waste pickers who in a majority are women and have the onus of augmenting the household income. As reflected by the dependency for the two actor classes, we conclude that the pressure to earn is more for the itinerant buyers. This pressure is seen to evoke two extreme responses within the IBs group, which links well with the visible structure of INSWE. Either there is a complete subjugation of the itinerant buyer by the retailer where he is virtually a bonded labourer. Or a total reversal of role takes place where a buyer starts his own

20 For the retailer this is the most lucrative state wherein he can pay the itinerant buyer a bare minimum each day get an ensured good quality scrap while the IBs are able to meet their financial needs.

21 The graph of literacy levels achieved by the two retriever categories points out to a subtle rather important point, that even though comparatively itinerant buyers are more educated than waste pickers, none of them records a high (8th plus) grade levels, they are all males and a majority of them are Muslims. Add the three facts and we get a picture, that of IB's , a majority of them being Muslim men who are not able to continue their studies and are forced to brace some form of employment and end up working as IB's. A lot of questions are embedded in this small observation; why do they opt for this employment? Is it a manifestation of the caste and religion politics? Or is it a reinforcement of their socio-economic position in the society, which is known to be disadvantaged? The answers to these questions are important perhaps not in the context of this study but none the less for the *greater common good* it is important that these be raised and answered.

retail outlet; borrowing money from the wholesaler and functions at a sub-optimal level with huge amounts of debt although at a higher level in the hierarchy²²

Itinerant buyer case study: Twenty-two Year old male has been in the trade for more than 13 years {when he was nine...was a waste picker for four years and after that became a IB}. The profile no-3 is not an unusual case. Living in the vicinity of scrap shops in the middle of the city this is what he has seen people do from the childhood and now he is a part of it. Takes an advance of Rs. 300 daily from the retailer and pays the owner of the trolley Rs. 5/day, finally managing to squeeze some 80 rupees everyday. He covers a distance of 15 kilometers on foot, every day calling out for prospective sellers in each street that he goes to. He belongs to a backward community and is aware of the exploitation he faces from the trader. Thus is selective in taking the stuff back to the trader each day. Whenever he gets some material that he knows would fetch him a better deal than what his trader would offer him. He either sells it to another place or keeps it with himself and participates in the itwari market held on Sundays in which IB's like him put things up for sale and directly bargains with the customer. This is his way of escaping the exploitation, rather than fighting the trader or demanding a fair deal. He dreams of becoming a retailer himself has climbed the ladder before, so is hopeful of doing it again.

We have seen the similarities and likeness of the two actor groups constituting the retrievers' status in the above discussion. The following table summarises some key variables discussed for the waste pickers and itinerant buyers.

Table: 6.3: Selected Variables for the Retriever Class

FEATURE	WASTE PICKER	ITINERANT BUYER
Hours Of Work	5 to 10 hrs (7.5 hrs)	6 to 10 hrs (8 hrs.)
Distance Covered in kms.	5 to 15 (10)	15 to 20 (17.50)
Money earned in Rs.	20 to 50 (30)	50 to 70 (60)
Waste Load in kgs/day	15 to 20 (17)	20 to 50 (30)
Collection in group (%)	61.30	Nil
Illiterates (%)	84	64

Note: the values in the parentheses are averages for the variables.

Source: survey data

22 ...becoming a dealer represents the only way to make money in the recuperation business, since it is the dealer who handles materials in sufficient quantity to become profitable. To become a dealer one needs both access to capital and the possibility of breaking into the market [which are provided by the wholesaler], (Bierbeck, 1978 pp-1180).

In order to find the determinants of vulnerability of the collectors (both waste pickers and itinerant buyers) to exploitation, a correlation of literacy and work experience was checked. The hypothesis being that with increasing years of experience and levels of literacy, exploitation would decrease. Hence a negative relationship is hypothesised for both the variables. The results are summarised in the following table

Table: 6.4: Correlation of Exploitation With Literacy and Work Experience for Retrievers.

VARIABLE	VALUE OF THE COEFFICIENT	PROBABILITY
Literacy	-.373	.010
Work experience	-.285	.005

With the aid of the above table 6.4 it can be said that as the collector becomes more experienced in the industry his/her vulnerability to exploitation would decrease. Another form of vulnerability talked in the literature is territoriality²³. We reported earlier that close to half of the waste pickers acknowledged the existence of such, coupled with this we note that two thirds of waste pickers also show a clear tendency of group collection. Thus a relation between the group behaviour and the occurrence of territoriality is anticipated. We can formulate this relation also because group mode of collection reduces the risk of offensive behaviour by other pickers and territoriality is a feature, which needs a group to be channelled. The data for waste pickers confirms this expectation and it is found that 44% of the actors reporting group collection also reported the presence of territoriality. The reason for the existence of such in Jabalpur is different than what is put forth for the metropolitan cities studied. In Jabalpur the zonation of space among the waste pickers is not a result of one group overpowering another in a quest to gain right for accessing the best quality waste, rather it stems from the social stigmas that this group has been subjected to. Usually these agents are implicated for any untoward incident (robbery, theft etc) occurring in the neighbourhood of their work. This in some cases might be done by pickers from another area of the town, therefore it is to protect against this eventuality largely, that the waste picker groups allow selective access to new pickers into their

²³ See Iyer and Dhanalakshmi, (1999)

neighbourhood. The explanation above was given by one of the waste pickers, and one can be sceptical about it.

6.3.3 Retailers

Retailers are third up in the ladder of hierarchy (materials) identified. They are the channels through which scrap collected via pickers and itinerant buyers is passed on to the wholesalers. There is value addition to the material in the course of this movement by means of grading, sorting, washing and bundling etc. Retailers also register leakage of materials as the reuse stream, this is seen to be the highest in the category²⁴ of scrap paper. Our sample set of retailers is quite heterogeneous in terms of actor age, which ranges from 21 to 70 years, the average age of the actor is 39 years. The religion wise distribution still shows a majority of Muslim actors (67%). For the first time the actor category registers other religion (4.7%) and the rest are constituted by Hindus. A majority of actors (83%) are locals and the migrant population has a prominence of actors hailing from other states in the country. Measured on literacy scale the picture generated by the sample set is extremely polarised with half of the actor population featuring in the 9-12th grade some of them are even graduates (for the ease of comparison they have been clubbed together). A third of the actors are illiterate and the rest 19% are primary (4%) or middle level (15%) educated. This if further investigated reveals a motley picture of how people are drawn into the trade. Our sample reveals three different categories, first distinctly visible is the class of economically strong and relatively better educated individuals who are presently in this trade as it was practised in their household or because they were not able to find employment. Coexisting with the first is the low literacy level category of second-generation retailers who are drawn into the trade owing to lack of resources and need for helping hands. The third category comprises of actors who have graduated from lower rungs of hierarchy into the retailer category.

The range of work experience is wide, which starts from 5 and extends upto 50 years. A table of literacy levels and the work experience groups reveals that in recent years

²⁴ Usually it is the wholesales who register the maximum amount of leakage in all materials category, but in the case of scrap paper it is retailers. They are instrumental in maximum amount of reuse through second hand bookshops and production of paper bags.

there has been an induction of either illiterate or poorly educated actors which was not the case in 1980's or beyond that time. Table 6.5 shows that of all the high school educated actors, 90% joined in 1980's or before that. Another detail exhibited is that a majority of actors were established in or before the 1980's, whereas in 1990's only 20% of the actors²⁵ have been added.

Table: 6.5: Distribution of Retailers According to Literacy and Work Experience

LITERACY	WORK EXPERIENCE GROUPS			
	<=5 Years	<10 Years	< 20 Years	20+ Years
Illiterate	2.43	9.75	14.63	4.8
Primary	2.43			2.43
Middle			7.31	4.8
High		4.9	29.26	17.07

Source: survey data

Since INSWE trading is geographically concentrated, in keeping with the "minimum distance rule" we find that more than 70% of the actors were located in zone 1 and 2, which is indicative of the clustering of agents. To confirm the above, actors were questioned on why they chose to locate in the particular area. In response to the question actors responded (43%) mainly in favour of availability of space, while over 1/3rd of the actors have shops in their homes, only 19% reasoned proximity to other retailers and wholesalers as the reason for the choice of location, and the remaining 7% of the actors named nearness to the collectors as the reason for location. A half of the total actors were found to own their establishments. In keeping with the informal nature of the sector it was found that 90% of the shops were not registered, however a 10% fraction points towards the informal to formal progression. When asked about the harassment they face from the public institutions or the local mafia due to their activity, a majority of them 36% abstained from giving a response while a little more than 1/3rd voiced a negation, and the remaining 19% affirmed harassment. It appears as if a majority of actors face no problem from either the local mafia or the police OR they choose to be silent about it.

The distribution of the actors according to turnover groups reveals the modal class [representing 48% of the actors] to be in the range of 1 to 5 lakh, followed by the class

²⁵ Jabalpur underwent massive urbanisation in the decade after the 1950's to 1960's industrialisation. Since then Jabalpur has grown but at a much moderate rate.

of <50,000 with a little less than a third of the actors. The range of Rs. 50,000 to 1 lakh comprises 13% of the actors and the remaining 11% belong to 5 to 7 lakh categories. In order to check whether work experience has any bearing on the turn over groups we tabulate the two variables. The assumption being that with an increase in the number of years in trade the turnover would also register an increase as the actor gets familiar with the tricks of the trade and builds a goodwill in the market. The following table shows that there indeed exists such a relationship. An increased experience in the trade would reflect in the turn over group, the actor belongs to.

Table: 6.6: Distribution of Retailers according to Turn over and Work Experience Groups.

Turn over groups in rupees	WORK EXPERIENCE GROUPS (as % of the total responses)			
	<5 Years	5 to 10 Years	10 to 30 Years	Total
<50,000	10	10	8	28
50,000 to 1 lakh		8	5	13
1 to 5 lakh	5	15	28	48
5 to 7 lakh		3	5	8
7 lakh +			3	3
Total	15	36	49	100

Source: survey data

Interestingly however table 6.6 points to a holding of actors in the 1- 5 lakhs category. The actors come and stagnate in this category almost as if this turnover group is the critical mass beyond which they do not profit or the case may be that after this level they might shift to wholesaling.

Retailer class, utilises labour, for hauling the scrap, sorting etc. The sample set exhibited a wide range of employee cadre from regular, temporary to family labour. However surprisingly the maximal use found was that of the *regular* category²⁶ which was reported by 42% of the actors. It points at the institutional set-up of the sector which resembles any other formal employment generating sector with surety of money *albeit* not tenure. In some cases the actors employ migrants from the surrounding villages ensuring term but not money. One third of the actors reported utilising temporary

26 For the study regular labour cadre was defined as those having regularity regarding emoluments, but no surety of contract term. Wages are higher than the daily wages category and the work profile is also varied including skilled workers.

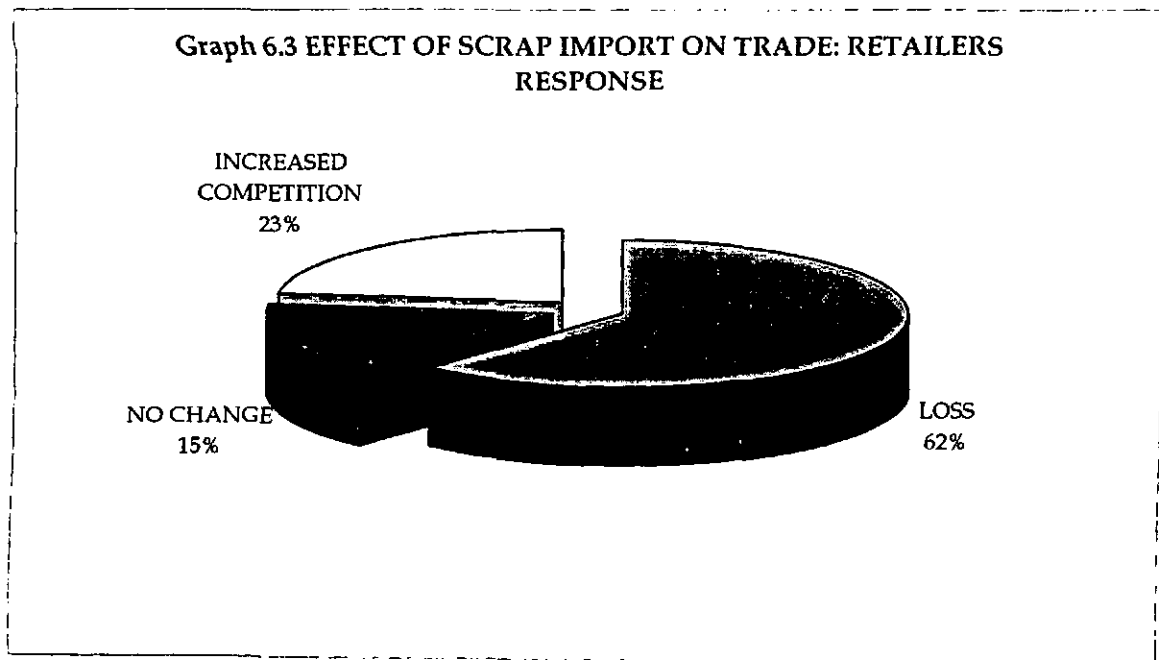
(daily wages) workforce while 15% admitted to the use of both. A little less than 10% responded to the use of family labour. The relationship between number of employees and turnover groups was explored²⁷, the assumption being that at a higher level of turnover larger number of labourers would be required. The exercise revealed that irrespective of the turnover on an average the labour employed by each retailer is less than or equal to five.

The demand for materials by retailers is met by sellers, the mode of transaction here attains regularity by the means of indebting the latter. Thus sellers can be loosely compared as their employees, as the retailer utilises their labour power. The distribution of regular sellers reported yielded a modal class of 5 to 20, one third of the actors reported 20 to 25 sellers, while the high categories of 25 to 35 plus sellers was reported by less than 10% of the actors, the remaining reported ≤ 5 sellers. As indicated in the earlier actor accounts the trading operates on a credit basis thus, it is surprising to note that 19% of the retailers do not disburse credit. When investigated further these retailers are found to be located in zone 1. They are the second generation (in some cases third) retailers and do not resort to such a practice as: a) they do not have the money to disburse and b) they say this is not their work ethic. We mark the difference in the mode of exchange.

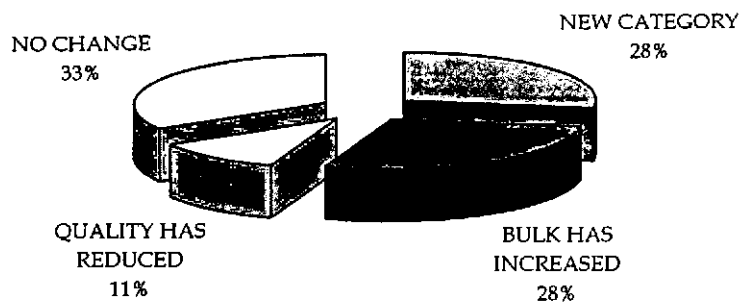
Coming to the method of quoting costs in the market, four fifths of the actors in the sample replied that they follow the local market rates. These are known by communicating with other retailers or wholesalers (here their clustering helps). The interesting thing to note is the response of arbitrarily setting up of prices, although reported in a minor proportion, when investigated further revealed an interesting practice. Price and quantity are determined by the interplay of demand and supply forces, distortions being caused by agents who dilute or aggravate the market forces. In our case this becomes clear as we see the supply side of the waste stream. Interestingly 5% of the retailers were found to be supplying material directly out of the state. When checked further it was revealed that these retailers are basically set-up

²⁷ This relationship failed to be substantiated by data, as the high turnover groups constituted a mere 8% of the sample, of which 2/3'rds was found to be employing less than 5 workers. Four fifths of the sample was reported employing less than 5 workers.

by the wholesalers functioning in metro cities (in this case it happens to be Mumbai) who find the import of materials from a city like Jabalpur much cheaper than procuring and processing the local waste. We consider this an important angle of the solid waste economy, for it gives us an idea about the area of influence of a city, the corridors of activity and possible enormity of the trade. When asked whether the import of scrap has affected their business, 43% of the actors agreed while a majority was either indifferent or considered that import has not changed anything for them. The graphs 6.3 and 6.4 summarise the responses of 43% of the retailers when asked about the impact of imports on the trade and nature of waste. In order to further our understanding of this actor class, 2 case studies are presented which are representative of the 2 groups within the retailer class.



**Graph 6.4 EFFECT OF SCRAP IMPORT ON NATURE OF WASTE:
RETAILERS RESPONSE**



Case study Retailer I: Is 23 years of age, the daily work includes keeping track of the advance he gives to the more than 40 people who supply him with the waste. The job also entails keeping track of the latest price changes in the market, negotiation of deals with the wholesalers, and clinching deals from the recyclers. This is retailer profile no. 43 who belongs to the upper stratum of the retailers. He heads the shop, a makeshift arrangement with a large tent area for storage established by his uncle, had been working with him before taking charge. Is a graduate and does not feel the stigma attached with the trade. Says it is profitable so why not? However when asked if he wanted to shift the profession, he responded positively. Says each month has a consistent profit of a minimum Rs.10, 000, even in a slump season. Has employed five regular labourers, one of whom stays on the property itself, the total operating costs are more than ten thousand each month. Makes sure he is not cheated by the wholesaler, and says the whole business works on an informal mode, the "word of mouth" should be in your favour which is absolutely necessary to survive. Says there is no exploitation in this business, unlike what people anticipate.

Retailer II: The profile of retailer 24 is a good representation of the other strata of retailers who shuttle between activity class of itinerant buyers and retailers. He is a forty-year-old male, has been in this profession for over eight years, was a fruit vendor before that suffered a loss and started to do this as all around him were earning their living by doing the same. When I interviewed him he was frantically roaming the streets collecting waste to pay the loan that he had taken from the wholesaler. The state of affairs was so bad that he had hired a person to go around with. He attributed the loss in trade due to the sudden drop in the prices of plastic after the supreme court ordered the small

scale plastic units to close down and relocate in Delhi. Says is subjected to harassment by the police.

Coming to the top of local INSWE hierarchy, we profile the wholesalers.

6.3.4 Wholesalers

They form the penultimate labyrinth of agents, which deal with scrap followed by recyclers. In the local INSWE of Jabalpur we found wholesalers located in zone 2 market of Adhartal. Some wholesaling activity was also reported from zone 1, the initial market. The actor age was found to vary in a range of 22 to 70 years. The activity class also records a much wider and less skewed distribution according to religion, the majority still being Muslims but the proportion significantly drops to 43%, with fast rising others category and a steadily improving Hindus section. Recollecting also from Table 6.1, we find that this actor class records the highest migrant population after the waste picker category, it is interesting to note that of the total migrant actors 67% are from other states and migrated to Jabalpur in decade after industrialisation that is. 1961-71. We know that in the case of Jabalpur, urbanisation was powered by industrialisation, factories set-up in the 1960's dealt with locomotives thereby discarding a lot of iron scrap. Actor's distribution by work experience found a majority of them (43%) to be in the 20 to 30 years category that is in the 70-80's decade, the decades after and before that do not record such a high proportion of actors. As said earlier our premise that INSWE is affected by urbanisation [for our case city powered by industrialisation] is verified in the case of Jabalpur when specialisation of agents is noted. Iron even today is the most commonly dealt with material (43%) while a fifth of actors each were engaged in plastic and paper, glass was reportedly dealt with by only 15% of the agents.

The distribution of agents according to the levels of literacy generates a polarised picture with more than 70% of the actors educated beyond high school level, a half of which are actually graduates and graduate plus. The percentage of illiterate actors was less than 15%, the remaining 15 constituted by actors who are educated till the primary level. The trend in activity class with respect to literacy over the years reveals that between 1970-90's literacy trends shifted from illiterate agents to those with high

and graduate level education. This is an important variable and a welcome one, as it can be ideally expected that with high-educated actors the sector would be more amenable to reform, both technically as well as institutionally. The distribution of actors according to turnover groups reveals that the modal class is Rs. 1- 5 crore with (38%) of the actors featuring in it, while a third of them fall into the 70 lakhs-1 crore category and the remaining 30 percent are divided into the 2 extreme ranges of < 20 lakhs and 5 crore plus groups. The distribution of agents according to the turnover groups and literacy levels reveal that over and above, turn over shows a positive trend with literacy. Although it is not uncommon that agents with low levels of literacy may also achieve the same level of turnover but the work experience in such is reportedly much higher²⁸.

Wholesalers are the ultimate nodes of waste aggregation in the local INSWE therefore they register most varied agents of material inputs. Quite expectedly according to the material chain, retailers are the principal actors contributing the bulk of waste stream (24%) followed by a close 1/5'th each proportion of itinerant buyers and private sellers. Auctioneers and village sellers each registers a 12% contribution, the rest 14% is an arrangement with other wholesalers²⁹. The proximity to other wholesalers and retailers has implications for reducing the costs of transport borne by the wholesaler. When asked the reason for locating in the area, a majority (42%) replied in favour of availability of space, while 26% named proximity to other agents as the reason, with 26 % articulating cheap land value as the principal factor determining location. It is to be noted that the flight of wholesalers from the main areas of Gurandi (zone 1) began in the late 1970's at that time the present market (zone 2) was at the outskirts of the city, near to the industrial area and situated on the highway. Being a periphery area then, the land was cheap, and was at a conducive distance from the industries therefore was brought over by wholesalers who were finding it difficult to store enough material in the zone 1 market due to lack of space. The city grew in the following decades and this present area is now located near the visible centre.

28 That is to say that without literacy, it is the goodwill of the market and the experience on field that helps the actors to achieve a comparable level of turnover.

29 An example of horizontal behavioural relations visible in informal markets, earlier discussed in first section.

Over 4/5'th of the agents are registered and half of them employ 10 or more workers, with the average number of worker in the group being 27. One fourth of the actors employed 5 to 10 workers and the remaining 14% employed less than 4 labourers. These labourers are used for various manual jobs like re-sorting, grading, washing, cleaning and in some cases they also operate machines for a primary level of material processing (like chipping in case of plastics and compressing in case of iron scrap). The distribution of agents with the number of employees and turnover group failed to show any association, however all the agents in the 5 crore plus category revealed a usage of more than 20 workers (the range actually varied from 27 to 62 workers). We have to keep in mind that the turnover data is highly under-reported therefore association with material of specialisation was checked, the assumption being that specific kind of material handling requires high amount of labour, this too failed to provide us with an answer. Thus for the sample the number of workers employed bears no association with the specialisation of wholesalers and the turnover group.

The cadre of employees when checked revealed an equal proportion (36%) of strictly regular and both (a mix of regular and temporary) categories, while strictly temporary employees were being employed by a third of the agents. To us, this points out that *in toto* there is a high use of daily wages labour but to what extent and how homogeneously it is utilised by different material categories is an open question. In order to find the determinants of the usage of temporary workforce (daily wage workers with uncertain term) we hypothesised that with an increased work experience and proliferation in trade the probability of utilising daily wage workers rather than regular workers increases (as perceived from the field). This was confirmed by our data³⁰, which leads us to conclude that with an increase in activity the gradient of labour power utilised shifts in favour of more informality. Apart from the labourers, the other category with which exchange qualifies to be termed as an employer and employee, is the transaction of wholesaler and his regular sellers. As already noted retailers constitute the bulk of these sellers, therefore what we are hinting is the retailer wholesaler exchange. The sample data reveals that 43% of the actors report to

30 correlation of work experience with use of daily wage labour force was found to be 0.606 and significant at 5% level

be serviced by more than 35 sellers' everyday followed by more than a third of the actors reporting 10-25 sellers. The remaining 21% was equally constituted by the classes of <5, 5 to 10 and 25 to 35 sellers respectively.

The supply network of the agents is basically spread within the state, with 41% of the actors reporting the same. While a third of the actors reported out of MP supply, and one fourth of the waste stream was found to be utilised locally. The range of gross profit reported by the actor class ranges from 2 to 20%. Credit giving is "business as usual" as 85% of them report the practice, so what determines the price they quote to the retailers which is then quoted to the agents down the hierarchy? An overwhelming 80% of the agents reported that they checked the local market for the prices implying an oligopoly set-up and ensuring homogenised prices over the city. The next proportion is that of actors who respond that the prices are set in accordance with the markets in India, after calculating the transport cost. The mark up is thus composed of two components, the transport costs and the profit share. The ease of communication has reduced the role of middlemen and now wholesalers directly interact with the recycling factories. This has also helped reduce monopoly and ensured symmetric prices of the materials. The interesting fraction is that of the 7% agents responding to the arbitrary fixing up of prices which basically indicates a monopolistic set-up. When investigated further it reveals that cullet glass sector records this response as the agent enjoys monopoly not just in terms of scale but also scope of the material.

It was found that a majority of wholesalers started off as auctioneers (42.85%), this is a clear influence of industrialisation on the INSWE of Jabalpur, however the encouraging thing to note is that a fourth of the wholesalers active in Jabalpur at present are agents who have elevated themselves from the itinerant buyer level to that of a wholesaler. This proportion is equal to the proportion of actors who started off as wholesalers. This indicates that there is an established domination of wholesaling by agents who initiated the activity as auctioneers, the rest of the scene is equally contested and divided.

Following is an account with one of the wholesaler who specialised in waste paper. The working of the wholesalers can be taken analogous irrespective of the specialisation if one solely considers the modus operandi ³¹.

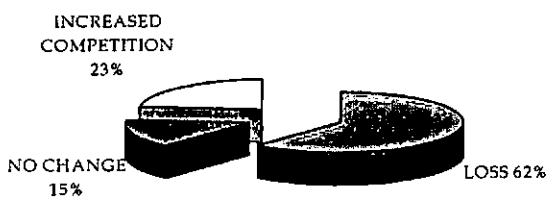
Case study wholesalers: A sixty-year-old man, postgraduate in commerce has been working in the field for over three decades now. Started off as an auctioneer, then with the decline of the trend has shifted to the acquisition of waste by the other retailers as well as itinerant buyers. He does not buy from the pickers due to the low quality of waste. Owns a shop in a busy commercial junction, known for its conglomeration of transport companies, and owns a godown and another two retail shops. *This is another thing to be noticed that even though they are wholesalers, in Jabalpur almost every wholesaler owns two or three retail outlets. These are used to create speculation in the market or to swap up the material from the other retailers/wholesalers/ and also function as clandestine godowns. This retail outlet is on a piece of land owned by him and is a storehouse cum-shop.* The man is extremely defensive about the amount of waste handled by him in a month and accepts that in wholesaling there is a big margin of profit. Employs minimum ten labours regularly and hires others for loading/unloading. The regular ten labours are paid at the end of the month the daily wages for who fall in the range of a minimum of 40 to a maximum of 70 rupees. Usually supplies out of M.P, and is not keen on family members joining the trade.

The responses to the impact of import of waste on the trade revealed a mixed picture about the direction of effect, but there was a complete agreement on the impact with more than three fifth of the agents responding a loss (please refer to the graphs 6.5 and 6.6). Of the turnover groups the middle group which spans between 70 lakhs to 1 crore, was in agreement that imports have affected the trade. The susceptibility to the impact decreases as one ascends the scale of turnover, this is well received in the light of our hypothesis that a large amount of turnover would imply reduced vulnerability of the actors to economic adjustments. In fact huge amounts of turn over in scrap trade are realised for materials which do not show much fluctuation in the markets, these being the iron and non-ferrous metals and glass industries. The categories of paper and plastic are hard hit by the imports as these markets are anyway not very stable and are prone to more seasonal fluctuations than other categories (Baud and Schenk,

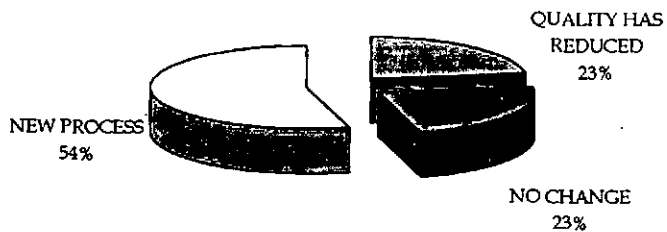
31 However there is one basic difference, iron scrap is ultimately re-rolled, for which it has to be first melted and purified in a furnace. Since this facility is not available in Jabalpur {as that requires a large unit and also a lot of power is consumed} the iron wholesalers, also function as agencies for the ultimate dissemination of recycled iron scrap which involves re-rolling of processed iron scrap into sheets and ingots. The intermediate step however requires them to send their product outside the city mostly into another state. Thus in the case of iron scrap some of the wholesalers can be termed as recyclers also this is an example of overlap of activities or what we term as mutability of agents.

1994). The wholesaler population in Jabalpur also emerges as an uncooperative class of agents as two-thirds of them negated the building up of a co-operative atmosphere with other agents.

**Graph- 6.5 EFFECT OF SCRAP IMPORT ON TRADE
WHOLESALEERS RESPONSE**



**Graph 6.6- EFFECT OF SCRAP IMPORT ON NATURE OF WASTE:
WHOLESALEERS RESPONSE**



In this section we made a detailed study of the actor categories and associated variables affecting the INSWE operations. In what follows next we discuss the growth and composition of the sector over the decades.

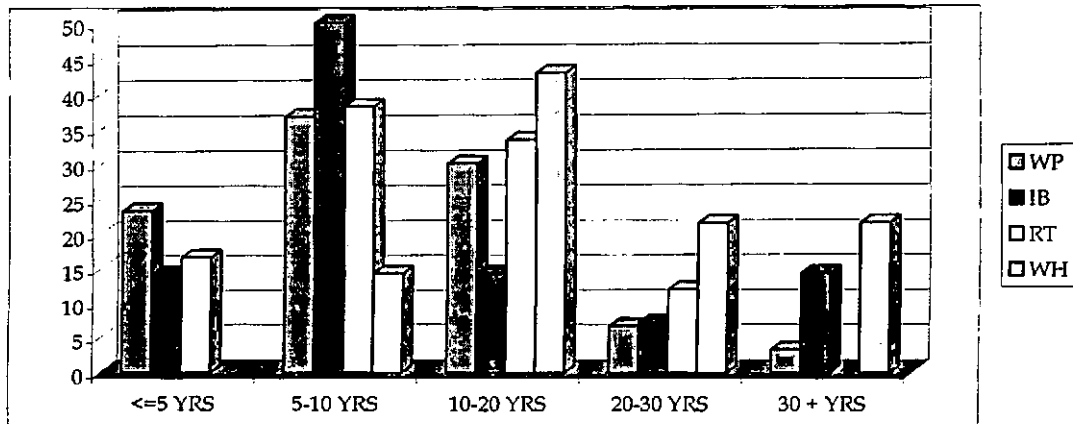
IV

In the present section we discuss the agents involved in the informal solid waste economy. This helps us in highlighting the growth of various hierarchical levels within the sector with the process of urbanisation. We also present the approximation on the amount of waste traded in the city and try to generate the size of the transaction in the city.

6.4.1 Effect of urbanisation on agent composition

The data collected from the field indicates that the waste economy of Jabalpur is unique from those reported in the literature. One obvious reason for us to explain this distinctiveness is the absence of recycling sector in the city which is a cause for a highly patriarchal set-up the wholesalers have weaved around themselves. The data collected when classified in decade's points to the declining participation by the wholesaler category, which does not record a single observation in last decade. Interestingly, the group of itinerant buyers shows a higher proportion of agents, second only to wholesalers in the 1960's plus decade, which was the decade of industrialisation experienced by Jabalpur (please see the graph-6.7)

GRAPH 6.7 - DISTRIBUTION OF ACTORS WITHIN DECADES



The itinerant buyers record a rise again in the recent times which indicates, that there is a stirring of activity in the segment, but it can be attributed to the lack of opportunity for local youth. We notice how the picker population grew in the seventies (the decade after active industrialisation), which corroborates the notion that migrants enter into waste picking. One stratum, which has been continuously increasing, is that of retailers, with a 40 plus proportion in each decade, save the first. Both retailers and waste pickers proliferated in the seventies and have maintained their activity proportion. The reason for a decline in the ratio of retailers in 1990's can be explained in terms of rapid growth seen in the previous decade, decline is just a reflection of the saturation in the tier of activity. Yet it can be pointed out that from 1970 onwards, of all the actors that have stepped into the activity circle the majority in every decade have been accommodated in retailer category. As said earlier this is the tier, which assures a better economic status along with being the one in which entry is facilitated by wholesalers. To the consequence, articulated above that the number of agents is inversely proportional to the returns of the activity, the sector remains disadvantaged.

The distribution of the actors across the work experience group has been summarised in the table 6.7 given below. It reveals that in the decades through which INSWE in the city has survived, the largest proportion of actors have entered the market in the

last five years that is in the late 1990's (36%). The proportion of actors has been on a continuous rise as can be seen from the table however it is not commensurate with the upward mobility (discussed later) which to us indicates that there has been a crowding of agents in the low activity levels. The majority of actors however are recorded in the retailer and waste picker category in the last twenty years.

Table: 6.7: Distribution of the Actors across years

ACTORS	<=5 years	5 to 10 years	11 to 20 years	20 to 30 years	30+ years	Total (Numbers)
Waste picker	7	11	9	2	1	30
Itinerant buyers	2	7	2	1	2	14
Retailers	7	16	14	5		42
Wholesalers		2	6	3	3	14
Percentages	16	36	31	11	6	100

Source: Survey Data

INSWE is marked by the property of actors aspirant to climb the ladder of hierarchy, this we know in the literature of labour economics as occupational (upward mobility)³². Birbeck in his study of dump pickers in Cali, notes that the hierarchical nature of this activity with channels of upward mobility available to only a few pickers, carries with it the feeling that anyone can get on in life if they work hard. The following table summarises the probability levels with which different tiers of actors climbed the ladder to higher levels in given time periods

Table 6.8: Upward (Occupational) Mobility of Actors

ACTORS	RT (<10 years)	RT(10-20 years)	RT (20+years)	WH (<10 years)	WH(10-20 years)	WH (20+ years)
Waste pickers	0.33	0.16				
Itinerant buyers	0.33	0.71	0.33		0.33	0.25
Retailers						0.25

Source: survey Data

The above table reveals that there was an increased probability of actors to climb the next higher level of hierarchy in the 1980's. Across all the actor classes there was an increased amount of actors transcending the levels of activity. We reason that it is

³² Upward mobility is a concept of labour economics and denoted the flux of agents from a lower level of activity to a higher level across main activity classes and from a lower stratum of activity to a higher stratum within an activity class.

possible only if there are some exogenous factors that affect the equilibrium. It can be either due to heavy demand in the sector or an increased supply of materials and working capital that facilitated the actors to move to the next level of hierarchy. What we offer as an explanation to the increased activity is that the effect was brought onto by a joint combination of both supply and demand. The decade of 1970-80 was the one which saw a spurt in the construction activities (growth in population), and also the one showing use of iron. With the cost of primary and secondary material fluctuating together, we expect an increase in the use of secondary iron also and along with it the number of people working in the scrap industry. As iron scrap was the pioneering material of trade in the city we relate the growth in iron utilisation being translated into a high amount of actor participation. Similarly, with the slowing down of the local industries the proportion of iron scrap coming in the waste stream decreased. This coupled with the increased practice of specialisation in material trading [the focus of which has been plastic trade lately]; and the overcrowding within the sector in the previous decades has led to decreased chances and low probability of actors to climb higher levels of hierarchy.

6.4.2 Amount

This subsection is an approximation of the size of solid waste economy in terms of monetary exchanges. In terms of the amount of waste handled we got an idea from all the wholesalers about their monthly output, except for one observation³³ all others record an average of under 200 tn/ monthly. In terms of local material consumption *in toto* it was approximated that five hundred tons of iron scrap gets consumed (reused) in Jabalpur per month beyond that how much is recycled is a open matter as it all depends on supply and the demand. Paper which records a wide seasonality had an average outsourcing of 1000 tones/month (we are mindful that Jabalpur acts as a channel for outsourcing waste from the hinterland as well). Around 2000 tons of glass per month is approximated to be supplied from Jabalpur. The whole turnover of the market was estimated between 5-600 million Rs. and 11 million US\$ annually. The following table is an attempt at estimating the size of the economy as can be

33 The outlier observation is that of an iron scrap wholesaler who has a very high material turnover due to his contract with the state electricity board.

calculated with the help of prices quoted in the markets and the approximated profit margins between different level of exchanges. As the price at which scrap is ultimately sold to the recycling units is undisclosed, we use the [least] price quoted for collector category. Then at an expected profit margin of 10% for the retailers and 20% for the wholesalers we try to construct the size of the solid waste economy. The following table gives the relevant figures. It shows that at the collectors level the annual

Table: 6.9: An estimation of the size of the solid waste economy

Materials	Number of wholesalers	Monthly out sourcing (tns.)	Total in tns.	Price (Rs./Tns)	Total For The Year (Rs.)	Total (US \$)
Plastic	3	200	600	8000	4800000	
Paper	3	200	600	6500	3900000	
Glass	4	200	800	1000	800000	
Iron	15	200	3000	5500	16500000	
Total	25				26000000	577777.8
RT					27300000	606666.7
WH					31200000	693333.3

Note: The estimation is done only for selected materials. The estimated outsourcing is assumed to be same for all the wholesalers. The price utilised is the one quoted to the collectors' category.

Source: survey data

It was found that price differentials existed in materials traded from different zones of the city. As one moves away from the cluster of market there is a more chance of making profits. In terms of the number of actors involved respondents were undecided about the size of waste pickers and itinerant buyers. For us this is significant for if the number of itinerant buyers is more then for the SWE it suggests that a relatively clean stream of waste is entering the market, which lowers down the possible value addition considerably and fetches a better price. It also points out to a social situation in which the households or institutions are more willing to sell the waste to the itinerant buyers. The matter was not decided and for the sake of convenience we assume that the itinerant buyers are less than the waste pickers (field observation). This again does not make much of a difference to the above hypothesis as the average amount of material collected by a waste picker is quite low than what a itinerant buyer collects (17 and 30 kgs/ day respectively). Thus we can say that in terms of bulk it is still the itinerant buyers who directly contribute to the waste stream of the city.

Sum up

The study points out that in the case of Jabalpur the actors which are most disadvantaged are the itinerant buyers, this becomes clear when we compare the per kilogram money earned by a waste picker and an itinerant buyer. Both of them earn a comparable per kilogram money viz. Re.1.76 and Re.1.71³⁴ for the waste pickers and the itinerant buyers respectively. The above calculation shows that there is not a fair valuation of the waste procured by IB from the field (we are hinting at the pricing of the clean waste) and to worsen it all they are not even aware of such a disparity. In terms of societal standing they are seen above the waste pickers but they are the actors with lowest autonomy in the whole hierarchical chain. Collectors are virtually employed by processors, as can be seen by the regularity of exchange but harbour the illusion of self employment, this is the reason why Birbeck (1978) calls them self employed proletarians, to quote:

...because of the nature of their relationship with the industrial market for recuperated materials, the garbage pickers in effect work for the factories but are not employed by them. They are little more than casual labours with the illusion of being self employed...

The present study reports a divergence between the two strata of actors (waste pickers and itinerant buyers) regarding the attitude towards exploitation, which is a reflection of the autonomy in the nature of exchange.

From the chapter we can conclude that INSWE of Jabalpur is structurally similar with the other reported studies beyond the metro-non-metro difference of bulk. The informal sector handles about 7% of the waste that is generated in the city. This is to say that apart from the waste that is pooled into the waste stream from other small size cities and settlements, Jabalpur contributes roughly 7% of the waste it generates for recycling and reusing it. It was also seen that there were a large amount of actors who accessed the nearby villages and small towns, this indicates the zone of influence of the waste economy of Jabalpur. This is important to note as it plays an important role in reducing the burden of the formal sector in terms of collecting and disposing off the

³⁴ we have aggregated the total earnings reported in a day and divided it by the amount of waste collected daily reported by the two groups of actors: this would however change if we had a clear idea of the earning figures reported by the buyers

waste. As pointed out by Chikarmane (2000) each picker gives services worth Rs.2360/month to the municipality in Pune. In the context of Jabalpur this works out to be Rs.423/month for the pickers and 871/month for the itinerant buyers³⁵. The annual worth of the services offered by the two classes of actors adds up to Rs.1,44,52,800/year. This indicates to us the value of the informal service in monetary terms alone, which is 14% of public health department's annual budget. Coming to the social and economic aspects of the sector, it is seen that debt is widely used as an assuring mechanism³⁶ which appears to be a recent phenomenon as it was found that earlier establishments, (those founded in the earlier 60's and 70's) did not indulge in this practice. This can be placed in the light of the growth in the number of agents recently where one way to ensure the sustainability of the business by the retailers would be to make sure of the supply stream. The sector also shows definite contours of change along with the decades of urban growth the city has been subjected to. The role of INSWE as a buffer for the unskilled/ semiskilled migrant/retrenched labour was fully established by our study. To the extent of other variables of sectoral operation the study does not report anything out of league from (except for some differences with Bhattacharya and Kundu, 1998³⁷) the earlier studies.

As such the sector is marked by the absence of firms utilising scrap. Hence the local demand is not a significant factor affecting recycling, although such stands true for reuse³⁸. Agglomeration of scrap shops in the initial area (zone 1) shows intensive reuse than recycling. The practice of *itwari* market has been sustained for over two decades and to us points a sizeable demand from the population for reuse. The formal set-up could bring about the other possible demand in the system, if it is engaged in recycling or reusing the waste. This does not seem to be the case in Jabalpur. The supply side in a solid waste economy register active informal participation, the formal

35 The costs of collection alone are used in the case of Jabalpur as the per tonne transportation cost was not available.

36 Also reported by Lowder (1986) in her work on vegetable vendors of third world countries.

37 We do not find that disturbing because the study of Bhattacharya and Kundu was localised, that is they studied the dump pickers who revealed a peak season in rain? and a slump in summer? They were also found to have amiable relation with the retailer. As the study was of a particular actor group and not the sector as a whole, it is not very illuminating for us.

38 Baud and Schenk (1994) name the production sector of Bangalore as the major player affecting the demand for the secondary material.

sector is latent. The interlinkage of the formal and the informal sector registers in a minuscule proportion with municipal sweepers selling scrap collected during official time to the retailers.

The nature of relationship of INSWE with the largely formal sector is exploitative. The exploitation not only manifests in the irregularity of markets and the vulnerability of actors to institutional action but also in the inter-sectoral exchanges like refusal of credits from banks, subsidies from the government, lack of infrastructure and protection of the market. The behaviour of local INSWE conforms to the behaviour of informal sector as discussed by Lowder in her work on the vegetable vendors. Prominent among them being the impact of urbanisation visible in the dispersal of agents from the main market onto national highway routes. Along with the mention of credit system, upward mobility heterogeneity of actor backgrounds and homogeneity of sex, class, and religion in particular activity class, domination of activities by particular gender owing to the cultural environment and impact of market structure on the growth in the sector. As we see that the market structure for most of the materials is largely oligopolistic and since it is a service sector, the growth within it has been largely involutory resulting in a failure of translation of profits for the upgradation of the sector on the whole.

This discussion assumes importance when viewed for the suitability of INSWE to be utilised for solid waste management services. For the city of Jabalpur we see that the nature of exchanges is largely vertical with negligible willingness of actors to alter it. The design of policies and managerial intervention for participatory approach hinges heavily upon the understanding of the local INSWE, in which this case study helps. Thus we reason that policy measures in the direction of the involvement of informal sector with the formal sector operations have to be taken at a local administrative level keeping in mind the local peculiarities, for example religion, actor concentration etc. In the case of Jabalpur it appears that the sector is quite large and is spearheaded by wholesalers who are well established in the trade as well as the city politics. A move for reforming the informal sector is bound to be met with protest. Added to that we

see that the formal sector on its own is overstaffed therefore a successful move of integration of the informal for services delivery, by the city appears bleak.

The case study also establishes a position for the INSWE in class one-size cities of India, as an engaging area of activity, the productivity of which can be further enhanced by exposing it to technical and institutional change. In a nutshell it could be said that this sector presents before the municipalities an excellent means of generating revenues. One can imagine the massive scale at which this activity is operating in the country and its contribution to the nation.

In the next chapter we examine the notion of informal and formal sector participation to manage solid waste service, as advocated in the recent literature in the field solid waste studies as well as urban governance. We critically evaluate the role of the formal and informal sector and showcase some alternative management strategies. In passing we also speculate on the options available to the formal sector in our case study area of Jabalpur.

ALTERNATIVES FOR SOLID WASTE ECONOMY

Introduction

Defining solid waste management as the environmentally desirable way of handling and disposing of waste, our discussion in the study has focussed on allied issues concerning solid waste management in an urban area of a developing country, with special reference to India. We identified a major facilitator of such in the informal solid waste economy operations. Solid waste management done in the way defined by us would generate a solid waste economy (benefits accruing to the society) but not necessarily vice versa. In this chapter we explore the possibility of a happy marriage between the two i.e. solid waste management (formal sector) and informal solid waste economy for India, a developing country. In principle both solid waste economy is inclusive of the solid waste economy management, as noted in developed world countries. In developing countries however various constraints in the way of such, have been adequately hinted at in the course of our discussion, (Chapter 1). The pertinent question then is what alternatives are available to better the system? and where does the informal system with its intricacies (Chapter 4) figure in? This forms the baseline concern of the chapter. In passing we also critically examine the notion of formalisation for informal sector as hinted in the literature and interpreted in the various participatory efforts documented.

The chapter is arranged in two sections. Section1 discusses the alternatives available for solid waste management in cities, with a special reference to our case study area. In the second section we discuss the conventional public goods nature of solid waste management services and the role of informal solid waste economy with respect to solid waste management, in the course of which we also propose a new role for the informal sector as resource mobilisers.

7.1.1 Alternatives for Solid waste management in cities (Jabalpur)

Solid waste management comprises of three activity circles, (each complete within itself) namely collection, transportation and disposal. Developing countries experience inefficiency in all the three. As gathered from the literature, the prime concerns emerge to be those of collection and transportation. From an environmental angle the most important part is that of ultimate disposal. The current practice of open dumping although sufficiently disagreed with in the literature has not been the subject of reform. There are various reasons given for the ineffective functioning of solid waste services, primary being a shortage of resources. In order to understand the fiscal constraints of the formal system operations hinted at in the literature¹, let us look at our case study area.

In Jabalpur as we earlier said three agencies associated with solid wastes are identified. Formal set-up, private and the informal recycling sector. Formal sector participation in solid waste management and subsequently in the solid waste economy for the case study city, Jabalpur is not out of league. It is well known in the literature that the formal set-up of the developing countries works under a severe budget constraint. Much of resources are spent in collection and transportation² of waste, such that the environmentally warranted handling and disposal of waste becomes impossible to adopt. The bottom line is that such options cost a lot of money, money that is scarce in Indian city administrative bodies³. In the case of Jabalpur this is further illustrated with the aid of the following table. Table 7.1 summarises the fiscal status of solid waste services, for Jabalpur. It shows that after the disbursement of salaries, which constitute 83% of the annual budget, the department is left with resources barely enough to cover the overhead running costs and maintenance of the vehicles.

1 Kala and Khan, (1997); Ogawa, (1998).

2 According to Cointreau –Levine (1994) 95% of the total budget in developing countries is allocated for collection and public cleansing (A.D Bhide, 1994)

Table: 7.1: Budget Of the Solid Waste Management Department

Solid Waste Budget Of The Public Health Department (in US\$)	Amount disbursed in salaries (in US\$)	Balance amount (in US\$)
22,94,444/year	18,97,280/year	3,97,164/year

Note: The amount disbursed in salaries is calculated for 1848 workers @ Rs3850/person/month. The total budget is reported after deducting the amount allocated to the private contractors working in two zones of Jabalpur.

The above table informs us of the magnitude of financial constraint faced by the local government while deciding on the option for the disposal of collected solid waste in the City.

The following table 7.2 shows that based on purely fiscal criteria open dumping is clearly the favoured alternative for disposal. It also reveals that composting which is hailed to be the best disposal option in the context of India (Bhide, 1994), is also not a fiscally feasible disposal option for the present local level administrative body in Jabalpur.

Table: 7.2: Comparative Costs of Alternative Disposal Methods

Open dumping		Composting	
Cost \$/metric tonne	0.5-2 (we assume 1\$)	Cost \$/metric tonne	5-20 (we assume 15\$)
Cost for the total in US\$/yr.	1,02,240	Cost for the total in US\$/yr.	15,33,600
Deficit or surplus	294924	Deficit or surplus	-1136436

Note: the total quantity of solid waste for which the costs have been calculated is 284Mt. The deficit/surplus are calculated from the amount left after the disbursement of salaries. The ranges of costs are based on Cointreau, 1999.

Formal sector in Jabalpur is required to take care 71% of total urban wastes⁴ that is estimated to be externalised in the city. Given the hierarchical structure of workers and supervisory staff of the city, we know that there is an imbalance in the allocation of manpower according to work profiles. A separate exercise done by us points out that the formal staff is short of 56 persons in the supervision category (please refer

3 The gap between the municipal resources generation and expenditure requirements underlines the financial constraints of the municipal bodies and explains why the civic bodies were not able to provide services at levels expected of them (Mathur, 1994)

4 Total waste externalised in the city=400 Mt/day

Amount of waste generated by the 16 wards which are contracted out=96 Mt/day

Amount mobilised by rag pickers in the waste economy=20 Mt/day

Therefore the total waste which is left to be collected by the municipal workers = 284 Mt/day

appendix table 1). Thus supervisory staff is overburdened and a consequence to that is the non-maintenance of sanitation service standards. Added to that when we calculate the required number of sweepers in the city utilising their rates of productivity⁵ we find that there is overstaffing. The government is losing money equivalent to approximately 20 million Indian rupees or 0.4 million US \$ on salaries supplied to the over-staffed workers

Adding to this created resource constraint, is the inefficiency in the transportation of waste from the city to the dumping grounds. The frequency with which waste is transported from each neighbourhood to the dump was found to be once a week, that translates into an amount of 40 metric tonnes each week in each ward (44 wards under the municipal corporation wards) before it is sent for disposal. Such lethargic treatment of the problem spells doom for the ecological health of Jabalpur. It is clear that in case of Jabalpur, sub-optimal functioning of the formal sector is a result of improper utilisation of manpower, which reinforces the resources crunch.

Now to take a look at the alternate arrangement of service provision in the city. Private sector has been initiated in the arena of service provision in two out of eight sanitation districts of the city. The contract is renewable contingent to satisfactory performance. It was also made clear that a competitive bidding by private contractors was allowed. We know that developing country situations do not offer scale economies and there are spatial bottlenecks for the smooth functioning of this sector.

Literature tells us that those areas, which offer economies of scale, qualify to be called for bidding by the private entrepreneurs. The possibility of economies of scale stems from the ease of collection of waste, which is facilitated by high accessibility, road connectivity and proximity to the official dumpsite. The private sector is thus expected to be employed in high-income neighbourhoods, industrial parks, commercial establishment's etc. Therefore we check for the areas, in the city, which have attracted private sector attention.

⁵ The labour productivity was calculated to be 173kgs/day for the city in 1983 (Bhide, 1994). An overstaffing of 414 employees was found using the above productivity rate. The total amount of salary disbursed to them annually is 0.4 million US\$.

In Jabalpur we find that the private sector is active in 16 wards which in total houses almost 20% of the slum population of the city. The two sanitation districts given for private operations house some of the highest density slums in the city. So much that the informal solid waste economy operations and a majority of its agents fall under the working area of the private sector. Private sector is not accountable to the public and both the contracts have been given to the same agencies and have not been revised since the initiative was started in 1997. In such a case one is sceptical of the quality of service provided to the residents. The point out of league is why was this practice not duplicated in other sanitation zones?

Functioning in parallel with the two set-ups is the informal sector. We find that the informal sector mobilises approximately 7%⁶ of the estimated waste load, even though there is no significant recycling happening within the city limits. In terms of its impact on the immediate environment, it can be said that informal sector operation adversely influences the ecological health of the city by illicit trade of hazardous substances (a common thing for the informal sector). The unfavourable working environment tends to exacerbate the poverty of the working population. Therefore to economically summarise the role played by informal solid waste economy in an urban area, we can say that in the long run the social costs of INSWE surpass the economic benefits associated with them. These costs are firstly lagged and secondly reflected in the occupational hazards associated with the mode of functioning⁷.

Having discussed our case study we conclude that even though lack of resources is a major bottleneck in providing adequate amount of services the problem is not entirely that of resources. Private sector initiatives can only be viewed sceptically as it is seen active in areas where it is not possible to attract the private profit-seeking entrepreneur. Given these constraints for Jabalpur, let us examine the alternative set-ups found in the literature. We find basically three forms of alternative arrangements of solid waste management proposed under the alternative development paradigm,

6 The approximate number of waste pickers in the city are 1200 which pick, on an average 17 kgs waste each day, this equals to an aggregate of 20,400 kgs. The amount of waste left in the system after private sector operation is 304 tn. Thus the total waste mobilised by the rag pickers daily amounts to 7% of waste generated in the city.

7 A good discussion of the health conditions is found in (Cointreau Levine, 1999).

often termed as the participatory approach for urban public service provision. We document them here in terms of three case studies. In this sub section we showcase the participatory approaches that have been followed in India and around the world. The decentralisation realised in such approach can take various forms. For the sake of our study we look at three structural set-ups that have been relatively successful in their specific locations.

Options for the formal sector: alternative strategies for management

(a) Private sector initiative in Hyderabad

The first alternative listed is that of private participation, i.e. when the services are let out to the private sector to be executed. Our example is Hyderabad, an Indian city where the services of street cleaning and garbage collection were let out to the private contractors. In this case the initiative came from the chief minister when he started with a campaign of *shramadanam*. In the purview of which an expert committee was constituted to look into the options utilised by the rest of the Indian cities, when faced with the problem of solid waste. This committee suggested private participation. This suggestion was met with opposition from the formal sector employees, which was negotiated.

The contract to private sector was offered for a trial period of three months to a year. Contracts ensured the monitoring of the service by the consumers of the service, and could be renewed as long as prices remained reasonable and the local residents were satisfied with the service. In this example the most important precursor of the system was the political will of the administration and the preparedness of local administration to put an end to its monopoly. The other balancing lever is found in the certificate of satisfactory performance issued to the contractor each month by the head of neighbourhood committee (mark the frequency of assessment). Along with this, a minimum level of wages was set for the workers employed by the contractors. In this way there is a representation of the interests of the labour engaged by the contractors, citizens and the state.

(b) Linnis Ganda (*Clean and beautiful*) program: Solid waste recycling in Metro manila

Our second example is from Philippines, where an initiative was taken involving the informal sector. *Balikataan* (the NGO involved) started the initiative in conjunction with the elected local community leaders. The program was carefully implemented, and the strategy is interesting to note 1) the old system of junk dealers was retained and not replaced, this was important to avoid antagonistic operating environment. 2) there was a mass awareness campaign, targeting the housewives who are the catalytic actors in the households. 3) thirdly and instrumentally the program operated via the elected community leaders: this is to say they had a mass support which is a very important factor once decentralised activities are envisaged. It can be seen that the interests of the waste collectors were also not compromised, as they receive a lift of social image (by naming them eco-aids and educating the masses about the importance of the service they provide). They are also spared the exploitation of the informal set up and given social security (in some cases the junk dealers also provide them with quarters on the warehouse). Finally and most importantly the federation has access to finances, and it is democratically provided at affordable rates of interest through the environment co-operatives formed by local junk dealers in every city. (Harper, 1999).

(c) Citizen's action: initiative in Chennai

This example is one among the varied forms of citizenry action noticed in the last decade in the field of public utility provision. Civic Exnora (**EX**cellent **NO**vel **RA**dical) is a non-governmental organisation, which promoted the idea of forming neighbourhood associations for managing wastes collection. The units are constituted by households from one or a set of streets. It has a small number of office bearers (either elected or filled up by volunteers) which form the committee that manages the Exnora. A person responsible for cleaning the street is appointed and trained (called as the "street beautifier") and a handcart or tricycle is provided to him with funds from the bank loan or private sponsors. Wastes are collected from each household daily and deposited in the municipal waste bin or the municipal transfer station. Each house

pays fee for the service to the Exnora and it is from this contribution that the street beautifier gets his monthly salary. It is reported that more than 60,000 people are receiving waste services from 150 Exnoras active in Chennai. A more recent estimate suggests that there are 1500 Exnora's active in Chennai providing service to 0.45 million people (Anand, 1999)

The three approaches discussed above present before us interesting alternatives but they do not address the disposal of wastes, which is important in an urban scenario. As long as solid waste management is not holistic, none of the approaches discussed or proposed serve the purpose.

We note that in all the above given arrangements political will is a necessity, along with a persistent action of the parastatal and non-governmental organisations. As agreed earlier, non-governmental organisations and other citizen-based organisations have a much larger role in the provision of urban services. Coming back to the case of Jabalpur, we find no citizenry or non-governmental action therefore there is no expectation of such an activity. The private set-up that is exhibited in Hyderabad differs from Jabalpur in terms of transparency of operation, anomaly of operation space and the designated area of coverage (in Hyderabad the inner lanes were retained with the public sector). Since data on the above said was not available we cannot judge the efficacy of operations. Then how can we address the problem for the city of Jabalpur?

Let us begin with the problem of resource crunch, it is widely reported that the developing country cities do grapple with a resources problem. Blore and Nunan (1994) report that financing for solid waste operations comes from general revenues or taxes collected as property taxes and a variety of municipal fees. There is no aesthetic evaluation of the environment neither is any charge levied on the tax payers in order to finance the solid waste management services as such. The theoretical links to unequal valuation of environment and its resources by the state as well as the polity can be traced to the dependency theory for the developing countries.

In developed countries basic services are largely funded by public as most of them are administered by the private sector. In developing countries however local

administration has been hesitant in introducing new taxes for solid waste management services⁸ sticking to its traditional role as the provider due to a perceived low willingness to pay of such services by people. The proposition of charging also does not withstand the equity criterion because if the tax is levied it has to be flat rate. As it is operationally impossible to monitor the quantity externalised in the community bin by individual households. If a flat rate is levied then the distributional aspect is ignored⁹.

The lax regulatory environment and resource crunch in developing countries encourages littering, which goes a long way in increasing the costs of operation. The argument for pricing becomes stronger, not only because the social cost of dumping is large but also because the effective way to reduce dumping is to raise the costs by enforcement of regulations and penalties¹⁰ evident in the case of Singapore. An assumption of low willingness to pay (WTP) might be erroneous. Studies reveal that there exists a demand for service provision¹¹ hence there is no valid argument that such cannot be tried in the present context of our case study area and generalised for the class one cities.

The weightage given to the costs and resources gap, while explaining inefficient service needs to be cautiously taken. Cost curves just point to us the deficit under which municipalities' function. These are also expected to change with the nature of the waste stream. In a situation where one has to make policy decisions it is easy to get lost in numbers and as Blore and Nuan¹² point out that these calculations are nothing but single points representing a range of costs, therefore not sacrosanct. However we argue that the formal set-up of service provision is such that even if resources are made available there are several structural inefficiencies, which cause

8 The allocation of budget for solid waste management service is made from property, housing and water tax etc.

9 In charging an equal rate of tax to all the residents it can be seen that the poor will subsidise the rich as they produce less waste *in toto*.

10 See (Blore and Nunan ,1994) for a discussion on the difference between north-south cost curves of dumping and source reduction.

11 Altaf and Deshazo in Gujranwala Pakistan found that low-income households were willing to pay for the provision of solid waste management services (1996) also the study of P.B Anand (1999) proves the same for middle level income households in Chennai, India.

12 Blore and Nunan (1994)

friction in the realisation of a better service provision¹³. If adequate resources were the solution to the problem then the developed countries would not be in a waste crisis. Thus there is more to the management of waste than just the lack of resources.

Furedy (1989) points urban solid waste management to be a socio-cultural problem and one that needs to be worked at by modifying the culture. The broader attitude of out of sight out of mind approach has to be replaced by *out of sight back in the cycle* approach. In the short run however the policies chosen should be a reflective of the larger move towards the above. The visible interventions of privatisation and community-based alternatives question the public goods nature of solid waste management service. Thus the very nature of solid waste management as a public good stands to be investigated. The following section is an attempt in that direction.

II

7.2.1 Rethinking solid waste service provision (as a public good).

Since the issues of efficiency and more importantly equity form the major criterion in the context of urban amenity provision¹⁴, a clear case of state intervention¹⁵ emerges. This is in agreement with the conventionally interpreted public goods nature of solid waste management service¹⁶. However, we are of the opinion that, the argument of solid waste being a pure public good is not tenable in the present day context. When the state fails to provide for, while the demand is large (enough to generate a market,) the private sector steps in. Grading of solid waste component services done by

13 Urban amenities production and delivery are more organisation oriented and not consumer oriented. The different kinds of social services are being supplied in insular fashion, and the interrelations among them in the administrative sense do not exist in many cases. For example health medical services and nutrition are not developed as a package although from the client's point of view that might be a better way of arranging their delivery.

14 Urban amenities are both tangible and intangible in nature their delivery entails some problems, but importantly they pose the question of efficiency and equity in urban amenities delivery systems (Mishra G.K., 1994).

15 Solid waste management qualifies to be a public good, in a micro-social framework it also qualifies to be a merit good (Blore and Nunan, 1994).

16 Baud and Schenk (1994)

Cointreau Levine (1982) on the basis of excludability and rivalry shows that solid waste services can be unbundled and a case for private intervention made.

Following which studies have looked into the WTP for solid waste management services and conclude that there is an effective demand for the service in the low as well as middle to high income groups the population¹⁷. Since the private actor works with a profit motive, we can be assured of the efficiency, but the question of equity is left unanswered. Furthermore the nature of waste stream in developing countries and the locational setting impede the generation of scale economies making private participation dubious. Added to that their deployment would require effective zoning and competitive bidding to ensure efficiency, which compromises the equity criterion (Bartone, 1993).

In the context of developing countries, since private sector does not view service provision as a lucrative enterprise the change advocated in literature is a reform in the urban governance. What we are hinting at is the popular and widely echoed strand of suggestion articulated best in Agenda 21 that is of involving the informal sector in the formal efforts of service provision. The same suggestion has been voiced by the expert committee constituted by Supreme Court of India in their report (1999) that looked into the matter of solid waste management in class one cities of India. The assumption for the suggestion is that the collection efficiency can be improved by merging the informal with the formal sector, which according to us is grossly misplaced.

It is indeed a welcome move that the formal sector should see the informal sector in a positive light but let us look at the analytics of the suggestion. Firstly there is no discussion of the productivity of municipal sweepers; it is just assumed that there is a problem of inefficient collection in the cities. In the light of the reported practice of retrieving recyclables from the garbage by municipal workers themselves, which in fact takes a lot of their time (10% of the official time in Mexico city to 40% in Bangkok)¹⁸; an induction of the informal would result in the competition (friction)

17 Anand (1999); Altaf and Deshazo (1996).

18 Cointreau (1994)

among the formal and the informal sector workforce to sieve off the valuables. The induction of the informal sector, or an alternative managerial option may although reduce transport costs for the waste pickers. We first need to see how much of the waste is actually getting mobilised from the roads and waste dumps into the recycling industry. Secondly, we know that informal sector agents are not just constituted by the waste pickers alone, there are other actors in the informal sector, all of which are interlinked.

Even if formalisation targets the waste pickers there are other logistical problems in its implementation. We have already mentioned the threat of opposition from the formal sector. Secondly the number of informal actors which can be accommodated in the formalised system will be limited as the amount of resources needed to absorb all the actors would be significantly large (Sudhir, 1997). Viewing the proposal from the side of the informal sector, the formalisation of the sector would attract agents apart from those presently active in the sector and in this process the average returns from the activity would decrease (Furedy, 1995). Informal sector operation is an economic activity hence recycling through co-operation may not be a feasible option, which is clear from our survey results. In light of the above scenario it is important to ask, to what extent can formalisation help (*informal solid waste economy*) the informal sector in terms of offering them a better alternative and the formal (*solid waste management*) in terms of service provision.

7.2.3 Rethinking the solid waste economy

The issue one can raise is whether there is a valid argument for the merger of the two at all? Having seen that the trajectory of alternatives, in the proposed form of urban governance is inclined towards the participation of the informal sector, this becomes an important question. Any alternative for the informal sector has to be viewed with its impact on the autonomy of the informal sector, a trade off which is not clear whether the informal sector is inclined to make¹⁹. Added to that if the alternative is in terms of forming unions, then the feasibility of such is itself debatable in the absence of a third party intervention as revealed by our survey. Informal sector structure and

¹⁹ Cointreau Levine, 2001 personal communication.

contribution calls for intervention, the question we need to posit then, is what form of intervention is desirable? And should the informal agents be roped with the formal workforce anyway?

Following from the discussion, we conclude that the process of formalisation does not present to us a win-win situation as it is widely interpreted to, then what is the alternative? In the next section we propose that the nature of formalisation needs to be in the form of labour protection and policies aimed at improving the disadvantaged position of the informal vis-à-vis the formal sector. We mean not just the formal workforce but point towards the extremely skewed exchange position of INSWE with other sectors of the economy so as to ensure a better distributive trickling of profits.

III

7.3.1. INSWE: a dichotomy addressed

Before proceeding on to the proposed intervention we like to clarify that, it has long been the tacit understanding that solid waste management and solid waste economy are issues that can be addressed together, we disagree with that.

To make the point clear, integrated solid waste management approach is inclusive of recycling and reuse which is an established approach, but we need to articulate the desirability of such for us in India. In view of India's management of solid waste firstly there is no articulation in the directives to the local administrative body for a conscious recycling initiative neither is there a technical plausibility of the option to be successful in India today. What then we are suggesting is that the two need to be seen separately, that is solid waste management needs to be viewed exclusively of the solid waste economy. The two cannot be targeted in the same way. In our view the role of informal solid waste economy and its functioning have to be interpreted largely in the light of their contribution in the resources constraint faced by the industrial sectors. We know that there is a wide difference in the motives of solid waste economy and solid waste management. What is symbolised by a ragpicker in the streets of any developing country city is not just the human face of urban poverty,

but beyond that they are symbols of the need to mobilise resources for the industries. These actors can be best termed as *resource mobilisers*, and this is the role that we highlight. In the light of this contribution they can be termed as the backward linkages of the larger industrial set-up.

Furthering the argument let us introduce the trade flows related with this sector. There is active trade in scrap, and even though it is not clear our hunch is that the informal sector is also involved in it, especially after it has become easier to trade in the post liberalisation regime. The following table is an indicative of the burgeoning quantity of scrap trade in some selected materials.

Table: 7.3: The Net Imports (quantity) of selected scrap in India for three time points.

CATEGORY	1989	1995	1998
Cotton waste	N.A	-4883	-73691
Tin waste	2728516	475126	20926
Cullet and other glass waste	N. A.	33937	87029
Waste rubber	195508	375046	1374089
Nickel waste	969459	138806	1842482
Lead Waste	9948519	48873529	16185927
Aluminium waste	2365268	20232749	18931281
Zinc waste	2807693	4048063	41942610
Plastic waste	10040507	23181369	48976974
Copper waste	67779680	84786530	144985887
Paper waste	181848417	331945481	736556521
Ferrous waste	N. A.	40864	1589314397

Source: Monthly Trade statistics for India vol-1&2, year 1989,1995 (March issue), for 1998 Centre for Monitoring Indian Economy, India Trades.

The table is an indicator that there are materials in which India is a net exporter, like any other commodity the comparative advantage plays a major role. There are materials, which have been showing a raise in the quantity for all the three years (aluminium, waste paper, zinc wastes etc) while there are others in which India is a net exporter (cotton wastes) and there are some which fluctuate, understandably according to the world prices. On the whole it can be said that there has been a boost in scrap trade after liberalisation. Since all the net imports are positive we note that the scrap utilisation in India is substantial. To us it means that there is a scope of the utilisation of scrap within the domestic industrial units, which is not being met

domestically. One of the reasons of such can be the absence of market. The existing structure of exchange (the national markets of materials which are existent informally) is an ad-hoc arrangement and cannot substitute for a formal market as such, thus the potential of the informal sector to cash on the domestic demand is reduced. An important question that arises in the backdrop of trade liberalisation are firstly, why Indian industries are not buying scrap from the domestic market.

A plausible explanation for this can be found in the price differentials or the superiority of imported scrap grade. We do not know to what extent the latter is reflected in the scrap movement across Indian borders. Nonetheless assuming that the former largely governs the decision to import scrap, we hint at the price discrepancy in the domestic and rest of the world rates. Another associated question is the desirability of this scrap movement given its environmental implications, as they can be viewed as transferred environmental costs. We shall deal with these questions now, coming to the price distortion issue. The price distortion that is faced by the sector is dual, firstly it has to compete with the domestic primary materials sector and secondly with the international firms which transfer the scrap at a much lower prices.

Let us elaborate, in terms of domestic market the recycling industry has a competition with the raw materials produced in the domestic mines. The mining sector is highly subsidised to the effect that it is not a true reflective of the extraction and refinement costs. This is a result of the larger developmental policy followed in developing countries, which usually have the comparative advantage in natural resource base thus in order to gain foreign exchange they subsidise the production (Ouano,1993). As a result recycled products in the domestic market are pegged against primary material products. These are not only low in price but also appeal to the consumer because they have not been utilised earlier. The consumer thus makes a choice against the recycled materials. Visualising the bargain from the international suppliers' point of view we know that owing to the strict environmental measures in their domestic countries, scrap is actually a liability which they are shifting to developing countries. The exporting firms are actually at the receiving end of the bargain, In those terms the prices are not truly reflective of the exchange. Unaware of the potential toxicity of imported scrap, developing countries led by the price differentials make themselves

vulnerable to environmental hazards. It is to curb these sort of exchanges that the Basle ban convention was called for which bans the transboundary transfer of hazardous material. Having established that the increased likelihood of utilising imported scrap originates in the initial disadvantage located within the recycling sector in India. We next move to the options available to address the identified.

7.3.2 The visible option

Gathering the notion that informal solid waste economy and its agents are extended backward linkages of the formal industrial process and coupling this with the ecological importance of resources cycle which recycling of materials aid, we argue that they be given the Industry status as comes with a formal recognition from the Government. Presently the recycling industries are classified under the small sector units, while their activity is overdue to receive recognition as a promising area of industrial activity. The latest national industrial classification (NIC) has recognised the activity by providing a four-digit classification code to the recycling industries. According to us, an industry status on its own does not help in addressing the informality of the sector, for this revision of materials policy is warranted. Following the grant of an industry status a valid case for the extension of labour laws for the agents working in unprotected and exploited working conditions can be made. As is shown in our survey a major portion of material traded is channelled through the collectors i.e. waste pickers and itinerant buyers, they emerge as the targeted beneficiaries not just because they internalise social costs but also as they are the workers powering this industry.

The formalisation we advocate can be resolved in two stages, first at the level of the interaction of the scrap trading units with the scrap utilising factories: a better exchange environment for them is warranted in terms of corrected price signals. Secondly, on the level of the actors involved in the different tiers of the informal sectors with the recycling units. The first level of formalisation is the necessary step to rectify the inequality of the inter sectoral exchanges. At the same time it is a change which has been advocated by the environmentalists lobby for a very long time, so that the prices are a reflection of the increased extraction costs which represent the

dwindling resources stock. We are of the view that given the industry status and a proper market environment, recycling sector would be able to address a lot of its exploitative situations itself. On the other hand once given an industry status the sector can make use of the various benefits, which it can utilise as a part of the secondary production activity in terms of access to better technology as well as other trade related benefits. Another thing which is simultaneously addressed is the pollution scenario, since the recycling industries are supposedly one of the highly polluting industries and presently get away from the regulations because they are classified with the small sector units. Once given the industry status monitoring the units will (theoretically) become easier.

The second step of formalisation of the INSWE is in terms of addressing the inequality in intra sectoral exchanges. The exchanges between agents as we have seen are highly exploitative and we are of the opinion, that in order to address that one needs to formulate a proper distributive mechanism. This can be ensured if regulation in terms of formulating a employer-employee relationship between the collectors and the processors or levying an occupational charge on the wholesalers and retailers (and utilising the same for setting up a credit facility so as to avoid the debt trap that they are caught into) is brought on. It is here where we advocate, a participatory approach as envisaged in the alternative development paradigm. The role of non-governmental organisations is identified for targeting the agents for formalisation so that the benefit of labour regulations is extended to them, and in the design of measures and managerial interventions to bring about such a change. For this the latter local INSWE and its specificity has to be accommodated in the instruments of such a change, for it is shown that formalisation operations are best executed, utilising the existent set-up rather than formulating a new one²⁰. It is for this that local INSWE needs to be studied.

20 predecessor of Linnis Ganda program failed because the existent dynamics of the informal system was completely ignored.

7.3.3 Atypical look at INSWE

The discussion in a nutshell can be put simply as the disjunction of solid waste economy and solid waste management. As we have seen from our case studies and still maintain the participatory approach, involving the informal sector in **solid waste management** is the best way to deal with the present scenario. Further to that, there is no debate on the transition in urban governance from a centralised to flexible and more decentralised set-up. The doing of such with the help of the informal sector participation is also welcome, as suggested by the Agenda 21 and the Supreme court expert committee (1999) on solid waste management in the class one cities of India. In order to do that what the study proposes is that there has to be a clear understanding of each local INSWE, to which such an alternative is applied. We have seen the nature of local solid waste economy differs given the differences in the waste stream owing to the differences in the nature of their urbanisation. It can be said that every community will have to customise its integrated management system to suit its environmental situation.

The point of disillusionment with participatory approach is its hope of addressing the plight of the actors within the informal sector. The participatory approach as suggested does achieve it, but the coverage is limited, the benefits cannot be extended for all the agents neither does it provide for a correction for the imbalance in the interaction of the formal and the informal sector which according to us is an imposing question. In order to answer that we look to the solid waste economy, which exists because of these agents. Government can contribute positively in the growth of this sector by ensuring that the indigenous scrap markets benefits out of the general economic adjustments and is not faced with unequal competition. In essence getting the prices right in the market for their service, becomes the spinal chord of the whole matter. The basic point is that whether state or a non-governmental agency intervention there is a scope for improving the efficiency and equity within this sector without merging the two but getting the price in the materials markets to reflect the ecological truth. So does it all come down to political will, well yes it does, but such is warranted to be catalysed by the action of the third front (NGO's, CBO's) involving the public at large to raise the consciousness in favour of recovered and recycled

materials. According to us the most important question to be addressed is the inherent inequality in the exchange of the sector which is not only affecting the sectoral agents but largely the reserve stocks of materials that are getting depleted at a rapid rate. The onus thus stays with the Government and the conscientious citizens of our country to make the right move in the direction of urban sustainability.

As per our case study, Jabalpur we know that the main problem is that of management and even though we know that the local level administration is open to innovations in management and there still is a long way to go for Jabalpur. In terms of integrating the informal sector with the formal, we do not see a case. This is due to the fact that not only is there underemployment in the formal sector but also because the informal sector comes through as a more rewarding, flexible and similar when the standards of working are compared. The welcome change would be that of structuralising these agents, which is favoured by the sector agents themselves (even if it comes at some cost) as that entitles them to the benefits, which are not available as they are not recognised. The mention here is made for institutional credit which goes a long way in determining the financial security of the agents, the absence of which is instrumental in the existence of an exploitative exchange within and out of the sector on the whole.

Sum up

The informal solid waste economy sector (INSWE) demands attention as their activity not only reduces the bulk of waste that is to be attended to by the municipal authorities but also because they facilitate materials (resource) cycle which has both marginal private and marginal social benefits. It is evident that they are highly interlinked with the formal sector, the nature of this linkage is one, which needs to be redefined and valued properly. Whether we like it or not the informal sector does internalise a bulk of our disposal costs, this exchange provides them with basic sustenance but to the formal sector it provides services which are worth more than just the operation costs, these are the avoided environmental damage costs. There is not much data to accurately measure the extent to which the sector internalises the costs but the hazardous health effects on ragpickers are an eye opener to the increasing

toxicity of materials in waste²¹. Given the scenario the formal sector should actually pay the informal for taking care of the residuals, but the inequality of exchange is such that ragpickers are blamed for the inefficiency of formal sector operation.

This study figures, in agreement with the earlier works which suggest that the alternative is to be explored in participatory action. The third front, NGO and CBO, have a greater role to play according to us not only in terms of enabling the agents to make an informed choice, but according to us lobby for a correct price signal in the materials market and in terms of designing better management techniques for a formalised and organised set-up to function. The choice advocated is not just in terms of upgrading the service provision but also in tackling with the inherent disadvantage the informal sector faces when compared with the rest of the sectors of the economy. For till and unless the core of the issue is not dealt with we cannot expect the socio and the environmental dimension of the issue to be addressed. The role that informal waste economy plays in the present urban scenario in India has long been neglected, it is a not only necessary that the sector be viewed as a complementary one but also that it be given an industry status. It is such strategy for provision that can guarantee an effective level of quality of life and an efficient wielding of efforts for the common good by two different agencies associated with solid waste.

21 The vulnerability of waste pickers to various diseases like diarrhea, parasitic diseases, dysentery, stomach trouble, eye trouble, respiratory diseases was found to be higher after they became waste pickers. An indication of the increased health risks is also given by the health status of the sanitation workers. For a detailed discussion on this see Cointreau, 1999.

Appendix 7.1

SUPERVISORY STAFF	NORM	REQUIERED	AT PRESENT
Health Officer	1	1	1
Sanitation Officer	1/1 lac population or 1/2 sanitary inspectors	7	8
Sanitation Inspector	1/50,000 population or 1/120 sweepers	15	14
Sanitation sub inspector	1/25,000 population or 1/40 sweepers	36	Non-existent
Sanitary supervisor	1/12,500 population or 1/20 sweepers	72	52
Total		131	75

Note: The norms as specified in the report on solid waste management in class one cities, 1999

VIII

Summary and Conclusion

Environmental changes facing human civilisations can be broadly placed into two categories, namely reversible and irreversible. There is no ready solution to obviate the irreversible changes. While reversible changes are those which can be rectified by an alteration of technology, policy or collective corrective action. The issue of rising piles of waste /garbage in modern day cities presently posits such a reversible environmental problem for the city managers. In their urban agendas for 1990's, both World Bank and UNDP placed waste management as one of the environmental issues needing improvements and as the one whose growth presents urban authorities with problems beyond their current capacity to solve.

The reason why municipal solid waste issue is a reversible problem is because its origin lies in the socio-cultural domain that can be altered, secondly technical and managerial options are a plenty. Along with this solid waste management issues stands to be affected by the population and it's dispersal: urbanisation. Thus the type of and nature of urbanisation is the necessary background in which we need to place solid waste issues and their systematic study. The present study begins with a discussion of the characteristics of wastes in which we chronologically index the various definitions given in the literature.

We see that in the later decades the emphasis shifted to specification of wastes according to various factors like toxicity level, biodegradable nature and sources of origin to name a few. Present study more importantly attempts to conceptualise the notion of solid waste economy, which has long been noticed in the literature in relation to developing countries but not formally discussed. In this way the study opens a dialogue in the existing literature, to improve on this concept. For the study we define solid waste economy as

--- an activity performed by an individual or a society which profitably utilises the solid residual of a production or consumption activity generating a product and/or economic benefit which accrue to the individual and the society as a whole, constitutes the solid waste economy.

Present study accommodates the visible dichotomy of formal and informal regarding handling of waste in a developing country. As it furthers the bisection of solid waste economy into formal solid waste economy (FSWE) and the informal solid waste economy (INSWE). As INSWE is strikingly evident on the solid waste map of the developing countries and off late has been the object of debate, mention and much attention, the study focuses on such.

To us the issue of solid waste and the role of informal sector in it is of interest. As the mention of the above has been via the participatory approach which is much popularised and internationally endorsed way of urban governance. The study furthers the understanding on the above by studying the informal solid waste economy of a particular city, that of Jabalpur in the central province of Madhya Pradesh in India.

A gap identified by the present study in the literature was in terms of identifying the factors of influence, which affect the waste stream and consequentially the solid waste management as well as solid waste economy. As the solid waste stream of an economy determines INSWE, it was important to study its vulnerability to the general socio economic factors of the economy. Determinants of solid waste economy were checked at two levels of regional aggregation: at the country and secondly at the city level. For such an analysis we propose two frameworks in the study, which provide us with a set of probable variables and their directions. At a conceptual level the study proposes that the subject of solid waste stream influences can be broached in two ways, thus the two frameworks addressing the quantity and the quality of waste. Utilising one of these frameworks, which investigates the determinants of the total and per capita solid waste generated in a system the study analyses 28 countries, with respect to their urbanisation characteristics namely percentage urban population and value added by services in an economy. The results indicate that the total quantity of solid waste is elastic to the value added by services and relatively inelastic to urban population while it is negatively influenced by environmental awareness. Another exercise separately done by us helps us to conclude that solid waste stream is relatively inelastic to income (Beede and Bloom, 1995) but highly elastic to population. An exercise with twenty-three metropolitan cities of India is also done to attempt a city level examination. It also helps us to generate a national scenario from which we conclude about the gravity of the solid waste problem for Indian cities. We

find that cities showing higher rate of growth are also the cities, which have one of the highest quantity of waste generated (standardised for population).

In order to understand the ramifications of the issue, a micro level study was thought necessary and for that the study narrowed down on the city of Jabalpur, which is the fourth largest city of the state of M.P. By choosing to study Jabalpur, we addresses an evident gap in the literature that of an absence of INSWE account for class one size non metro cities, in which presently a vigorous urban growth is witnessed.

The INSWE of Jabalpur was found to be different in certain socio-economic factors owing to its difference in status as a non-metro city. Agents are classified in four levels according to the activity, namely into generators, retrievers, processors and users. Essentially what follows from the primary survey analysis, highlights the role of INSWE as the safety net of uneducated unemployed, poor and migrant population of the city. A larger involvement of Muslim community in this sector was found to be distressing given the widely reported backwardness of this community. The set up is very patriarchal (almost feudal) with debt trap proving to be the instrument assuring waste supply. Absence of a production sector in the city has led to the ultimate supremacy of wholesalers in the hierarchical chain, with the market structure being largely oligopolistic. The growth experienced by the industry has been involutionary which is true to the theoretical expectation. To this end the INSWE exhibits a typical informal sector characteristics.

On the other hand an analysis of INSWE with urbanisation experienced by the city revealed that the INSWE sector has grown over time in response to the wave of urbanisation. At present the traditional trade materials market (iron) is recording stagnation due to the predominance of increasing services sector in the city (in the face of declining industrialisation). The upcoming materials of trade are now plastics, glass, and paper. Effect of urbanisation on the INSWE can also be witnessed at close quarters while observing the intra urban spatial location of the activity. Over the years as the city grew in size and area, the activity market was seen to split from its main location, in the middle of the city to other centres, conveniently near the highways for the ease of transport. We find the trend true to those discussed earlier in the literature.

A thorough study of INSWE leads us to discuss the suggestion of involving informal actors in the solid waste management, as is generally deemed desirable in the

literature. We emphasise the need for a distinction between solid waste management and solid waste economy, and build our argument on the basic premise that an effort to target both issues together is misplaced. The study discusses the participatory approach of urban solid waste service provision, facilitated by the joint efforts of public, government and NGO's representing the case of the INSWE actors. This suggestion in the case of Jabalpur does not prove to be a desirable exercise for the formal as well as the informal sector agents and their respective solid waste economies. Instead the study advocates that formalisation should indeed be pushed through but in terms of granting an industry status to the recycling units as well as formalising standards for exchanges between agents of this sector and granting them access to institutional facilities.

We conclude that a participatory approach towards this form of formalisation would be best, which would involve the government, industries and INSWE represented by NGO's. Solid waste management is and continues to be a hazard for urban safety and living standards, but the notion that utilisation of formalisation of INSWE with the formal workforce can effectively change the present scenario is questioned in our study. We view the informal sector as a main contributor bridging the resource constraints faced by the cities' production sector and the national industrial community as a whole. This is the role that we highlight. Their role as ones responsible for safe and clean neighbourhoods has to be best left to them to decide.

References

- Allaby M. (1977), "*Dictionary of Environment*", Macmillan Press Ltd. pp-512.
- Altaf M and Deshazo J. R. (1996), "Household Demand for Improved Solid Waste Management: A Case Study of Gujranwala, Pakistan", *World Development* 24(5) pp .857-868
- American Society of Civil Engineers Committee of Sanitary Engineers (1976), *Sanitary Landfill*, Division Manual No: 39
- Anand.P.B. (1999), Waste Management in Madras Revisited, *Environment and Urbanisation* 11(2) October pp.161-176.
- Ayres U. R. (1999), "Materials Economics and the Environment" in Jeroen C.J.M. Van Den Bergh (Eds.) *Handbook of Environmental and Resource Economics*, Cheltenham: Edward Elgar.
- Aziz A. (1984), *Urban Poor and Urban Informal Sector*, New Delhi: Ashish Publishing House.
- Barrow C.J. (1995), *Developing the Environment: Problems and Management*, Essex: Longman Group Limited.
- Bartone C. (1993), Comment on Sinha Kazal," Partnership in Collection: Malaysian Experience" *Regional Development Dialogue* 14(3) pp. 50-52.
- Baud I. and Schenk H. (1994), *Solid Waste Management-Modes, Assessments, Appraisals and Linkages in Bangalore*, Delhi: Manohar Publishers and Distributors.
- Beede David N. and Bloom David E. (1995),"The Economics of Municipal Solid Waste", *The World Bank Research Observer* 10(2) pp.113-150.
- Beinfeld (1975),"The informal sector and peripheral capitalism: the case of Tanzania", *Bulletin of the institute of development studies* 6(3).
- Beukering,P.(1994),"Economic and Environmental Impact of Formal and Informal Recycling Activities in Developing Countries", M.A. Thesis (Unpublished), University of Amsterdam.
- Bhattacharya M.and Kundu N. (1998), " The Rag Pickers: A Study in Urban Poverty", *Nagarlok* 30(3) pp.1-17
- Bhide A.D. (1994), "Solid Waste Management in Urban Areas"; *Nagarlok* 26(4) pp.16-25
- Bierbeck C. (1978),"Self Employed Proletarians in an Informal Factory: The Case of Cali's Garbage Dump", *World Development*, 6(9/10) pp.1173 –1185
- Blore and Funan (1994), "Residual Resources and Public Policy", *Nagarlok* 26(4) pp. 1-16.
- Boerner and Chilton (1994), "False Economy: The Folly of Demand Side Recycling", *Environment* 36(1) pp. 6-15.
- Bose S. (1998), Its Not Sheer Garbage, *Indian Journal of Environmental Protection*, 18(6).
- Bower T.B. (1977)," Economic Dimensions of Waste Recycling and Reuse Some Definitions, Facts and Issues" in Pearce and Walter (Eds.) *Resource Conservation: Social and Economic Dimensions of Recycling*, New York: New York University Press.

- Bromely R. (1978), "Urban Informal Sector: Why is it worth discussing", *World Development*, 6(9/10) pp. 1033-1039.
- Buch, Dasgapat and Sivaramakrishnan (Eds.) (1993), *Urbanisation in India-Basic Services and People's Participation*, New Delhi: Concept Publishers.
- Centre For Science And Environment (2000), "State of India's Environment: The 5'th Citizens Report, Statistical Database, New Delhi: Centre for Science and Environment Publications.
- Chaplin, S.E (1999), "City Sewers and Poverty: India's Politics of Sanitation"; *Environment and Urbanisation* 11(1), pp. 145-158.
- Chikarmane P. (2000), "Formalising Livelihood: Case of Waste Pickers in Pune", *Economic and Political Weekly*, 35(41) pp.3639-3642.
- Coad, N.A, (1973), "The Dynamics Of Domestic Solid Waste Generation in an Industrialising Economy". MS Thesis University Of Shiraz: Iran.
- Cointreau S.J. (1987), *Solid Waste Recycling: Case Studies in Developing Countries*, Washington DC: World Bank.
- Cointreau S.J. (1991), "Living with Garbage: Cities Learn to Recycle" in *Development Forum*, Jan-Feb, 12-13
- Cointreau S.J. (1994), *Private sector participation in Municipal Solid Waste Services in Developing Countries*, Vol.1; The formal sector, Washington DC: World Bank.
- Cointreau S.J. (2000), *Occupational and Environmental Health Issues in Solid Waste Management*: Mimeo
- Cointreau S.J. (1982), "Environmental Management of Urban Solid Wastes in Developing Countries", *Urban Development Technical Paper Number 5*, World Bank, Washington DC.
- Cointreau S.J. (1984), "Solid Waste Collection Practices and Planning in Developing Countries", in J.R. Holmes (Eds.) *Managing Solid Waste in Developing Countries*, New York: John Wiley and Sons.
- Cutright,P.(1970), "The Distribution and Redistribution of Income: Political and Non Political Factors" in Bloomerg W and Schmandt J (Eds.), *Urban Poverty Its Social and Political Dimensions*, California: Sage Publications.
- Dayal G. (1994) "Solid Wastes: Sources, Implications and Management" *Indian Journal of Environmental Protection* 14(9) pp.669-677.
- De Souza (1991), "The Waste that People Want: An Intermediate Report on Solid Waste Collection and Disposal in Bangalore" (Unpublished): Mimeo.
- Dhanalakshmi R. and Iyer S., (1999) *Solid Waste Management in Madras City-1994* Chennai:Pudhuvazhvup Pathinppagam(P) Ltd.
- Dubey D.R. (1985), "Solid Waste In Jabalpur" M.Tech Thesis, Unpublished, Jabalpur: Jabalpur Engineering College.

- Eiensiedel N.V. (1999) www.hsd.ait.ac.th/ump/uaop.html.
- Faber M., Niemes H, Stephan G. (1987), *Entropy Environment and Resources: An Essay in Physico-Economics*, Hiedelberg: Springer-Verlag
- Fujita M. (1989), *Urban Economic Theory*, Cambridge: Cambridge University Press.
- Furedy C. (1992), "Garbage: Exploring Non-Conventional Options in Asian Cities", *Environment And Urbanization* 4(2) pp. 42-54.
- Furedy C. (1995), "Liquidation Of Solid Wastes", *Down To Earth*, 4(14) pp.52-53
- Furedy, C (1989), Social Considerations in Solid Waste Management in Asian Cities, *Regional Development Dialogue*, 10(3) pp.13-43.
- Gardner G. (1997) *Recycling Organic Waste: From Urban Pollutant To Farm Resource* Worldwatch Working Paper-135, Washington DC: World Watch Institute,.
- German Technical Agency (GTZ) *Gate*: Various Issues.
- Gilpin A. (1976), *Dictionary of Environmental Terms*, London: Routledge and Kegan Paul Limited pp-169.
- Gilpin A. (1996), *Dictionary of Environmental and Sustainable Development*, Sussex: John Wiley and Sons pp-201
- Gouri G. (1992), "Urban Services and the Private sector in India" *Public Private provision of Urban services*. Research Study series No: 50, New Delhi: National Institute of Urban Affairs.
- Gove P.B. (Eds.) (1971), "Websters 3rd New International Dictionary of the English Language unabridged edition", vol 2, Massachusettes: G & C Merriam Company.
- Gupta and Asher (1998), *Environment and The Developing World: Principles Policies and Management*, Singapore: John Wiley And Sons
- Harper M. (2000), *Public Services through Private Enterprise Microprivatisation for Improved Delivery*, New Delhi: Vistaar Publications
- Hart (1971), "Informal Income Opportunities and Urban Employment in Ghana". Paper Presented At Institute Of Development Studies, University Of Sussex Later Published In *Journal of Modern African Studies* (1973) 11 pp. 61-89.
- Hershkowitz, A. (1986), *Garbage Burning –Lessons from Europe*, New-York: Inform Inc.
- Hochman O. (1982), Congestible Local Public Goods in an Urban Setting, *Journal of Urban Economics*; 11 pp.290-310.
- Hoomweg (1999), World Bank, [url: http://www.rti.org/cid/identity.html](http://www.rti.org/cid/identity.html)
- Hoselitz (1969), "Role of Cities in the Economy", *Journal of Political Economy* 61(3) pp.195-200.
- Huriot M.J. And Thisse F.J. (Eds.) (2000), *Economics of Cities: Theoretical Perspectives*, Cambridge: Cambridge University Press

- Indian Statistical Institute (1981), *Glossary of Terms Relating to Solid Wastes*, New Delhi.
- Jabalpur Town Planning Department (2001), "Jabalpur Development Plan-2005": Personal Communication
- Jagannathan N.V. (1987), *Informal Markets in Developing Countries*, New York: Oxford University Press, INC.
- John E.Young and Aaron Sachs (1994) *The Next Efficiency Revolution: Creating a Sustainable Materials Economy*. Worldwatch Working Paper-121, Washington DC :World Watch Institute.
- Kala J.C. and Khan R.R. (1994)"Management of Municipal Solid Wastes", *Yojana* pp.18-21. Jan.
- Kalra S. (1994), "Wasteful Profits", *Down to Earth*, October 31.
- Kansal *et al* (1998)" Delhi Municipal Solid Waste and Environment: An Appraisal" *Indian Journal of Environmental Protection* 18(2).
- Kasarda John D.and Berry Brian J. (1977), *Contemporary Urban Ecology*, New York: Macmillan.
- Kemp, (1998),"*The Environment Dictionary*", London: Routledge pp-426.
- Khoshoo T. N. (1996), Foreword to *Wealth from Waste*, New Delhi: Tata Energy Research Institute.
- Kreith F. (Eds.), (1994) *Handbook of Solid Waste Management*, New York: Mc-Graw Hill.
- Larkin A. (1986), "Environmental Impact of Industrial Adjustment: Application of Fosters Principles to Solid Waste Disposal" *Journal of Economic Issues* 20(1) pp.43-63.
- Lowder S. (1986), *Inside Third World Cities*, Kent : Croom Helm.
- Mathur M.P (1994), "Financing Urban Services: Strategic Options", *Nagarlok*, 26(1) pp.35-40.
- Mathur O.P. (Eds.)(1999), *India the Challenge of Urban Governance*, New Delhi: National Institute of Public Finance and Policy.
- Mazumdar D. (1976), "The Urban Informal Sector", *World Development* ,4 pp. 385-413.
- Mehta M. (1999), "Participation and Urban Governance" in Mathur O.P. (Eds.) *India the Challenge of Urban Governance*, New Delhi: National Institute of Public Finance and Policy.
- Mishra. G.K.(1994), "Public, Private Interface and Harmonisation of the Delivery of Urban Services", *Nagarlok*, 26(2) pp.1-15.
- Misra U.S., Rajan I, Ramanathan M. (1999),"A Decade of Urban Explosion: 1981-91" *Nagarlok* 31(3) pp.10-22 .
- Moser C., (1978)"Informal Sector or Petty Commodity Production: Dualism or Dependence in Urban Development, ", *World Development*, 6(9/10) pp.1041-1064.

- Nodal Research Centre (1996), *Urban Waste Recycling -Economic and Practical Options*. Mimeo: Calcutta.
- Ogawa H. (1998), 7'th ISWA Congress And Exhibition, Parallel Session7-International Perspective, <http://www.gdrc.org/uem/waste/waste.html>.
- Ouano E.A.R. (1993), "Imperatives for Recycling and Resource Recovery" *Regional Development Dialogue* 14(3) pp.25-39.
- Paragal, S And Muthukumar (2000), "Citizen Activism, Environmental Regulation and the Location of Industrial Plants: Evidence from India", *Economic Development and Cultural Change*, 48(4).
- Pollock C (1987), *Mining Urban Wastes : The Potential for Recycling*. World Watch Paper-76, World Watch Institute, Washington D.C.
- Qadeer M.A. (1983), *Urban Development in the Third World: Internal Dynamics of Lahore, Pakistan*, New York: Prager Publications.
- Rangers and Meadows (1973),"The Dynamics of Solid Waste Generation" in Meadows *et al* (Eds.) *Toward Global Equilibrium: Collected Papers*, Cambridge Massachusetts: Wright Allen Press.
- Ravichandran and Poongodi (1999) "Economics of Urban Solid Waste Management", *Nagarlok* 31(2) pp.48-56.
- Redclift M (1996) *Wasted: Counting The Costs of Global Consumption*, London: Earthscan.
- Report of the Committee Constituted by the Honourable Supreme Court of India (1999), *Solid Waste Management in Class 1 Cities in India*. New Delhi. March.
- Roy, G. K. (1988), "Economics of Urban Solid Waste Management", *Indian Journal of Environmental Protection* 8(9) Pp.676-680.
- SchellasR.M. (Eds.) (1982), *Solid waste Disposal and Utilisation in Developing Countries*, Bulletin 310, Department of Agricultural Research, KIT:Amsterdam..
- Schertenleib R.and Meyer, W (1992), *Municipal Solid Waste Management in Developing Countries: Problems and Issues . Needs for Further Research*, International Reference Centre for Waste Disposal (IRCWD) News 26 p-42.
- Shaw P. (1989), "Rapid Population Growth and Environmental Degradation: Ultimate Versus Proximate Factor", *Environmental Conservation* pp.199-209.
- Sudhir, V. (1997), "Approaches to Sustainable Solid Waste Management in Urban India: A Critical Systems Perspective", *Nagarlok* 24(2) pp. 1-13.
- Sundaram, K. (2001), "Employment –Unemployment Situation in the Nineties: Some Results from NSS 55'th Round: Survey, *Economic and Political Weekly* 34 (11) pp.931-940.
- Tokman V. (1978), An Exploration into the Nature of Informal Formal Sector Relationships, *World Development* 6 (9/10) Pp-1065-1077.

Turner, K.R. (1995), "The Firm And The Environment" in Folmer, H., Gabel, H. Opschoor, H.(Eds.). *Principles of Environment And Resource Economics: A Guide For Students And Decision Makers*. U.K: Aldershot Edward Elgar.

United Nations (1991), *World Urbanisation Prospects 1990*: United Nations.

United Nations Commission On Sustainable Development, Working Paper 2, Solid Waste Management And Sewage Related Issues. Chapter 21, Agenda 21, 1999.

United Nations Development Program, (1999) *Human Development Report* Oxford: Oxford University Press.

W.H.O, (1980), *Glossary on Solid Wastes*, WHO Regional Office for Europe, Copenhagen.

World Bank, *World Development Report 1997*, New York: Oxford University Press.

World Bank, *World Development Report 2000: Entering the 21'st Century*, New York: Oxford University Press.

World Resource Institute (2000) News Release, www.wri.org/wri/

World Resources (1998–99), *Urban Characteristics, City Level, 1993*, World Resource Institute, www.wri.org

World Watch Institute (1999), *State of the World: A World Watch Institute Report on Progress toward a Sustainable Society*, New York: W.W. Norton.

A STUDY OF WASTE ECONOMY IN JABALPUR URBAN
AGGLOMERATION

QUESTIONNAIRE FOR WASTE COLLECTORS:

DATE:

AREA OF ENQUIRY:

PLACE:

QUESTIONNAIRE NO:

• WP

IB

1 INDIVIDUAL PARTICULARS

1.1 AGE

1.2 SEX

1.3 MARITAL STATUS

1.4 LITERACY LEVEL:

1.5 AREA OF RESIDENCE

1.6 MIGRANT: * YES

* NO

1.6 (a) IF YES THEN FROM WHICH : DISTRICT IN THE STATE
: STATE

1.7 CASTE:

¹ note : wp waste picker for 1.3 s =single
: ib itinerant buyer m =married
w = spouse not alive
for 1.4 x---no education
pri---primary
mid---middle school
high plus ----high school and plus

II OCCUPATIONAL PARTICULARS

2.1 WORK EXPERIENCE:

2.2 AREA OF OPERATION:

2.3 THE AMOUNT OF:

DISTANCE COVERED IN KMS,DAILY	MONEY EARNED IN RS. DAILY			YEARLY			WORKING HOURS	WASTE COLLECTED IN KGS DAILY			
	MX	AV	MIN	MX	AV	MIN		MX	AV	MIN	
>3-5	>15-20							>15-20			
>5-10	>30-50							>30-50			
>10-15	>50-70							>50-70			
>15-20	>70-100							>70-100			

2.4-----**MATERIALS INFORMATION for 2000**

MATERIAL	BUYING PRICE			VALUE ADDED		SELLING PRICE			PROFIT REALIZED (TO BE FILLED IN LATER)
	MAX	PRE	MIN	YES	NO	MAX	PRE	MIN	
PAPER									
a. notebook									
b. newspmt									
GLASS									
a. bottles									
b. cut glass									
PLASTIC									
a. milk pouches									
b. thin polybags									
c. others									
GUNNY BAGS									
RUBBER/ SYNTHETIC									
LEATHER									
INERT MATTER									
METALS									
a. iron									
b. tin									
c. aluminium									

NOTE:

- 1 ---- yes in value added is to identify materials which undergo primary modification after retrieval.
 2 ---- MAX = maximum; PRE = present; MIN = minimum

2.5 (A) WERE YOU PREVIOUSLY EMPLOYED: * YES
* NO

(B) IF YES THEN WHAT AND THE REASON FOR LEAVING IT:

2.6 . ARE ACCESORIES USED TO AID COLLECTION: * YES
* NO

IF YES THEN WHAT

1. _____
2. _____
3. _____
4. _____

2.7 DO YOU GO FOR COLLECTION ALONE or IN GROUP:

2.7 (1) IF IN A GROUP THEN

a. HOW MANY MEMBERS IN THE GROUP?

b. WOULD YOU LIKE TO GO TO A DIFFERENT AREA WITHOUT YOUR GROUP AND WHY?

*YES

* NO

2.8 WHERE DO YOU SELL THE WASTE EVERYDAY TO

- ONLY ONE TRADER
- DIVIDE AND SELL ACCORDING TO TRADER SPECIALIZATION
- RANDOM

2.9 DO YOU RECEIVE MONEY IN ADVANCE FROM TRADER:

* YES

* NO

III-----FAMILY PARTICULARS

3.1 MONTHLY INCOME OF THE FAMILY:

3.2 FAMILY STRUCTURE:

S.NO.	SEX	AGE	WORKING	EDUCATION ₁	SICK/DISABELED	MIGRANTS	OBSERVATIONS

NOTE: X---NO EDUCATION
PRI---PRIMARY
MID---MIDDLE SCHOOL
HIGH+-----HIGHSCHOOL AND PLUS

IV. VIEWS/ OTHER INFORMATION:

A. WHAT DO YOU DO IF YOU REALISE THE TRADER IS CHEATING YOU?

B. IF A TRADER MISBEHAVES WHAT DO YOU DO (FOR WOMEN)?

C.DO THE POLICE/LOCAL LORDS HARRAS YOU?

D. DO YOU THINK YOU GET A BETTER PRICE IF YOU SELL IN A GROUP?

* YES / * NO AND WHY?

E. DO YOU AVAIL OF FINANCE ASSISTANCE FROM A BANK/NGO/OTHER AGENCY?

F. ARE YOU A RECIPENT OF SOCIAL SUPPORT SERVICE PROVIDED BY ANY AGENCY?
