

**SOLID WASTE MANAGEMENT INITIATIVES:
AN EXPLORATORY STUDY OF SOLAN TOWN
(HIMACHAL PRADESH)**

*Dissertation Submitted to Jawaharlal Nehru University
In Partial Fulfillment of the Requirement for
the Award of the Degree of*

MASTER OF PHILOSOPHY

JAGDEV CHAND SHARMA



**CENTRE OF SOCIAL MEDICINE AND COMMUNITY HEALTH
SCHOOL OF SOCIAL SCIENCES
JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI 110067
2007**



CENTRE OF SOCIAL MEDICINE & COMMUNITY HEALTH
SCHOOL OF SOCIAL SCIENCES
JAWAHARLAL NEHRU UNIVERSITY

New Delhi-110067

Dated: 19th July 2007

CERTIFICATE

This dissertation entitled, "SOLID WASTE MANAGEMENT INITIATIVES: AN EXPLORATORY STUDY OF SOLAN TOWN (HIMACHAL PRADESH)" is submitted in partial fulfillment of the requirements for award of the degree of MASTER OF PHILOSOPHY, of Jawaharlal Nehru University. This dissertation has not been submitted for any other degree of this university or any other university and is my original work.

(JAGDEV CHAND SHARMA)

We recommend that this dissertation be placed before the examiners for evaluation.

Prof. K. R NAYAR
Chairperson
Centre of Social Medicine &
Community Health, SSS
Jawaharlal Nehru University
New Delhi-110067

19/07
Dr. SANGHMITRA S. ACHARYA

(Supervisor)

Dr. Sanghmitra Acharya
Associate Professor
Centre of Social Medicine &
Community Health SSS
Jawaharlal Nehru University
New Delhi-110067

Dedicated to my Grandmother
The eternal source of inspiration

C ONTENTS

<i>List of Tables</i>	<i>iv</i>
<i>List of Figures</i>	<i>v</i>
<i>List of Plates</i>	<i>vi</i>
<i>List of Appendices</i>	<i>vii</i>
<i>Abbreviations</i>	<i>viii</i>
<i>Acknowledgement</i>	<i>ix</i>
Chapter-1 Solid Waste Management : Some Issues	1-25
1.1 Introduction	1
1.2 Solid Waste Management	2
1.3 Municipal Solid Waste management Policy in India	4
1.4 Theoretical Framework	8
1.5 Evolution and development of Solan Town	11
1.6 Spatial-Temporal growth of the town	12
1.7 Development, Pollution and Solid Waste	12
1.8 Solid Waste Generation and Disposal	14
1.9 Classification of Solid Wastes	15
1.10 Stakeholders in the refuse collection and disposal services	16
1.11 Rationale of the study	16
1.12 Himachal Pradesh: A Profile	19
1.13 Research Design	19-24
1.13.1 Area of the study	19
1.13.2 Methodology	21
1.13.3 Objectives of the study	24
1.14 Limitations of the study	24
1.15 Chapterisation Scheme	25
Chapter-2 Urbanisation and Urbanism: Understanding the Phenomenon	26-39
2.1 Urbanisation: Stemming a perilous impact	29
2.2 Third World Urbanization	30
2.3 Urbanization and its Ramifications	30
2.4 Urban development in Himachal Pradesh	33-36
2.4.1 Urbanisation pattern in H.P.	33
2.4.2 Urban infrastructure in H.P.	36
2.4.3 Water Supply	36
2.5 Solid Waste Management	37
2.6 Critical appraisal of JNNURM	38

Chapter-3	Contextualizing Solid Waste Management	40-61
	3.1 Government initiatives	40
	3.2 Gender based division of labour in SWM	43
	3.3 Process of SWM	44-50
	3.3.1 Waste collection and sorting	44
	3.3.2 Separation at source	44
	3.3.3 Hard approach	50
	3.3.4 Soft approach	50
	3.4 SWM and related Environmental factors- Linking Health	51
	3.5 Health and Environment issues	52
	3.6 Healthy cities	53
	3.7 Government versus private waste collection	54
	3.8 Privatisation in SWM	54
	3.9 Community Participation	55
	3.10 Concerns growing about SWM	56
	3.11 Poverty statistics in H.P.	59
	3.12 Economic Profile of H.P.	60
	3.13 Industrial workers	61
Chapter-4	Solan and Solid waste Management-Field Data Collection, Presentation and Analysis	62-93
	4.1 Evolution of Solan Town and Agencies of SWM	62-63
	4.1.1 Growth of Solan Town as an Urban Entity	62
	4.1.2 Evolution of Solan	62
	4.1.3 Brief history of Municipal Council of Solan	63
	4.2 Demographic and socio-economic profile of Solan town	64-65
	4.2.1 Demography of Solan Town	64
	4.2.2 Disposal of Garbage	65
	4.3 Methods and Material	67
	4.4 Solid Waste Management System in the context of Public Health	69
	4.5 Awareness about the harmful impacts of improper disposal of waste	72
	4.6 Spatial Variation in SWM in Solan (Developing a Composite Index)	73-74
	4.6.1 Index of SWM	73
	4.6.2 Assigning the weights	74
	4.7 Formal Waste collection in Solan	78
	4.8 Disposal of Solid Waste in Solan	78
	4.9 Scope for Informal Sector	78
	4.10 Reflections on SWM scenario in Solan	79
	4.11 Solid Waste Management in the informal sector in Solan	80
	4.12 Interplay of various actors engaged in waste picking	80

4.12.1	Perceptions of Waste Pickers about Thekedars	80
4.13	Willingness to avail Health and Educational facilities	81
4.14	Impact of poor health on the economic condition of waste pickers	82
4.15	Waste Picking as a compulsion or vocation	83
4.16	Non Formal Sector Initiatives in SWM	83
4.17	Characteristics of Non Formal Institutions engaged in SWM	84
4.18	Vatavaran	85
4.19	The initiatives by Non Formal sectors in SWM in Solan	87
4.20	Waste Pickers	88
4.20.1	Social Aspects of Waste Picking	89
4.20.2	Economic Aspects of Waste Picking	89
4.21	Privatisation in Solid Waste Management	89
4.22	Solid Waste Management in Formal sector	93
Chapter-5	Summary and Conclusion	94-102
	Bibliography	103-111
	Appendix	112-117

LIST OF TABLES

Table 2.1	Trends of Urbanization in Himanchal Pradesh	33
Table 3.1	District-wise PCI, 1990-91 to 1999-2000 at 1990-91 Prices	60
Table 3.2	District-wise numbers of industrial workers per 1000 of population in H.P, 1991 and 2000	61
Table 4.1	Ward wise population of Solan Town	62
Table 4.2	Brief History of Municipal Council	63
Table 4.3	Decadal growth rate of District Headquarter towns during 1981-1991 & 1991-2001	64
Table 4.4	Growth Rate of Solan town since 1971	64
Table 4.5	Nearest Medical Facility	65
Table 4.6	Housing	65
Table 4.7	Availability of Garbage Disposal facility	66
Table 4.8	Local Municipal bodies in Himachal Pradesh	66
Table 4.9	Status of Municipal Solid Waste in Himachal Pradesh	66
Table 4.10	Frequency of Garbage Disposal	71
Table 4.11	Selected Variables and Factors	74
Table 4.12	Ward wise Composite Score of all the variables	77
Table 4.13	Ranks of the wards in descending order of composite index	77
Table 4.14	Average weight of waste measurement in one dumper	88
Table 4.15	Average weight of waste measurement in one tipper	88

LIST OF FIGURES

Figure 1.1	Legislative Framework for MSWM in India	5
Figure 1.2	Solid Waste Material	14
Figure 1.3	Location of Wards in Solan MC	23
Figure 3.1	Processes and Products from Organic Waste	42
Figure 4.1	Garbage Disposal Places	70
Figure 4.2	Average Waste Generated Per Ward Per Household	71
Figure 4.3	Safaikaramcharis Deployed	72
Figure 4.4	Awareness about the harmful impacts of Garbage Disposal	73
Figure 4.5	Process of Waste Management	92

LIST OF PLATES

Plate 1	Ward-wise location of Solan Town in Himachal Pradesh	x
Plate 2 (A)	Panoramic View of Solan Town	xi
Plate 2 (B)	Solan Town within Solan District	xi
Plate 3 (A)	Disorderly Situation at old bus Stand Solan	32
Plate 3 (B)	Stray Animals at Garbage Processing Plant Site at Salogara	32
Plate 4 (A)	Man collecting food items for animals (Pigs) from garbage	90
Plate 4 (B)	Women rag pickers at processing plant	90
Plate 5 (A)	Bio-compost prepared at processing plant	91
Plate 5 (B)	Hoardings put up by forest department	91

LIST OF APPENDICES

Appendix - 1 Questionnaire for Household/Community	112
Appendix – II Questionnaire for Waste-Pickers/Informal Sector	114
Appendix – III Questionnaire for Municipal Committee	115
Appendix – IV Questionnaire for Hospital Personnel	116
Appendix - V Questionnaire for Non-Governmental Organisation	117

ABBREVIATIONS

CAGR	Compound Annual Growth Rate
CBs	Cantonment Boards
CPCB	Central Pollution Control Board
CSMCH	Centre of Social Medicine and Community Health
EPR	Extended Producer's Responsibility
GOI	Government of India
HP	Himachal Pradesh
HPHDR	Himachal Pradesh Human Development Report
IASSI	Indian Association of Social Science Institutions
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
JNU	Jawaharlal Nehru University
LSGBs	Local Self Governing Bodies
MC	Municipal Committee
MoEF	Ministry of Environment and Forestry
MSW	Municipal Solid Waste
NGO	Non Government Organisation
O&M	Operations and Maintenance
PCI	Per Capita Income
RCRA	Resource Conservation and Recovery Act
RRA	Resource Recovery Act
SDP	State Domestic Product
SER	State of Environment Report
SMTs	Small and Medium Towns
SWM	Solid Waste Management
TERI	The Energy Research Institute
UP	Uttar Pradesh
ULBs	Urban Local Bodies
UNCED	United Nations Conference on Environment and Development
USWM	Urban Solid Waste Management
UTs	Union Territories
WHO	World Health Organisation

ACKNOWLEDGEMENT

Realization of a dream is certainly a collective endeavour. In the process directly and indirectly many people other than the one who nurtures the dream, contribute towards materializing it. Therefore I take upon the opportunity to express my sincere gratitude to each of them.

*First of all I earnestly express my immense indebtedness to my esteemed Supervisor, **Dr. Sanghmitra Sheel Acharya**, Associate Professor, Centre of Social Medicine and Community Health, Jawaharlal Nehru University, New Delhi for her invaluable guidance, stimulating inspiration and meticulous advice and encouragement during my research work, without which this work would never have been realized. I am also grateful to **Dr. Rajib Dasgupta**, who helped me to focus on to the specific topic in the beginning of the year. I am much beholden to **the professors, teaching faculty** at CSMCH who introduced me to understanding the Public Health from an interdisciplinary perspective and the staff of CSMCH for their support.*

I benefited greatly from the libraries of Jawaharlal Nehru University, Centre for Science and Environment, The Energy Research Institute, Urban Health Resource Centre, Documentation Unit CSMCH, all in Delhi, Himachal Pradesh University Library, Shimla and District Library, Solan. I therefore wish to express my gratitude for the help extended by their staff.

My intense sincere thanks to 'Matyaik family', my parents, my sisters, my brothers Dr. Bhaiya, Yash Bhaiya, Shastri bhaiya and Santosh for their love and support in different capacities.

I am thankful to my friends and seniors for their outstanding co-operation and emotional support. They are Sarada, Reetu, Mayank(Muttu), Ranvir, Dr. Harish Gajju, Shailendra, Anil(Chintoo), Sanchita, Tarun, Rajeev, Anurag, Anns, Venkatesan, Anoop, Arunibala, Ashish, Saheli, Akash, Chhering, Dharam kirti, Davinder, Virender, Jagdish chand, Mozzam, Manish, Mushtaq, Anjani, Manish bhai, Subash bhai, Jayant bhai, Pranta bhai, Rajesh Bhai, Rokey bhai, Jitender ji, Zara.

Finally, I feel obliged to the residents of the study area, Municipal Committee staff Solan and the workers at the waste processing site who willingly co-operated with me and provided me with personal information. It would not have been possible to carry out this study without their co-operation.

However, I am alone responsible for the mistake in the present work.

Date:
JNU, New Delhi

Jagdev Chand Sharma

Plate 1
 (A) Ward wise location of Solan town in Himachal Pradesh

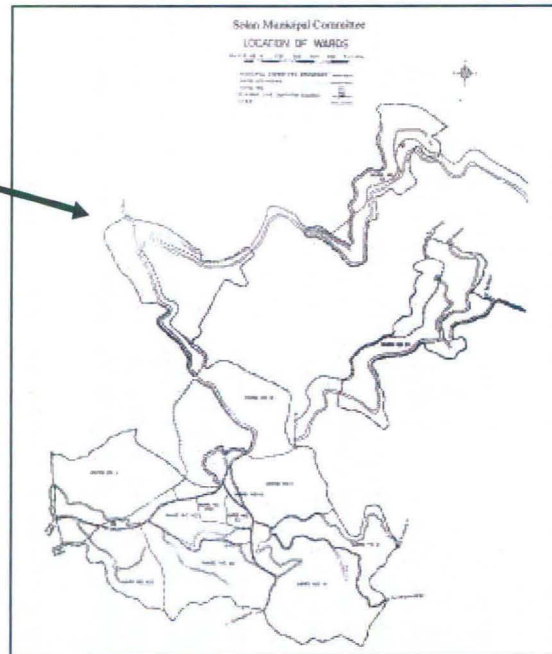
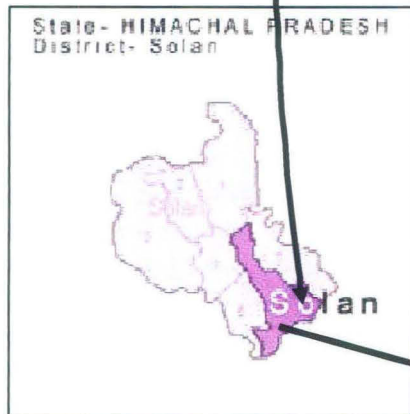
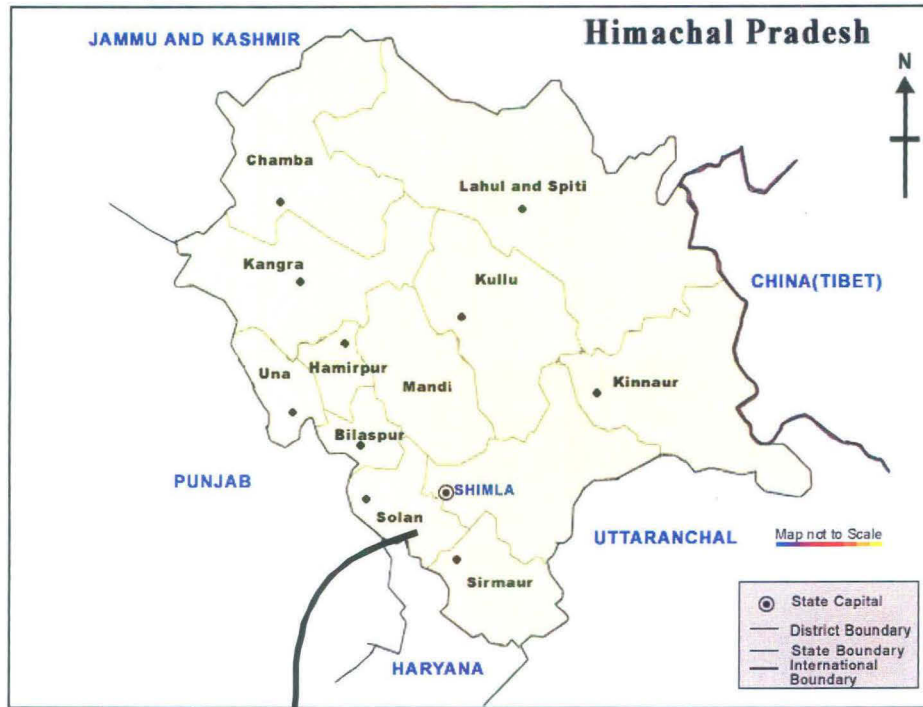
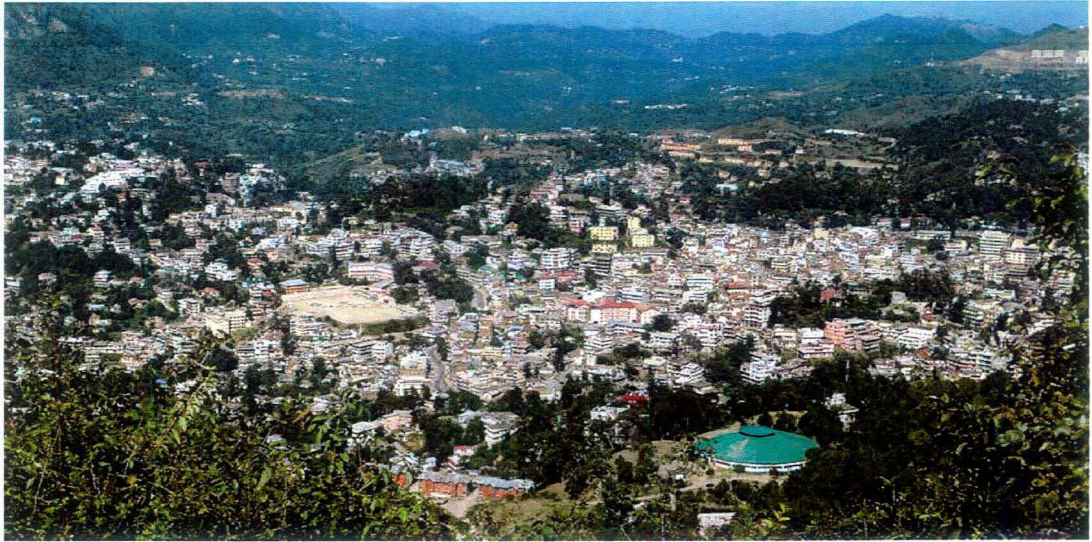
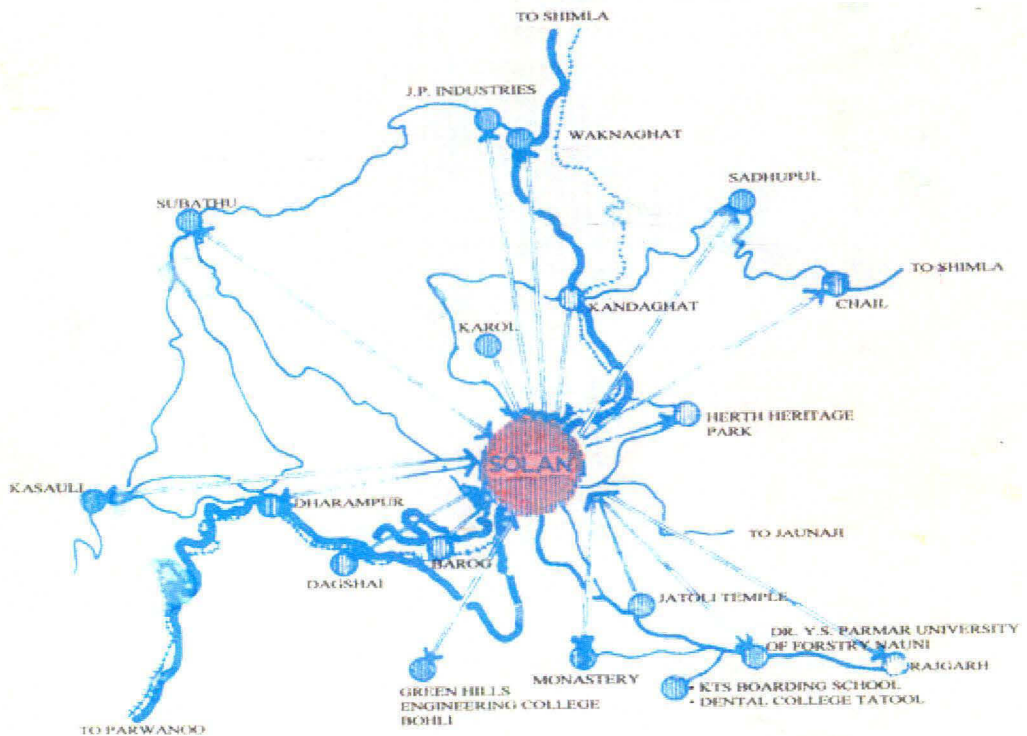


Plate 2
(A) Panoramic view of Solan Town



(B) Solan Town with in Solan District



Chapter I

Solid Waste Management: Some issues

1.1 Introduction

The urban population of India was 25.9 million in 1901 which comprised just 10.8 per cent of total population. Of the 1028 million people in India in 2001, about 286 million were living in urban areas. The net addition to urban population during 1991-2001 has been 68 million. This addition in a decade is higher than the population of any country in Europe except Russian Federation and Germany, or any country in Africa except Nigeria and Egypt. The urban population of the country is 27.8 percent as compared to 26.1 percent during 1991 Census (*Premi, 2006*). However, the urban decadal growth rate has declined successively in the last two decades for various reasons. It declined from 46.1 per cent in 1971-81 to 37.5 per cent in 1981-91 and to 31.5 per cent in 1991-2001.

It increased to 286.1 million in 2001. The change in the total urban population over this period is the result of various historical, economic and demographic factors- famines, epidemics, industrial growth, country's partition into India and Pakistan in 1947, and decline in crude death rate especially since the beginning of the planning process in the country, more so in urban areas.

The urban population figures prior to 1961 and since 1961 are not comparable as on the eve of 1961 census the definition of urban settlements was substantially revised and made more restrictive,¹ which resulted in the declassification of 810 towns in the 1951 census. Consequently in making any comparison, we have concentrated on the pattern that has emerged during the past

¹ Tests of eligibility for places to be treated as towns in 1951 and 1961 censuses

1951: All areas having a municipal corporation, municipal area, town area committee, all civil lines not included in municipal limits, and cantonments. Further tests prescribed for distinguishing towns from villages in different states were based on ideas common to all states, but they were not identical nor had they been applied with meticulous uniformity. In the case of princely states, the definition of town was applied a little indiscriminately.

1961: All areas having a municipal corporation, municipal area, town committee, notified area committee, and cantonment boards. All other selected places with (a) density of not less than 1,000 persons per sq. mile (b) a population of 5000 (c) three-fourths of the working population should be working outside agriculture (d) or any other place, which according to superintendent of the state, possesses pronounced urban characteristics and amenities (census of India 1991, 1997: 165).

40 years. Urban growth was fastest during 1971-81 decade. It declined to 31.5 per cent during the 1990s (Premi, 2006).

Urban health in developing countries has distinctive characteristics. There are communicable diseases on the one hand and proliferation of non-communicable diseases triggered by urbanization and industrialization on the other hand. This dual characteristic complicates the health scenario. Added to this is the fact that much of the natural environment which contributes to the etiology of diseases is lost or replaced by a man-made environment. While the physical stressors of the natural environment are buffered, both communicable and degenerative diseases thrive under a new system of bio-social interaction.

Urban areas especially large ones are exposed to health threats uncommon in rural settings. Pollution of water and air as a result of industrial and transportation activities is a prime example. The incidence of infectious diseases (e.g. acute respiratory infections, tuberculosis, and other airborne infections) tends to be more prevalent in crowded urban areas than in rural environments. Urban environment, particularly poor neighbourhoods with poor sanitation, water and solid waste services, are hosts to vermin that transmit diseases. Inappropriate disposal practices of municipal solid waste and industrial and health care wastes imperil public health.

The urban centers play an ambiguous role on the health status. On the one hand they have the potentiality of producing healthier citizens due to concentration of medical services, better water and sewage system and treatment facilities etc. on the other hand same urban centers are prone to the increasing incidences of diseases due to concentration of poor people in crowded under serviced slums and their attraction for transient people.

1.2 SOLID WASTE MANAGEMENT

Urbanization is now becoming a global phenomenon, but its ramifications are more pronounced in developing countries. Natural growth of population, reclassifications of habitation and migration trends are important in urban population in India. Global experience shows that when a country's urban population reaches almost 25% of the overall population (as in the case of India), the pace of urbanization

accelerates. Due to rapid urbanization and uncontrolled growth rate of population, Solid Waste Management (SWM) has become an important issue in India. Municipal bodies and other organizations in India render SWM services. Though, it is an essential service, it is not given due attention which it deserves and also the services are poor. Municipal Solid Waste Management is a part of public health and sanitation, which is enshrined in Seventh Schedule² (State List- List II) and solid waste management in Twelfth Schedule (Entry 6) of the Indian constitution under Article 243W³ and is entrusted to the municipal government for execution. Presently, the SWM systems are assuming importance due to population increase in municipal areas, scope for legal intervention, emergence of newer technologies and rising public awareness towards cleanliness. Human activities create waste. The way these wastes are handled, stored, collected and disposed, they can pose a risk to the environment and to the public health. Where intense human activities concentrate, such as in urban centers, appropriate and safe solid waste management (SWM) are of utmost importance to allow healthy living conditions for the population. This fact has been acknowledged by most governments. However, many municipalities are making efforts to provide even the most basic services. In our country municipal corporations are primarily responsible for solid waste management. But with the growing population and urbanization municipal bodies are facing financial crunch and can no longer cope with the demands. The limited revenues earmarked for the municipalities make them ill equipped to provide for high cost involved in the collection, storage, treatment and proper disposal of waste. Municipalities are able to provide secondary collection of waste. They collect waste from municipal bins and depots. A substantial part of the municipal solid waste generated remains unattended and grows in the heaps at the collection centers. Open dumping of garbage facilitates breeding of disease vectors such as flies, mosquitoes, cockroaches, rats and other pests. The services provided by the municipal authority are, often inefficient. It is estimated that, on an average, 30% of the disposed solid waste are left uncollected (Jan Seva Ashram estimate submitted to M.C. Solan).

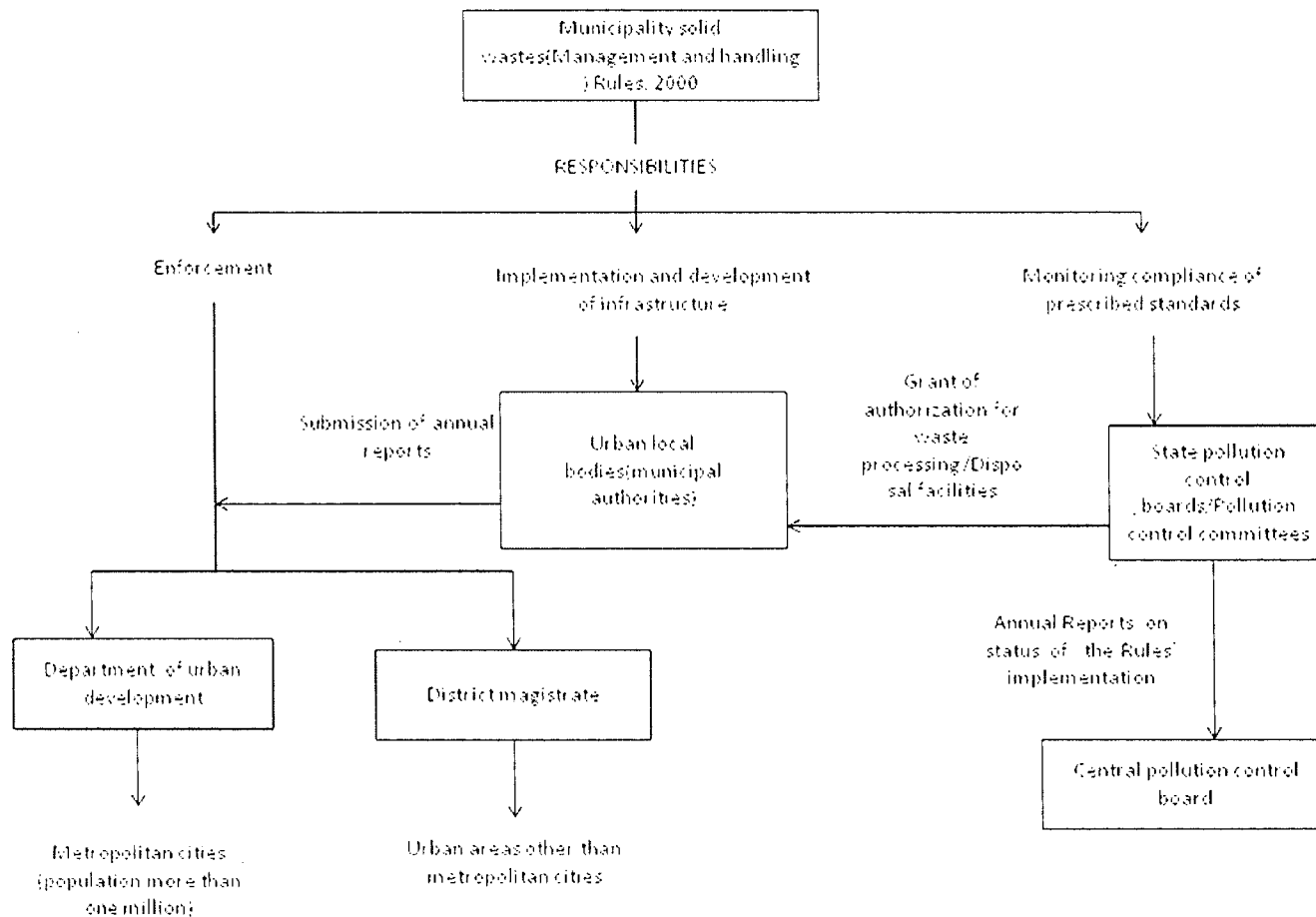
² Seventh Schedule contains three lists: List I- Union list, List II – State list, List III – Concurrent list, List II contains the subjects which comes under the state's discretion

³ Article 243 W deals with the powers, authority and responsibilities of Municipalities etc. Entry 6 in Twelfth Schedule empowers municipalities for public health, sanitation conservancy and solid waste management.

1.3 Municipal Solid Waste Management Policy in India

The constitution of India explicitly cites municipal solid waste management as an essential service and one of the obligatory duties of the local governments. Nevertheless, there have not been many systematic attempts to develop policies that prescribe the norms and standards for collection, treatment and disposal of waste. The first major attempt to develop a national strategy on solid waste management was made by the National Environmental Engineering Research Institute in 1995, which focused mainly on the issues faced by large cities. In 1998, on the directions of the Supreme Court of India, a committee was constituted by the Indian Government to look into all aspects of municipal solid waste management: the recommendations of this committee again covered only the large cities. Subsequently, the Government of India published the Municipal Solid Wastes (management and handling) Rules in the Gazette of India, in September 2000 (MoEF, 2000) these rules make the municipal authorities primarily responsible for collection, segregation, storage, transportation, processing and disposal of MSW generated in their respective urban areas. The legislative framework prescribed for MSW management in India by these Rules is presented in Figure 1.1.

In most developing countries, there is an active informal network in the country that exists as a parallel system and contributes significantly to the overall waste management process in the cities. Comprised of waste pickers, itinerant waste buyers and junk dealers, the quantum of waste recovery by this informal sector is placed in the range of 6-7 % to around 15% of waste generated (Bhinde, 1990). The health situation is largely related to the social environment. This is well substantiated in a study on Surat plague, in Gujarat wherein during the plague people were scared of garbage. It was almost believed that the garbage in the streets was the cause of the plague. According to cross-section of society, dirtiness was the main problem of the city (Shah, 1997).



Source: Waste Management world, (Vigneswaran et al 2002)
 Figure 1.1: Legislative framework for MSW management in India

As a result, the uncollected waste, which is often also mixed with human and animal excreta, is dumped indiscriminately in the streets and in drains, so contributing to flooding, breeding of insects and rodent vectors and the spread of diseases. Most of the municipal solid waste in low-income Asian countries which is collected is dumped on land in a more or less uncontrolled manner. Such inadequate waste disposal creates serious environmental problems that affect health of humans and animals and cause serious economic and other welfare losses. The environmental degradation caused by inadequate disposal of waste can be expressed by the contamination of surface and ground water through leachate,⁴ soil contamination through direct waste contact or leachate, air pollution by burning of wastes, spreading of diseases by different vectors like birds, insects and rodents, or uncontrolled release of methane by anaerobic decomposition of waste.

In the cities it is the urban poor that suffer most from the life-threatening conditions arising out of SWM. Municipal authorities tend to allocate their limited financial resources to the richer areas of higher tax yields and where citizens with more political power reside. Usually, wealthy residents use part of their income to avoid direct exposure to the environmental problems close to home, and the problems are shifted away from their neighbourhood to elsewhere. Thus, environmental problems at the household or neighbourhood level often recede in higher income areas. Citywide and regional environmental degradation, due to a deficient Solid Waste Management, remains and often increases.

⁴ Leachate is the liquid produced when water percolates through any permeable material. It can contain either dissolved or suspended material, or usually both. This liquid is most commonly found in association with landfills, where rain percolates through the waste and reacts with the products of decomposition, chemicals and other materials in the waste to produce the leachate. If the landfill has no leachate collection system, the leachate can enter groundwater, and this can pose environmental or health problems as a result. Typically, landfill leachate is anoxic, acidic, rich in organic acid groups, sulphate ions, and with high concentrations of common metal ions, especially iron. Leachate has a very distinctive smell which is not easily forgotten.

Lack of financial resources, institutional weaknesses, improper choice of technology and public apathy towards municipal solid waste (MSW) has made this service far from satisfaction. The current practices of the uncontrolled dumping of waste on the outskirts of towns/cities have created a serious environmental and public health problem. MSW in India's urban areas is collected from individual households by various means, including push-carts, animal drawn carts and tricycle trolleys. When the cart is full, the waste is dumped in designated large bins, constructed at locations easily accessible for the collection trucks that then carry the wastes to disposal sites. In small and medium towns, the financial requirements for even this simple and low-cost collection method could not be adequately met, and so not all parts of towns have household collection on a regular basis. Instead, bottomless open concrete rings, placed at street corners, are used as bins for waste disposal by households. In streets without such bins, the street corners and open drains (used for waste waters and storm water collection) are abused for dumping garbage, road sweepings, building wastes and so on. This causes frequent choking and overflows of sewage, particularly during rainy season, posing public health risks.

Waste from street corners and garbage bins is transferred to on-road collection points, from where it is transported by trucks or mini-lorries to dumpsites. A recent Central Pollution Control Board study found that there were few evidences to show that solid waste in small and medium towns is collected regularly or disposed of in an environmentally benign manner (CPCB, 2000) and reported the widespread use of unauthorized dumpsites for disposal of solid wastes in these towns. The authorized dumpsites that exist in some of the small and medium towns are often officially designated as 'compost yards', though no composting is practised. In order to assess MSW management practices, a study 'Sustainable MSW management in developing countries; the experience of smaller towns in India' conducted by Sundaravadivel and Vigneswaran (2000) in four small and medium towns (SMTs) of Tamil Nadu. It brings out two important issues, first there was no door-to-door service in Andipatti, one of the four towns studied, while in other three towns only 48.5% of the house holds were provided with either door-to-door service or access to a bottomless garbage bin; the remaining households disposed of MSW on street corners. The other issue studied was pertaining physical

composition of the solid waste which is compared with the composition in Metropolitan cities the major difference being Organic waste comprises 69.0% in SMTs where as it is 41.8% in metropolitan cities (Vigneswaran et al. 2002).

Waste is an unavoidable by-product of human activities. Economic development, urbanization and improving living standards in cities, have led to increase in the quantity and complexity of generated waste. Management of Municipal Solid Waste (MSW) resulting out of rapid urbanization has become a serious concern for government departments, pollution control agencies, regulatory bodies and also public in most of the developing countries. Rapid growth of population and industrialization degrades urban environment and places serious stress on natural resources, which undermines equitable and sustainable development. Inefficient management and disposal of solid waste is an obvious cause for degradation of environment in most cities of the developing world. Improper disposal of this waste leads to spread of communicable diseases, causes obnoxious conditions and spoils biosphere as a whole. Cleanliness is a major factor that influences development of any nation, which is otherwise hampered due to improper disposal of solid waste. From literature on MSW it is apparent that there are two major problems due to poor solid waste management. One is the loss/under utilization of resourceful material and other is social cost due to health impact on rag pickers, community living in dump site surroundings and general public suffering from improper or no collection of waste from streets resulting in nuisance and spread of diseases.

1.4 THEORETICAL FRAMEWORK

Urbanisation process has been studied from different perspectives and through different approaches taking into account features of cities, towns and urban agglomerations. Ecological approach on cities was applied to social sciences by Park (1925). It was an early stimulus to the urban ecology. Park believed that the patterns and relationships evident in a city could be paralleled by land use and people in cities. The cardinal principle emphasized was competition. It is human nature to compete for limited space and for access to the most desirable location for once residence and business activities. Social area analysis which got recognition in

1955 was examined by the Shevky-bell model. Just as in different plant communities one specie exerts a dominant influence which controls the environmental conditions and in turn encourage or discourage the other species, similarly the Central Business District exercises control over the functional use of land in the other parts of the city. This has been observed in a study on Delhi too (Sheel, 1994). The traditional ecological studies can be characterized into three basic types as follows:

- a) Morphological Approach
- b) Social Area Approach
- c) Factorial Ecological Approach

Morphological approach deals with the concept and principles derived from plant and animal ecology to the analysis of human community largely based on the concept of competition, dominance and succession. The pioneering works include that of Park (1925), Burgess (1925) and Mckenzie (1925) which lay emphasis on concentric zone model. The social areas have been identified through the classical model (Burgess 1925, Hoyt 1939, Harris and Ullman 1945) which metamorphosed into more recent multivariate studies over a period of time. The Morphological approach encompasses three basic 'classical' models of spatial patterning. These models are: concentric zone model, sector model and multiple nuclei model.

Burgess (1925) developed concentric zone model after studying the land use and social characteristics of Chicago city in early 1920s. He divided city into five concentric land use zones which not only described the pattern at a particular point in time, but also represented the successive zones of urban expansion.

The first and innermost zone described as 'central business district', characterized by all types of economic activities, office, bank, recreation, wholesale and retail business etc. The second zone termed as 'zone in transition' was characterized by poor residences and inner factory belt. The third zone was labeled the 'zone of interdependent working men's homes'. It contained the working class people who could move out of the second zone. The fourth zone was entitled the zone of better residence and comprised of single family dwelling units with spacious yard and owned by middle class native population. The fifth outermost

zone was the 'commuter's zone' lying on the periphery, outside the legal boundary of the city. It consisted of a ring of small towns and villages. They primarily were dormitory suburbs, with very little industry or employment of their own.

Sector model formulated by Hoyt (1939) suggested that social areas within the cities could be summarized in terms of sectors rather than zones. Hoyt examined 142 cities of United States and concluded that socio-economic status varied primarily in a sectoral fashion. He postulated that the Central Business District (CBD) remains in a circular form and the residential area of similar socio-economic status tends to extend in sectoral fashion towards the fringe. He made certain observations pertaining these sectors like the highly valued residential areas were located in sectors on one side of the city, the intermediate rental areas were often found on either side of the highest rent areas, the low rent sectors were frequently found on the opposite side of the city to the high rent sectors.

The Multiple Nuclei model was propounded by Harris and Ullman in 1945. The guiding principle is that the land use pattern is not shaped by a single nucleus. Instead a number of separate nuclei around which the land use concentrates are responsible for it. Such pattern reflects a combination of factors like certain activities require specialized facilities like accessibility, water, land etc. Such activities group together because they profit from cohesion, some activities are detrimental to each other such as industrial and high rent residential districts.

Social Area Approach primarily analyses the basic features of specific natural areas which are characterized as social, economic and demographic elements (Wirth 1938, Zorbaugh 1926). The basic concern to develop this alternative was to segregate people and their business activities into relatively homogeneous entities termed as 'natural areas'. Zorbaugh defined it as a 'geographical area characteristics of the people who live in it'. It was higher order concept than morphological area, for its definition included physical and cultural features. This model is criticized for its inclination towards the central sections of the city where unambiguous lifestyle and ethnic territories were contained within large areas of industrial and transportation land uses.

The Social area approach provides a broader framework for the analysis of ecological structure within the cities by examining the underlying dimensions of urban society. This approach was first developed by E. Shevky and M. Williams (1949) in a study of Los Angeles and elaborated by Shevky and Bell (1955) in a study of San Francisco. The analysis is premised on three basic constructs concerning the changing nature of modern society, change in the range and intensity of relations, differentiation of function and increasing complexity of organization. The three constructs can be listed as:

- i) Economic status or social rank
- ii) Family status or urbanisation
- iii) Ethnic status or segregation

The present study derives its conceptual frame work from the social area approach based on the multiple nucleic growth of the district of study. Historically an important settlement, Solan has evolved into a trading and industrial centre in last two decades. Identified social areas are superimposed by the pockets of different functions within the city. Tremendous potential is visible for its economic growth and therefore the need to examine. With the development and population growth over the period, solid waste generation has also increased. Mechanisms for disposal and management have thus evolved as important constituent of the development process and policy.

1.5 Evolution and Development of the Solan Town

Solan town is located in lesser Himalayan zone and it presents a mountainous terrain. The national highway 22 and meter gauge railway line connects Solan with Shimla, the state capital of Himachal Pradesh only at a distance of 48 kms and Chandigarh, the Union territory at a distance of 70 kms, so it occupies a prime location easily accessible from Shimla and Chandigarh. Solan is an important town of summer resort of the state. This is a class III town with a population of 34,206 persons as per 2001 census and is fourth populated district in Himachal Pradesh. Solan district as a whole is the most industrialized area of the state and many trading activities linked to industries are being carried out in Solan.

Solan is ideally situated and has a vast potential for developing as an industrial town; units have already come up and more new ones are likely to be established in the very near future. The town is serving as a whole sale market for the export of seasonal vegetable and stone fruits and is fast coming up on the industrial map of the state.

1.6 Spatial-Temporal Growth of the Town

A significant area growth was registered by the town when it became the district headquarter of district Solan in 1971, in all the directions especially along the national highway in *Ribbon-Pattern*. The town recorded a phenomenal increase in the population from mere 61 persons in 1901 to 34,206 persons as per 2001 census and the built up area due to expansion of town. The peripheral area, encircling the town was taken away by the urban expansion and the open spaces began to be filled up by the residential buildings along both the sides of the road.

1.7 Development, Pollution and Solid Waste

Development is a continuous process which changes the contents of space often drastically. A necessary, but undesirable, by-product of development has been environmental pollution and degradation. Development is a continuous process which changes the contents of space often drastically. The undesirable effects of development include the problems such as global warming,⁵ acid rain,⁶ ozone depletion,⁷ reduction in biodiversity⁸ and serious ecological imbalances threatening the very existence of survival of mankind.

Pollution causes reduction in the quality of the environment by the introduction of impurities and makes vital resources less useful. It reduces the quality of life. Pollution is the outcome of urban-industrial and technological

⁵ Global warming refers to the potential increase in global average surface temperatures resulting from enhancement of the *greenhouse effect* by air pollution

⁶ Acid rain is any precipitation, including snow that contains a heavy concentration of Sulphuric and Nitric acids. This form of pollution is serious environmental problem in large urban and industrial areas. Gases like Sulphur dioxide and nitrogen oxide emitted from industrial operations into the atmosphere combine with water vapours in clouds to form Sulphuric and Nitric acids which may contaminate lakes, streams, damaging fish and other aquatic species.

⁷ Ozone layer is a protective layer formed in upper atmosphere by the effect of *ultraviolet (UV) radiations on oxygen*. Ozone strongly absorbs solar UV radiations preventing much of this radiation from reaching earth's surface, where it would injure many living things. Chlorofluorocarbons (CFCs) and some other air pollutants that diffuse into the ozone layer diffuse ozone.

⁸ Biodiversity refers to the quantity of plant and animal species found in a given environment.

revolutions, excessive exploitation of natural resources, increased rate of exchange of matter and energy, and excessive generation of industrial wastes, urban effluents and consumer goods.

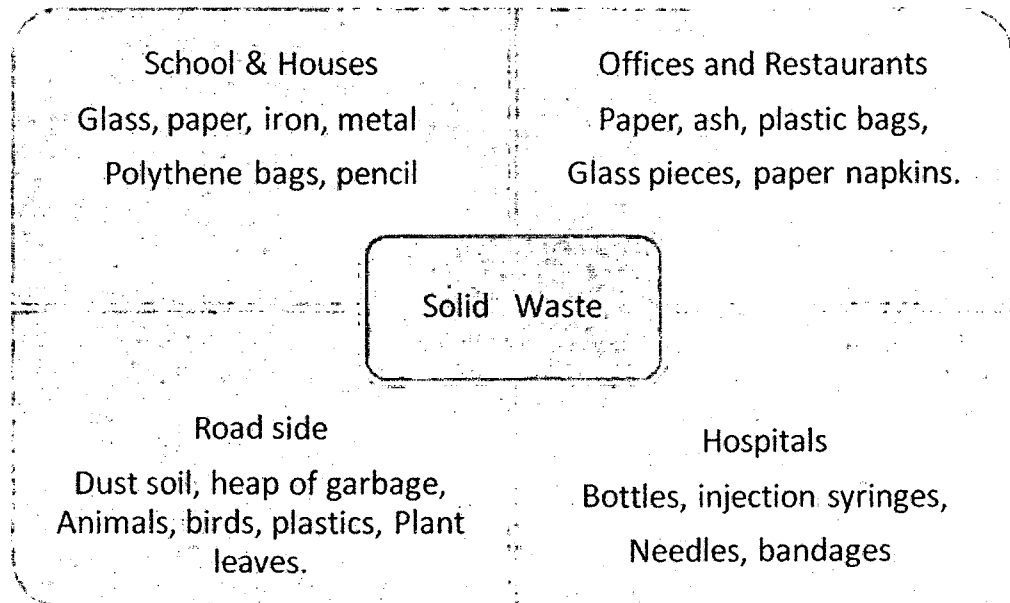
In the report restoring the quality of our environment (President's Science Advisory Committee, USA) Pollution is defined as "unfavorable alteration of our surroundings wholly or largely as a by-product of man's actions through direct or indirect effects of changes in energy patterns, radiation levels, chemical and physical constitution and the abundance of organisms."

Pollution is viewed as "the release of substances and energy as waste products of human activities which result in changes, usually harmful, within the natural environment" (National Environment Research Council, India).

Several studies have been conducted focusing on water and air pollution, but there are certain other aspects of pollution which have received lesser attention. The problem of Garbage disposal is one of them. In our towns, cities and even in rural areas these days this is a major problem. Any type of waste material which is generated at home and discarded as they are no longer in need or do not have any other use, fall under the category of waste and we tend to throw them away. The generation of solid waste and its disposal are not new phenomena in human society. It dates back to inception of human civilization itself (Misra and Mani, 1993). The generation of solid waste is increasing year by year and its management is becoming difficult due to increasing pressure on urban areas (Rai, 1996). It is directly related to rapid increase of population, industrialization, urbanization, fast changing life style and living pattern, food habits and the culture of over consumerism, which gave rise to disposal and throwaway pattern of solid wastes.

The term 'solid waste' includes such items as glass bottles, crockery, plastic and polythene, waste paper, automobile spare parts and also organic waste such as plant leaves etc, which are discarded as garbage. The solid wastes are created by a vast range of socially desired accepted activities in homes, factories, offices, institutions and public buildings. Many foods, clothing, machines, vehicles etc are packaged in different kinds of material. This packaging material becomes waste sooner or later. The modern civilization produces an ever increasing amount of all kinds of unusable, unwanted, surplus, spoiled, discarded, broken and mixed solid waste. This has been illustrated in the following diagram:

Figure 1.2: Solid Waste Material



Definition:

As defined by World Health Organization the term 'solid waste' is applied to unwanted and discarded materials from houses, street sweeping, commercial and agricultural operations arising out of mass activities. It is a mixture of papers, plastics, rags, and other fabrics, dust ash and a variety of combustible and non-combustible, bio- degradable and non-biodegradable matter. These materials are commonly known as garbage, refuse, rubbish, and solid wastes etc. An Indian municipality follows this definition of WHO for Solid Waste. This excludes commercial and industrial wastes that contain variety of toxic and hazardous materials.

1.8 Solid Waste Generation and Disposal

The generation and disposal of garbage was not considered a very serious problem some years ago, but now it has become a serious problem not only in metropolitan areas but in other cities, towns, and rural areas also. Solid Wastes are probably the most visible form of pollution. They present a serious problem because most of the

methods used to dispose them result in some type of damage to the environment. Open dumping is ugly and offers home for disease carrying insects and animals, its burning pollutes air and its random dumping in water affects the aquatic life and makes water unusable.

The studies conducted in this field show that both the absolute quantum of solid waste generation and per capita solid waste has been on the increase. It is generally believed that there is a positive correlation between solid waste generation and the wealth of a nation. There by meaning that the wealthy nations generate more solid waste than the poor nations. With the increase on the wealth level of a nation, not only the quantum of solid waste generation increases but also the composition of the waste changes qualitatively. For example, with increasing standard of living the nature of solid waste of a society changes from biodegradable organic material to plastic and other synthetic (non-biodegradable) materials. The quantity and quality of refuse generated by a population depends on various factors such as size of population, geographical location, climatic conditions and nature and status of community. The magnitude of garbage generation is increasing at a tremendous rate. Some of the responsible factors are listed below:

- a) Rapid urbanization cum modernization and industrialization.
- b) Higher intensity of consumption levels and even unlimited ends from scarce sources.
- c) Unmanageable rapid growth of population.
- d) Improper use of resources for production and consumption by the society.
- e) Preference in using new material rather than reusing old ones.
- f) Emergence of slums, ghettos, and shanty colonies in urban agglomerations.
- g) Ignorance about the environmental degradation.

1.9 CLASSIFICATION OF SOLID WASTES

SWM is a vital, ongoing and large public service system, which needs to be efficiently provided to the community to maintain aesthetic and public health

standards. Broadly on the basis of generation sources, solid wastes can be classified into three main categories namely household waste, hospital waste and industrial waste. Based on degradability, the solid wastes are of two types: Bio-degradable and Non-biodegradable.

Bio-degradable wastes are those substances that can be broken down by organisms and dispersed. This includes organic waste e.g. vegetables, fruits, flowers, leaves, kitchen waste etc. Non-biodegradable wastes are those that are virtually indestructible. They can be further divided into the following:

- 1) Recyclable waste- plastics, paper, glass, metal etc.
- 2) Toxic waste- old medicines, paints, chemicals, electricity bulbs, fertilizers, pesticide containers, batteries, discarded electronic devices etc.
- 3) Soiled hospital waste- such as clothes soiled with blood and other body fluids etc.

1.10 Stakeholders in the Refuse Collection and Disposal Services

The contributors in the urban solid waste management process are the waste processors and waste generators. Waste processors refer to the agents directly active in waste processing i.e. service producers and waste generators refers to all the agents generating and consuming services provided by the waste processors.

The former comprises of waste pickers, itinerant waste buyers, middlemen like junk dealers and wholesalers, the urban local body and recycling unit. The first three form informal network and the others are formal agents. The later category comprises mainly of the agents viz. households, commercial establishments (markets and hotels), institutions (offices, educational institutions and hospitals) and industries.

1.11 Rationale of the Study

The influence of Municipal Solid Waste (MSW) on public health and environment has been felt strongly over the last two decades. Traditionally, MSW has been understood as solid waste generated in a community and should be disposed off as

useless material. Waste managers have always asked the question: *How does one get rid of the waste?* People have traditionally been using crude ways to dispose off waste, such as burning, burying, land filling of now they are beginning to use some sophisticated techniques such as incineration and secured landfills. But as societies have developed, so has the production and consumption of a wide variety of materials. That has resulted in increased generation of waste, leading to ever-larger waste management plants, which have become serious threats to health and environment and have triggered contentious socio-political issues. While this is still the dominant paradigm, fortunately, many countries are bringing about radical changes in the approach to waste management and disposal. Now, one man's waste can be another man's resource. This signals a shift from the disposal centric waste management paradigm to a recovery-centric one.

As noted earlier in an urban set up an enormous amount of garbage is produced. Given the modern consumerist culture invading every home in Himachal Pradesh (Solan), the people tend to use everything in excess and also produce waste in abundance. At the same time the infrastructure in place, including waste disposal systems, is of pre-independence vintage in concept, technology and administration. There is no land available to fill in at reasonable distances from the sites of waste accumulation, nor is the waste produced susceptible to traditional methods of disposal and management. Solan is the fastest urbanizing district in Himachal Pradesh and therefore an attempt has been made to study Solan town by taking into consideration the problem of garbage generation and its disposal. It has a large proportion of population living with high standard of living. The town has large number of shops, hotels, restaurants, private and government offices. The town has an enormous floating population including migrants. This generates a large amount of garbage. In the present study different aspects of garbage problem of Solan town has been studied. The sources of garbage have been identified. Solan city is the districts headquarter of Solan district in Himachal Pradesh. It is situated on the national highway and is connected with Chandigarh on one side and Shimla, the state capital of Himachal Pradesh, on the other side. It lies on the railway track from Kalka to Shimla. The phenomenon of rapid urban sprawl is well evident in

Solan. There is a brewery, industrial areas like Deunghat, Parwanoo and Baddi. Urban areas in Himachal Pradesh will continue to grow not only due to the natural increase of their own populations but also due to continued rural–urban migration.

The gradual urbanization of a predominantly rural society has been set into motion and the urban population of Himachal Pradesh has increased to more than double between 1971 and 2001 (HPDR, 2005 pg.340). District wise trend of urbanization indicates that Shimla, Solan and Sirmour districts have 23.12%, 18.26% and 10.38% urban population respectively and are the top three urbanized districts with higher level of urbanization as compared to the state average (Ibid, pg.340). The urban infrastructure scenario in Himachal Pradesh is grim. Deficiencies in water supply, sewerage, solid waste management, municipal roads, streets and street lights are becoming acute with growing urbanization. The urban infrastructure and municipal services have been deteriorating in the larger towns and have been grossly unsatisfactory in the small towns. A considerably high proportion of urban population remains uncovered by municipal services. The cost of providing urban infrastructure services is higher in the urban centers of Himachal Pradesh because of the difficult mountainous terrain, inadequate supply of low-cost raw material and labour. At the same time pricing and cost recovery of the urban infrastructure is negligible. The technology used for providing and maintaining the urban infrastructure services is old and inappropriate to meet the growing needs (Ibid pg.342).

Urban decay is visible in Himachal Pradesh in the form of water and air pollution, ecological degradation and traffic congestion. It is largely due to unplanned and uncontrolled urbanization and faulty urban management development systems. The similar situation also prevails in Solan. It is important to mention here that Solan was de-notified from the country and town planning Act in 1982 (Sharma, 2003).

1.12 HIMACHAL PRADESH: A PROFILE

Position of Himachal Pradesh in the National Context

H.P. with an area of 55,673 Sq. km is one of the smaller states of India. It ranks 17th among the States and Union territories in terms of area, which is one-sixth of the largest state-Rajasthan. Himachal Pradesh has a population of about 61 lakhs and ranks 21st among the States & UTs. Its population is 27 times below that of the most populous state, U.P., is an indicator of its smallness.

The state accounted for 1.7% of the total area of the country and 0.59% of the total population in 2001. With a density of 109 persons/sq.km, it ranks 28th among the states and UTs which is much below the all-India average of 324 persons per sq. km. The urban population constitutes 9.79% of total population of the state, the lowest among all states and UTs. Almost eight out of every ten persons in the state are literate and it ranks 11th in terms of literacy.

1.13 Research Design

1.13.1 Area of Study

It is in this context that this study primarily aims to understand waste generation and management issues from the perspective of a developing country, with focus on Solan town in H.P. This involved a look at traditional and recent ways of waste management, patterns of urbanisation and waste generation, problems pertaining to them, organisation of waste management and public awareness, participation and responsibility.

Solan, a class III town, as per census definition is the districts headquarter of Solan district in Himachal Pradesh. It is situated on the national highway and is connected with Chandigarh on one side and Shimla, the state capital of Himachal Pradesh, on the other side. It lies on the railway track from Kalka to Shimla. The phenomenon of rapid urban sprawl is well evident in Solan. There is a brewery, industrial areas like Deunghat and Baddi. Urban areas in Himachal Pradesh will continue to grow not only due to the natural increase of their own populations but also due to continued rural–urban migration.

The gradual urbanization of a predominantly rural society has been set into motion and the urban population of Himachal Pradesh has more than doubled between 1971 and 2001 (Himachal Pradesh Development Report 2005, pg.340). District wise trend of urbanization indicates that Shimla, Solan and Sirmaur districts have 23.12%, 18.26% and 10.38% urban population respectively and are the top three urbanized districts with higher level of urbanization as compared to the state average (Ibid, pg.340). The urban infrastructure scenario in Himachal Pradesh is grim. Deficiencies in water supply, sewerage, solid waste management, municipal roads, streets and street lights are becoming acute with growing urbanization. The urban infrastructure and municipal services have been deteriorating in the larger towns and have been grossly unsatisfactory in the small towns. A considerably high proportion of urban population remains uncovered by municipal services. The cost of providing urban infrastructure services is higher in the urban centres of Himachal Pradesh because of the difficult mountainous terrain, inadequate supply of low-cost raw material and labour. At the same time pricing and cost recovery of the urban infrastructure is negligible. The technology used for providing and maintaining the urban infrastructure services is old and inappropriate to meet the growing needs (Ibid pg.342).

Urban decay is visible in Himachal Pradesh in the form of water and air pollution, ecological degradation and traffic congestion. It is largely due to unplanned and uncontrolled urbanization and faulty urban management development systems. The similar situation also prevails in Solan. It is important to mention here that Solan was de-notified from the country and town planning Act in 1982 (Sharma, 2003).

Solid waste management encompasses the range of activities, such as —

- i) prevention, either by reducing the content of waste or by reusing it,
- ii) recycling the waste into secondary raw material or as a source of energy;
and
- iii) disposal through land filling

However, the reality is quite different from these environmentally sound options.

The Rs. 28 Lakh municipal solid waste disposal-cum-microbial compost plant has set up at Salogara. Funded by NORAD, a Norwegian government aid agency, the local municipal council, the state council of Science, Technology and Environment and *Jan Seva Ashram*, an N.G.O. based at Jabli in this district, the plant was supposedly designed to convert municipal solid waste into bio-fertilizers, recycled paper, polythene mats, wall coverings and some other economically useful products.

It envisaged providing jobs to at least 75 persons needed for running the compost manufacturing machinery and segregation of garbage into different categories like hazardous waste, sharp edged pieces such as broken glass and metal pieces, chemicals, pharmaceuticals, infectious garbage generated at various doctors clinics and bio-degradable waste. Prior to the designing of the plant, a government survey had calculated the daily garbage output of the town at 20 towns. The plant was accordingly designed to handle 25 towns of municipal waste per day (Dutt, 1998).

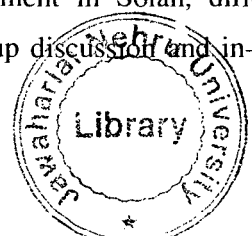
JH-14/21

1.13.2 Methodology

This is an exploratory study. It is imperative to have knowledge of formal waste collection system and informal waste recovery process to understand the mechanism of the solid waste management system. Solan, a class III town in Himachal Pradesh is formally served by the municipal committee and also depends upon a large number of individual waste pickers who reduce the burden of urban local body and in the process relieve the town from the uncollected waste.

Collecting data on solid waste generation and collection is not an easy job as municipal committee hardly releases any systematic data on the status of solid waste. Field investigation is the only alternative a researcher has in carrying out an empirical study due to unavailability of data with respect to the contribution of informal sector and to have an understanding of solid waste management system as a whole. The study methodology combines field investigations in the role of stakeholders playing in solid waste management in Solan, differently in their capacities. Personal observation, focused group discussion and in-depth interview

363.7285 0954 52
Sh234 Sc
TH14121



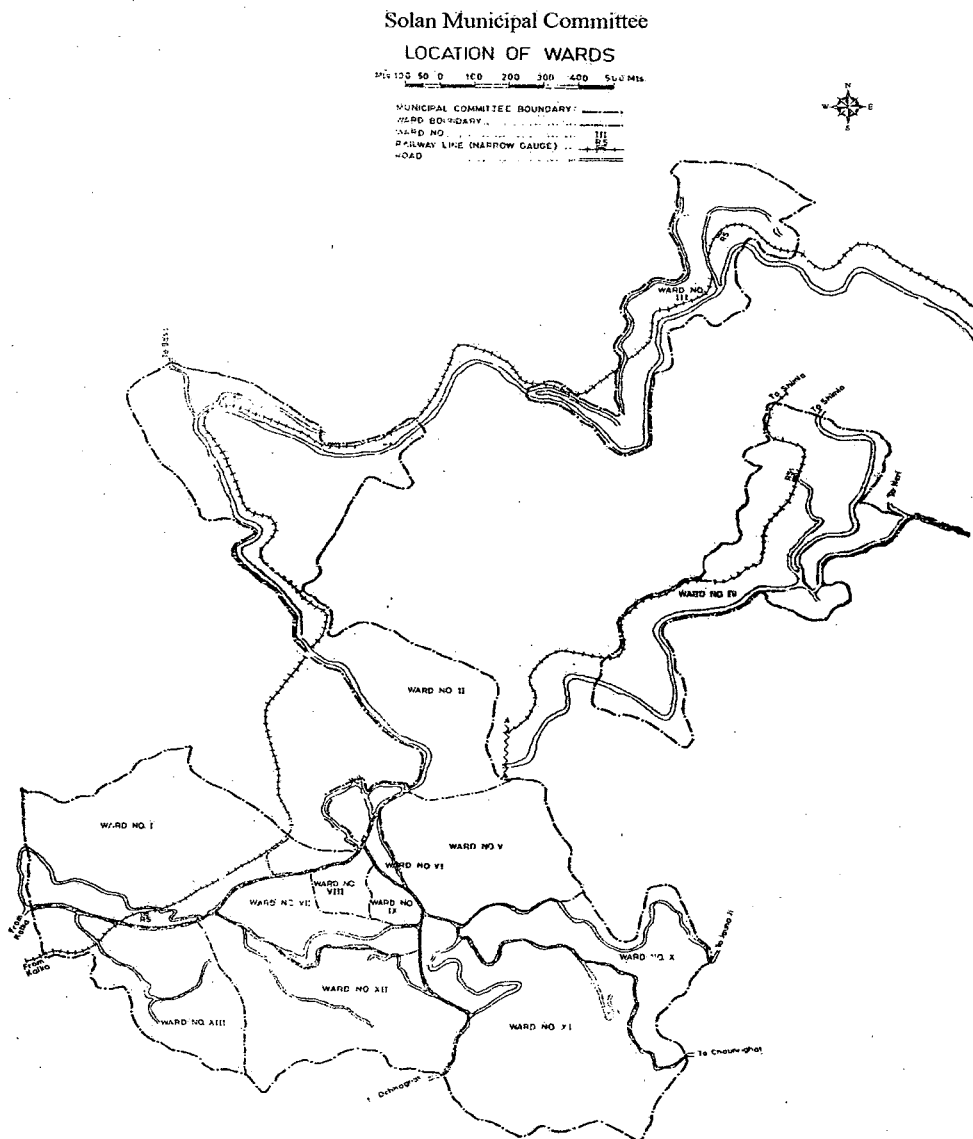
have been the prime source of information for this type of study. Interviews, which are a flexible and adaptable way of finding things out, were taken by the researcher in the study. To gather up information pertaining to garbage generation, disposal and different services provided by municipality some Safaikaramcharis and local people of the town were interviewed. This proved helpful in collection of information about garbage generation and disposal in the study area. Some information about the garbage generation and disposal of the town were collected by direct observations. The observations were also recorded in form of photographs taken in the field. It proved in asserting the authenticity of the responses given by various respondents. Before the conduct of interview/discussion the consent to respond was taken from the participants/respondents.

Data and information used in present dissertation also included those already collected, recorded and reported in already existing sources. These secondary sources included data collected by various governmental agencies and also the one posted on internet. Finally the data has been presented in the form of contingency tables, relevant bar diagrams, pie charts, line graph etc.

Purposive Grab Sampling has been used in this study. The present study is based upon primary information collected through a field survey. The household level data from 13 wards has been generated through canvassing a structured questionnaire from 65 households of the Solan town selected through a purposive grab sampling though the distance of garbage bin from the household was taken care of. The household particulars, information regarding services provided by local municipal committee and problem related to garbage disposal have been included in the questionnaire. Some information based on personal observation has also been taken into account while analyzing the data.

There are 13 wards in Solan town that come under the Solan Municipal Committee area. With the help of interview schedule and semi-structured questionnaires five respondents from each ward were interviewed. Apart from this the study has also taken collection and synthesis of existing literature on urban areas, including published and unpublished government reports, censuses and

articles published in local newspapers and magazines. The principal methods of field enquiry has been the discussions with pertinent municipal and health care personnel and Non-Government organization, individual and group interviews with residents, municipality workers and disposal plant workers.



13 wards of Solan M.C.

In addition a Composite index was developed on the selected variables to identify the variation in solid waste management existing in Solan town. The methodology for how the composite index was developed has been discussed in Chapter IV.

1.13.3 Objectives of the Study

It is important to comprehend the entire solid waste management process in the urban areas. Since Solan is the fastest growing industrial district of Himachal Pradesh and Solan town being the district headquarter the present study is undertaken to understand and analyse the following objectives:

1. Trends of urbanisation in Himachal Pradesh with special reference to Solan district.
2. Profiling the Solid Waste Management initiatives – traditional and recent, taken in Solan district.
3. Mapping perceptions of the stakeholders (providers and the recipients) involved in the Solid Waste Management in the district.

1.14 Limitations of the Study

The researcher's involvement in the affairs of society often raises certain methodological and moral limitations. The undertaken study, as well, has its limitations, which has to be taken into consideration for proper apprehension of the existing scenario.

Purposive sampling is been accused of not being representative of the reality due to assumed unspecificable biasness of researcher's judgment in selecting the sample. This study has tried to minimize such biases by selecting the sample from various parts of the town across wards.

Factories like Paper recycling unit etc. are not taken into the study as they are situated towards the outskirts of the Solan Town. Sometimes it was very difficult to convince the respondents for the interview. The social and political

insecurities have often restricted the field work due to their reluctance to interact with the researcher.

1.15 Chapterisation Scheme

The present study has been organized in five chapters. The first chapter is Introduction which outlines the conceptual theme of the study. The first chapter introduces us to the research problem undertaken through its theoretical background and rationalizes the need to conduct the research. The later section of this chapter explains the research process along with the organized research design. This section highlights the area of study, methodology and the objectives of the study.

Chapter II reviews the literature dealing with urbanisation process and tries to understand the phenomena. The review of literature is organized as beginning with general urbanisation trend and then looking at the urbanisation trends in Himachal Pradesh.

Chapter III deals with the readings on solid waste management (SWM), Process of SWM, Approaches to deal with the SWM, Government versus Private waste collection, concerns growing about SWM, and Economic profile of Himachal Pradesh.

Chapter IV titled Field data collection, presentation and analysis looks at methods and materials used. This chapter is largely field work based. It looks at Demographic and socio-economic profile of Solan town, housing, garbage disposal in Solan, contextualizing SWM system vis-à-vis Public Health, generating a composite index to look interlinkages between different components, evolution of Solan town and agencies of Solid waste management.

Chapter V is Conclusion, which summarises the discussion and results. On the basis of the findings, conclusions are drawn. An attempt is also made to discuss the relevant policies and their implications in the light of the present study.

Chapter II

Urbanisation and Urbanism: Understanding the Phenomenon

The term 'urban area' or a town or a city is used in two folds: demographically and sociologically. In demographic terms it refers to the size of population, density of population and nature of work of the majority of the adult males; while sociologists focus on the issue of heterogeneity, impersonality, interdependence and the quality of life. Max Weber (1961) and George Simmel (1978) have stressed on dense living conditions, rapidity of change and impersonal interaction in urban settings (Weber 1961, Simmel 1978). According to Louis Wirth (1938) a city may be defined as 'a relative large, dense and permanent settlement of socially heterogeneous individuals' (Wirth, 1938: 8). While Tonnies (1887) makes differentiation between rural and urban communities in terms of their social relationships and values (Tonnies, 1887). The rural community (*gemeinschaft*) is one in which social bonds are based on close personal ties of kinship and friendship and the emphasis is on tradition, consensus and informality, while the urban society (*gessellschaft*) is one in which impersonal and secondary relationships predominate and the interaction of people seemed to be formal, contractual and dependent on the special function or service they perform.

Urbanism is indeed a way of life and it reflects an organization of society in terms of a complex division of labour, high level of technology, high mobility, interdependence of its members in fulfilling economic functions and impersonality in social relations.

Different scholars have defined the concept of urbanization from the perspective of their respective disciplines. For instance, demographers (Mitra, 1967; Bose, 1973; Premi, 1991) define urbanization as a population agglomeration, a city or a town is a concentration of population of different hues. Sociologists are also concerned with how the traditional social institutions and social structures undergo changes in the new social milieu of a town or a city. For instance, Rao (1991) has

defined urbanisation as a worldwide process and an important factor for social change (Rao, 1991). Some of the changes occurred in Indian towns and cities have been visualized as those from the caste-system to the class structure, from joint families to nuclear families and from sacred to profane or religious belief system to secular outlook and behaviour. Davis (1965) and Pocock (1970) have looked at urbanisation as a process of change from rural way of life to urban life patterns and also a shift from agricultural economy to the industrial economy (Pocock, 1970, Davis, 1965). In other words, urbanization not only covers the special movement of people permanently or temporarily from village to town or city, also refers to the effects of city habits upon the village manners (Vishwakarma, 1981).

Urbanisation is, thus a process of expansions in the entire systems of interrelationships by which a population maintains itself in its habitat. There is both increase in the number of people at a point of population (in town or city) and also increase in the number of points (of town or cities) at which population is concerned (Boragatta, 1984: 2198). Yet the rate of urban growth is distinguished from the rate of urbanisation. Demographer Ashish Bose refers to the former as the percentage increase or decrease in the urban population in a given decade or in a particular year, while they signify the later to the percentage increase or decrease in proportion of the urban population to the total population in a given decade or period (Rao, 1974).

The study of urbanization in India by its very nature involves several dimensions of analysis. This involves a time dimension, a spatial dimension, and a socio-cultural dimension that covers a wide spectrum of people of diverse ethnic origins, speaking a variety of languages and having an abiding faith in some of the world's oldest religious traditions. The fourth dimension significant to the study of Indian urbanization has to do with the economic and political processes that have shaped and are still continuing to shape the basic character of urban life in India. In particular, we can not refrain from recognizing the fact that India is emerging into a strong and viable nation-state based on the principles of socialism, secularism and democracy and is building up a strong scientific and technological framework.

In an urban setting, the habitat comprises not merely the territory of the city and its hinterland but also the spatial linkages between a large number of urban and rural settlements within the region. Cities are products of man and environment interacting in a heuristic process of adaptation and response. The net result is a highly variable and complex matrix of human and environmental attributes which are in a constant process of change. Urbanization has brought about a chain of practical problems of poverty, of employment, of housing, of social pathology. These problems have called for urgent attention; and they have been chiefly investigated on the local scale, though they would be also subject to international comparisons within a wider framework of development experience. A considerable part of the literature of urban sociology in all countries which have such a literature is, therefore, devoted to practical local inquiries; to local social surveys, originating from the description of the panorama of urban poverty; and to inquiries into special aspects, such as crime, race relations, public health, and nutrition, in an urban setting. The troubles of 19th and 20th century urbanization as experienced on the local and national levels have been, and still very largely are, uppermost in many people's minds. The early formative stages of large-scale urbanization during that period have been invariably the by-product of uncontrolled (or only partly controlled) industrialization within a capitalist economy. And *laissez-faire* urban growth is ugly and painful; conducive to social disorganization, but also, with its "massed-millions", a stage-setting for potential organized social transformation. This latter image, in particular, used to be predominant among all those devoted to the maintenance of the established social order: large cities were disliked and feared because they were regarded as the training centres of social rebellion.

This particular branch of urban sociology is preoccupied with certain defects, or alleged defects, of urbanism – with the concept of anomie; with problems of personal relationships in an urban setting. Attention is focused on such problems, apparently on the assumption (though quite often a tacit one) that these are crucial social problems; and also that it is the 'urban way of life' which is responsible for them; it is that which is believed to have caused depersonalisation and anomie.

Ruth Glass in her article 'Urban Sociology' studied and analyzed this *urban way of life* and *urbanism* and put it in the form of a question "Is urbanism really the culprit or the scapegoat? Is it not the social system that has created cities in its own image to which problems of face-to-face relationships must be ascribed? And how serious are such problems in fact? To what extent do they really exist?" (Glass, 1970).

Such questions are neither asked, nor could they be answered, by the 'sociability' section of urban sociology. For sporadic, detailed evidence about personal relationships within individual small communities or primary groups does not, by itself, suffice to evaluate such relationships, nor it is of much help in identifying the impersonal divisive or unifying forces to which such groups are subjected.

Nevertheless, parochialism has remained fashionable for sociological studies within the urban scene; indeed it is the current vogue. And it is this tendency which indicates the most important reason for the lack of systematic concern with the world-wide phenomena of urban diffusion. Perhaps the social sciences in one part of the world are still preoccupied with the bric-a-brac of their own parlours because urban diffusion has not yet gone far enough to compel them to give their attention to more important problems on the global scale? In every respect – approach and object, theme and scale, methods and sources – urban sociology faces the boundary problems. Although most of these are general, perennial problems of the social sciences, they do occur in this branch of sociology in an accentuated form.

There is always a difficulty in demarcating the area of study – the territory both in terms of subject matter and geography. Moreover, arbitrariness tends to be cumulative as the definition of 'urban' usually is (or at least has to begin and end with) an administrative definition.

2.1 Urbanisation: Stemming a perilous impact

Urbanism refers to patterns of social life typical of urban population. These include a highly specialized division of labour, growth of individualism in social relations, growth of

voluntary associations etc. Urbanisation can be defined in terms of increase over time in the population of cities in relation to the region's rural population, while in terms of a place; urbanization refers to increased spatial scale, density of settlement and other activities in the area over time. However, a clear contrast between rural and urban societies is not plausible. There are gradations of urban and rural regions. Eminent sociologist Robert Redfield has made an important contribution to develop the concept of folk, rural, and urban continuum. The spread of modern industrial traits has decreased considerably the difference between the village life and city life. Therefore a clear line of contrast between the two is not visible.

Urbanisation is a dynamic process taking place due to a variety of factors; it could be either due to natural expansion of the existing population, though usually not a major factor since urban reproduction tends to be lower than rural, or due to the transformation of peripheral population from rural to urban, incoming migration, or a combination of these. According to the UNHABITAT 2006 Annual Report, sometimes in the middle of 2007, the majority of people worldwide will be living in towns or cities, for the first time in history. In regard to future trends, it is estimated 93% of urban growth will occur in Asia and Africa, and to a lesser extent in Latin America and the Caribbean. By 2050 over 6 billion people, two-third of humanity, will be living in towns and cities.

2.2 Third World Urbanisation

Urbanisation is taking place at a very fast pace in several third world countries. However sociologists have raised several pertinent questions regarding the nature of urbanization process and its possible outcome and impact on society, ecology and economy of the third world countries. It has been argued that much of third world urbanization is the result of over population in the countryside, also given lack of development and non-availability of productive work in rural areas a large chunk of rural population migrate to urban areas.

2.3 Urbanisation and Its Ramifications

Most studies in the field of urban sociology have observed that people's psychology and lifestyle's change in an urban environment. In addition, urbanization has effects on the ecology of a region and on its economy. Both perilous as well positive impact of the ongoing process of urbanization is quite discernible in India. While on the one hand it has

opened new avenues and vistas of development, on the other hand it has opened floodgates for the thriving and perpetuation of a host of social problems. The increasing urbanisation in India has led to problems like pollution, over-crowding, slums, unemployment, poverty, crime and juvenile delinquency. Especially due to unplanned and haphazard growth of urban areas has led to several complicated problems in several cities of India. The case in point could be the ceiling drive in the capital city. Due to large-scale encroachments by commercial establishments and unauthorized construction, urbanization has become a source of great nuisance.

On the social and cultural front the dynamic process of urbanization led to intermingling of rural and urban population and as a consequence helps in the spread of new cultural traits, thus further enriching the cultural matrix of a society. This trend is quite evident in a multicultural country like India. However at the same time urban pressures weaken traditional family values and social control over children. Schools are not always available which further breeds to the vicious cycle of disparity. Interaction between children and parents, recreation and cultural stimulation are all lacking. Economically urbanization in terms of the process of industrialization has played and is playing an immensely important role in the development of our country and there is no denying the fact that urbanisation has led to increased productivity and economic diversification, but at the same time has also given rise to deprivation, poverty and marginalization. This process has gained further momentum in this era of liberalization and globalization.

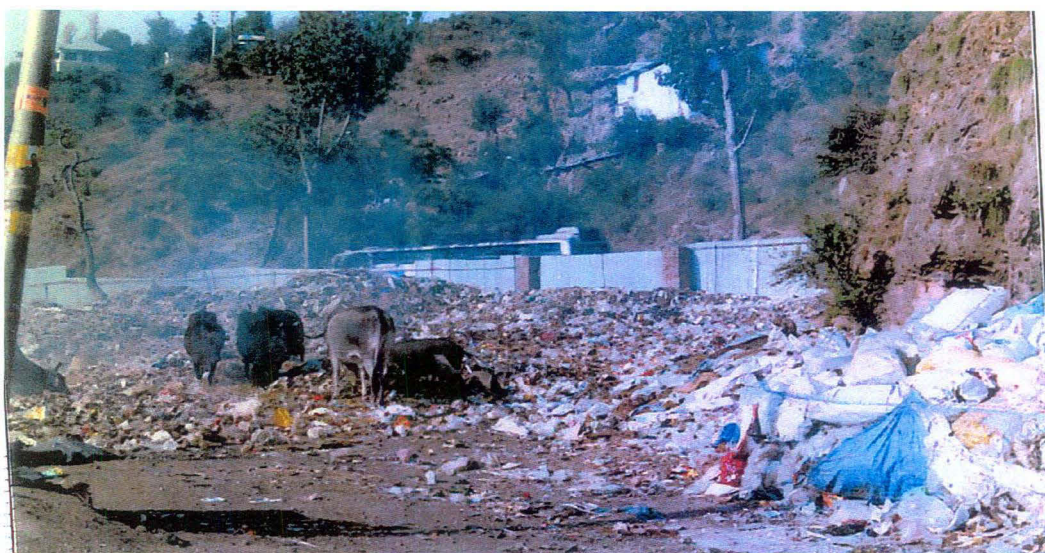
The urbanization process has greatly altered the lifestyle of urban dwellers, which in many cases giving rise to a host of health problems particularly for poor and low income groups. Noise, overcrowding, inappropriate design, and stresses contribute to the growing psycho-social health problems of many urban dwellers in developing countries, especially adolescents and young adults. These preventable health burdens cause disease, accidents, and premature death. In addition to poor housing and sanitation, excess of chemical pollutants in urban areas, toxic hazardous wastes, shortage of fresh water etc. lead to variety of health related complications. Slum dwellings have no ventilation or natural light and are the most vulnerable. Slum dwellers suffer from dust, smoke, and noise pollution. Piles of garbage, potholes, stray animals, flies and mosquitoes are common in these areas. Children in these areas are more vulnerable to diseases and deficiencies than their rural and other urban counterparts.

Plate 3

A) Disorderly Situation at old bus Stand Solan



B) Stray Animals at Garbage Processing Plant Site at Salogara



2.4 Urban Development in Himachal Pradesh

2.4.1 Urbanisation Pattern in Himachal Pradesh

The formation of H.P. as a part 'C' state on April 15, 1948 with the merger of 30 erstwhile princely states marked the onset of Urbanisation in the State. H.P. experienced a sudden growth of its urban population from 0.86 lakh in 1941 to 1.54 lakh in 1951. The rate of urbanization grew from 3.80% to 6.45% in respective census decades. The compound annual growth rate (CAGR) of urban population rose to 1.5% during 1931-41 to 5.99% during 1941-51. Since then, the growth of urban population has been steady. The gradual urbanization of a predominantly rural society has been set into motion and the urban population of H.P. has more than doubled between 1971 and 2001. The absolute increase of urban population during 1981-1991 is 1.46 lakh against 1.23 lakh during 1971-81 and 0.84 lakh during 1971-81. Though the growth of urbanization has slowed down in the 1990s, yet the net increase of the state's urban population during period 1991-2001 has been only slightly less than the total urban population of the state in 1951. The projected higher growth of economy, industry, trade, commerce and tourism in H.P. may lead to faster urbanization. Table indicates the trends of urbanization in H.P.

Table 2.1: Trends of Urbanization in H.P.

Census Year	Total population (in Lakh)	Urban Population (in Lakh)	Rural Population (in Lakh)	% of urban population	CAGR** (%)		No. of towns/ urban Agglomerations
					Rural	Urban	
1971	34.60	2.42	32.18	6.99	-1.98	3.12	36
1981	42.81	3.26	39.55	7.61	4.15	3.02	47
1991	51.71	4.49	47.22	8.69	1.79	3.25	58
2001	60.77	5.95	54.82	9.79	1.50	2.86	57
2011*	71.42	7.89	63.64	11.05	1.50	2.86	-
2021*	83.93	10.45	73.88	12.45	1.50	2.86	-

Source: i) Census of India 1981 Town Directory, H.P. Series 7, Part XA.
 ii) Census of India 1991 Town Directory, H.P. Series 9, Part IX.
 iii) Census of India 2001 Rural-urban distribution, H.P. Series 3, Paper 2 of 2001.

Note: * Projection based on CAGR of 1991-2001 decade.
 ** The CAGR of 1971, 1981, 1991, 2001, 2011, and 2021: calculated from actual decadal values of 1961-71, 71-81, 81-91, 91-01, projected values of 2001-11, 2011-2021 respectively.

From 1971 onwards, urbanization has been constant, with the CAGR of urban population varying between 2.86% to 5.25%. During the period 1971-2001, the average CAGR of urban population i.e. 9.41% has been considerably higher

than the CAGR of the rural population i.e. 5.47%. This difference is likely to increase in the future due to higher growth of population in the urban areas, which offer better employment opportunities. The consequent economic, environmental and physical changes are likely to exert pressure on the Urban Local Bodies (ULBs) to meet the growing demand for infrastructure such as land, water supply, sewerage, SWM, housing, roads etc.

District-wise trend of urbanization indicates that Shimla, Solan and Sirmaur districts have 23.12%, 18.26% and 10.38% urban population respectively and are the top average. The urban population of HP is not growing in an equitable manner. The inequalities have increased considerably in the last 5 decades. The 2 most urbanized districts of the state have 18 towns of different sizes i.e. 10 in Shimla and 8 in Solan and these indicate a linear/ corridor pattern of urbanization. There is a ribbon-type of growth of towns in other districts also i.e. Bilaspur, Mandi, Kullu, Una, Hamirpur, Kangra and Chamba except Kinnaur and Lahaul & Spiti, which have no urban population.

Shimla, the only class I town is highly urbanized. There are 6 classes III towns, 7 class IV towns, 17 class V towns and 26 class VI towns, two new towns i.e. Baddi (Solan district) & only the census town of Mant Khas (Kangra district) came up in 2001. Pandoh, a census town in Mandi district in 1991, lost its status in 2001.

The number of towns has increased from 36 in 1971 to 57 in 2001 and the urban population of H.P. is converging in the larger towns. It is also interesting to note that the smaller towns with a small urban population have started exhibiting a decadal rate of growth, which is as high as that of the larger towns or even higher. Manali Nagar Panchayat, a class V town in Kullu district, experienced the highest decadal growth rate of 157.50% during 1991-2001 which is largely due to growth of tourism in Manali, which is emerging as an alternative to J&K. With the growth of urban population, the number of municipal councils is likely to increase. The spatial pattern of urbanization emerging from the growth of tourism, trade and industrial activities needs to be observed and monitored for sustainable development of the urban areas.

The population base and growth trend of municipal towns/cantonment boards (CBs) confirm the unequal trend in towns of various size and class. Shimla is the largest and the only municipal corporation town of the state. Among the 20 Municipal Councils, Solan (0.34 lakh) is the largest and Naina Devi (0.01 lakh) in Bilaspur district the smallest. Among the 28 Nagar Panchayats, the recently constituted Panchayat of Baddi (0.23 lakh) is the largest and Narkanda (0.007 lakh) is the smallest. Among the seven Cantonment Boards, Yol (0.11 lakh) in Kangra district is the largest and Bakloh (0.02 lakh) the smallest. Some Municipalities in the upper areas (inner Himalayas) of Kangra, Chamba and Kullu districts are very small in size, weak in fiscal base and are unable to initiate projects for infrastructure development. There is a wide variation of size, population base and the growth of population between towns of the same class and between towns of different classes.

The spatial pattern of urbanization in H.P. is creating imbalances of resources and deficiencies in the coverage of urban infrastructure and municipal services. Despite the growing contribution of urban sector, particularly the urban service sector, to the State Domestic Product (SDP), the quality and quantity of urban infrastructure continue to be poor in H.P. with the decreasing share of the primary sector and the increasing share of the secondary and tertiary sectors in the SDP, in terms of generation of employment and total output, the share of the urban areas in SDP has increased disproportionately.

One of the major concerns in H.P. is the growing environmental pollution due to the disposal of untreated sewage in most of rivers by a large number of towns. Even solid waste such as garbage, polythene bags and other domestic waste, is thrown in the rivers or dumped on the slopes. 'One of the major concerns in Manali is growing environmental pollution due to disposal of untreated sewage in the river Beas and unscientific disposal of non-biodegradable waste' (Gupta J.P. and Manoj K. Teotia 2003). Open defecation is common in urban areas. H.P. does not have any "urbanization strategy" or "urban development policy" to meet the demand and shortfalls in the supply of urban infrastructure/services.

2.4.2 Urban Infrastructure Scenario in Himachal Pradesh

The urban infrastructure scenario in H.P. is grim. Deficiencies in water supply, sewerage, SWM, municipal roads, streets and street lights are becoming acute with growing urbanization. According to the state of environment report (SER) – HP (2000) most towns lack sewerage systems, and SWM is also inadequate. These twin factors expose water to severe pollution hazards (pg. 107). The situation becomes acute in peak tourist months in summer as well as in winter. The urban infrastructure and municipal services have been deteriorating in the larger towns and have been grossly unsatisfactory in the small towns. A considerably high proportion of urban population remains uncovered by municipal services the cost of providing urban infrastructure is higher in urban centres of H.P. because of the difficult mountainous terrain, inadequate supply of low cost raw material and labour. At the same time pricing and cost recovery of urban infrastructure is negligible.

Urban decay is visible in H.P. in the form of water and air pollution, ecological degradation and traffic congestion. It is largely due to unplanned and uncontrolled urbanization and faulty urban management/development systems. Such inadequacy of urban infrastructure services is affecting the quality of life in urban areas. It could be attributed to the poor fiscal health of the ULBs. The ULBs of small and medium towns have more serious problems due to planning bias in favour of larger towns.

2.4.3 Water Supply

Though all towns of H.P. have water supply facility, yet the per capita availability of water in a large number of towns is well below the desired norms. The major populated towns i.e. Shimla, Solan, Bilaspur, Mandi, Hamirpur and Dharamshala have a per capita water supply of less than 80 lpcd and the industrial towns of Baddi, Paonta Sahib and Nalagarh have a per capita water supply of less than 50 lpcd.

In a survey of drinking water in the six towns of Chamba, Dharamshala, Manali, Mandi, Shimla and Solan done by the health department in 1994, it was found that water borne diseases were a major health problem in the urban areas of

the state. Nearly one-third of the tested water samples were found contaminated with enteric bacterial pathogens (SER-HP, 2000, p.109). The situation is no better in other towns as a large number of cases of water-borne diseases are reported in hospitals every year.

2.5 Solid Waste Management (SWM)

There are series deficiencies in SWM in urban areas and environmental decline is visible in almost all towns. The sudden influx of tourist puts tremendous pressure on the sanitary services. The SWM services are inadequate and the accumulation of garbage can be seen in most of the towns. Diseases like diarrhea and malaria break out frequently in many towns due to the poor sanitary conditions. The situation has been worsening despite the favourable climate and environmental conditions in H.P. The municipalities usually complain of the shortage of sanitation staff but the local people in several towns reveal that the existing sanitation staff does not work or irregularly sweep the streets and collect the garbage. The cost of collection, transportation and disposal is high due to certain outdated practices and old technologies. Unscientific disposal of waste is common and biodegradable waste is not taken care of at the household level.

One of the factors for poor SWM in the urban areas is the gap in physical targets and achievements in several SWM activities i.e. construction of dustbins, toilets, purchase of vehicles and construction of waste treatment plants, though the Urban Local Bodies of Shimla, Kullu, Manali, Nahan and Solan has SWM plants, the problem of poor SWM continues due to the lack of support of local people in providing segregated waste to the sanitary staff. These Urban Local Bodies have to segregate waste at the sites of treatment plants, which is a costly and time-consuming affair. A large number of towns do not have treatment facilities and are creating environmental pollution. Heaps of polythene bags are seen in all major towns. The tourists have a lot of garbage including polythene bags in the urban areas, which is affecting the ecology of the state. Throwing of garbage in drainage channels/nallahs and in the streets is a common practice and the ULBs have to start special campaigns to desist the nallahs/channels time and again. Sanitation charges

are collected by few municipalities, which are grossly inadequate to maintain even O&M of SWM.

2.6 Critical Appraisal of Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

JNNURM was launched on December 3, 2005. The programme, JNNURM, acknowledged that urbanisation was a 'relentless process' that had caused an acute urban crisis. Infrastructure development had not kept pace with urban growth and the people who were paying for this were the most vulnerable people: those living in expanding slum sprawls and the homeless, the centre set aside Rs. 50,000 crore under JNNURM, covering a period of seven years beginning with the 2005-06 fiscal. Another Rs. 50,000 crore was to be raised through private sector participation. During this period mission proposes to develop 63 Indian Cities into model sustainable cities. In return, cities would have to implement mandatory and optional reforms, the mission guidelines said, 'to ensure improvement in urban governance so that urban local bodies (ULBs) and parastatal agencies became financially sound with enhanced credit rating and ability to access market capital for undertaking new programmes and expansion of services. In this improved environment, public-private participation models for provisioning of various services would also become feasible'. Narendra Pani of *The Economic Times* has summed up JNNURM in an article, Dressing up the Urban crisis, saying it 'could result in a huge expenditure on underutilized infrastructure, even as access to basic services gets more difficult and urban taxes increase inequality'.

The admissible components under the sub-mission on urban infrastructure and governance include urban renewal, water supply and sanitation, sewerage and solid waste management, urban transport, development of heritage areas, preservation of water bodies etc.

JNNURM is criticized on the ground that in the name of public-private participation it tries to give greater agency to the private corporations than elected bodies. Since JNNURM is a governance issue and not only a financial or technical issue thus what becomes important is 'process' and not the 'product'. Decisions are to be made by the elected metropolitan planning committees and not mayors or

bureaucrats, similarly at local level, Panchayats and municipalities should be the decision-makers.

However SWM is an admissible component of JNNURM, but it takes in its purview the three Category cities, i.e. category 'A' (7 Megalopolis), Category 'B' (28 million plus cities), and category 'C' (28 cities having population more than 1 lakh). The class three towns like Solan, which are 1151 in number, are not included in such mission. Therefore the policies need to look at these towns like Solan which are growing at faster rate than Class I and Class II towns.

Contextualizing Solid Waste Management

3.1 Government Initiatives

Government often regards informal waste recovery activities with disdain. It is usually the poorest people, often those at the margins of society, who roam the streets and waste dumps to find items that can be salvaged and sold, to earn their daily bread. Scavengers are often seen as social outcasts, their business as informal, and their work as nuisance to modern urban life. Nevertheless, municipal authorities and urban elites everywhere are facing mounting problems in dealing with the growing volumes of solid waste. Conventional approaches have included the purchase of high-tech equipment such as compaction vehicles, incinerators and computerized routing programmes, usually with little regard for its potential impacts. In particular, potentially valuable components of the waste are destroyed, resulting in the loss of means of survival for the waste numbers of people who work in the informal waste trade. Although a great deal has been written about the need for appropriate technology, decision makers in less developed countries, as well as the donor agencies seem to have under-estimated the complexity and thus the vulnerability of such high-tech waste technology, as well as its high maintenance costs and the need for skilled operators.

But the atmosphere is changing, and attention is now focusing on finding ways of dealing with the problem of waste in low-income cities that do not depend only on high-tech equipment. The appropriate solutions are now regarded as those that take into account the needs of the people who are already involved in the (informal) recycling business, and the financial capabilities of municipalities and national government. Waste technology that is feasible in high-income countries is usually inappropriate for the socio-economic conditions in the less industrialized countries. Whereas industrialized countries have often taken the road of capital-intensive development, in low-income countries the large labour surpluses and low salaries should favour the choice of labour-intensive options. Wider issues such as

the availability of space, climatic factors, and the existence and enforcement of environmental legislation also influence the choice of the most appropriate approach adapted to local circumstances.

Solid waste is often disposed of without the expectation of compensation for its inherent value. However it is increasingly being recognized that some of the value of refuse could and should be recovered. In economically less developed countries, poverty is the major reason why thousands of people are involved in the (informal collection), sorting and processing of solid waste. Rapid urbanization and related problems such as the steadily decreasing employment opportunities contribute to the extended scale of resource recovery. Many materials are categorized under the broad heading of solid waste. Urban solid waste can be considered to incorporate domestic or household refuse, institutional waste (from schools, hospitals, universities and offices) and commercial waste (from restaurants, hotels, markets and industry).

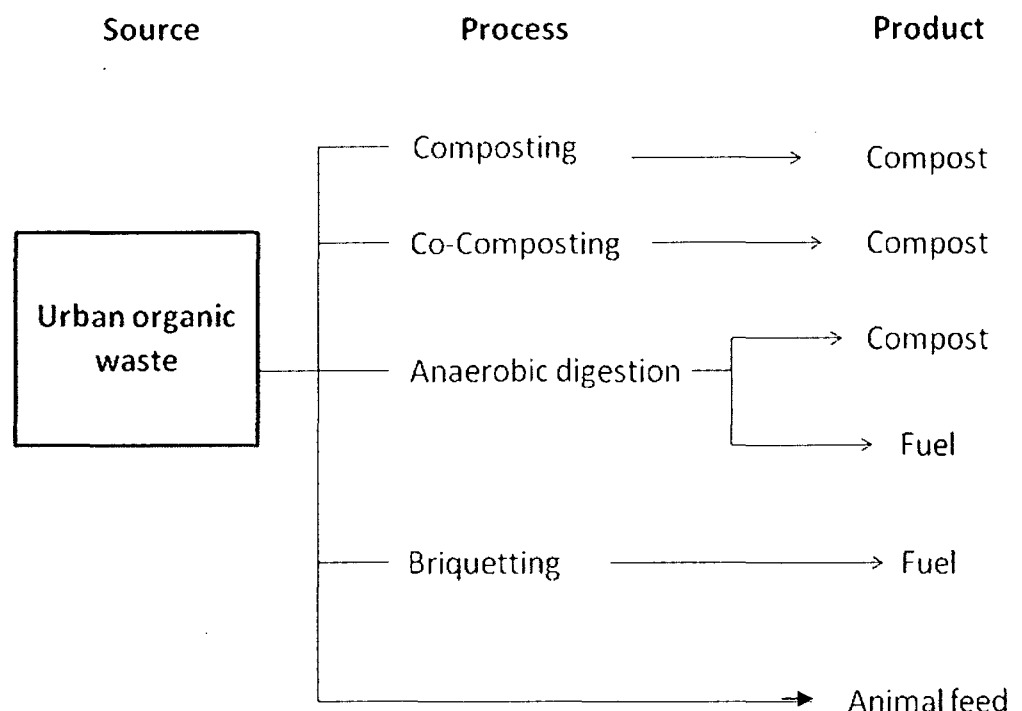
Municipal refuse can be divided into two parts: organic or biodegradable waste and non-organic or non-biodegradable waste. Organic waste includes kitchen waste, food leftovers, rotten fruit and vegetables and peelings, straw and hay, leaves and garden trimming, crop residues, rags, paper, animal excreta, bones and leather. Typical industrial organic waste includes coffee husks, coconut waste and sawdust. The non-organic components of solid waste includes earth, including ash, stone and bricks, coal and cinders, glass, plastics, rubber, and ferrous and non-ferrous metals.

An increase in wealth not only creates an increase in the volume of waste, but also in the value of the waste. The higher income-groups produce higher amounts of easily retrievable and valuable items such as paper, metals and plastics. Since organic material forms a large proportion of urban refuse, ways can be sought as to use this resource more effectively. Organic material can be reused in three ways:

- 1) to feed animals (fodder)
- 2) to improve the soil (compost)
- 3) to produce energy (biogas or briquettes)

The first two options are already very common in less developed countries. Raising animals is the easiest possibility; in most cases organic waste can be fed directly to domestic animals without pretreatment, but cooking or the addition of nutrients may sometimes be necessary. The various processes and the end products that organic waste yields are:

Figure: 3.1: Processes and products from organic waste



Compost is the end product of basically two processes: composting and anaerobic digestion. Both refer to the biological degradation of organic material, but via different processes. Composting, which is probably the oldest method of waste treatment, occurs in the presence of oxygen, whereas anaerobic digestion occurs in the absence of oxygen. The last treatment method produces as well compost as combustible gas, which is known as 'biogas'. Co-composting refers to the combined degradation of organic household waste and animal and human excreta. In principle the process is the same as composting, in that it occurs in presence of oxygen.

3.2 Gender-Based Division of Labour in SWM

Waste recovery may provide an important source of income for many households, especially in times of economic hardship (Furedy, 1989). The management of household waste is usually the responsibility of women. The disposal of household waste is just one of the many routine duties of the housewives, and so it is to women that appeals to reduce waste or take over part of these duties, such as by bringing household waste to communal bins.

Within informal solid waste recovery system, the tasks that fall to men and women vary according to the socio-cultural and economic circumstances. The men are usually involved in the selling of valuable items and the recycling of waste materials, whereas the women tend to be involved in collecting waste from the streets and dumps, and in sorting the material.

The gender division of labour within a waste system in many societies reflects a picture in which the women and children are responsible for running the household and for domestic food production, while the men earn incomes outside the home. Cultural or religious considerations often prevent women's participation in income-generating activities outside the home, whereas men have easier access to the starting capital required to purchase machinery and means of transportation. As soon as mechanization is introduced into a production process, men are usually responsible for handling the machines. Thus the introduction of new technologies may have negative impacts on the position of women by removing employment opportunities. Sometimes changes within a solid waste management system may have negative impacts on the position of women. For example as soon as informal activities become formalized, men become interested because of the status they derive from the work and the equipment. If no preventive measures are taken, women may lose access to certain jobs and areas. When jobs are formalized and carts and uniforms are supplied, men often take over the jobs previously done by women and children.

3.3 Process of SWM

3.3.1 Waste Collection and Sorting

In many countries waste is collected from the disposal/collection points either by municipality, (formal) or informal scavengers. Informal solid waste management systems are usually complex, consisting of several strongly interrelated activities. Micro-enterprises, dealers or middlemen, pickers at the dump site, as well as municipal workers and itinerant scavengers, all play indispensable roles in collection, treatment and disposal of waste. More and more approaches to the development of sustainable solid waste management systems are attempting to include the informal sector and to focus on the community level. This chapter deals with some sociological and organizational aspects of collection and treatment.

3.3.2 Separation at source

The growing amounts of non-organic material in waste have led many farmers to reject urban wastes for use as soil improver. In many parts of Asia, for example, the presence of thin plastic bags in waste has reduced the quality of compost (Furedy, C. 1989). The use of these bags for packaging has exploded over the last few years. Although a large proportion of plastic is recycled, waste pickers prefer hard plastic in large pieces, since they receive only low prices for dirty, low-grade plastic. In mechanical composting systems the plastic bags frequently cause operating problems and reduce the quality of the compost. Other non-degradable materials in compost may also cause problems: e.g. broken glass can injure farmers, and hazardous wastes may introduce toxins to the soil.

The separation of waste at source has been defined as 'setting aside recyclable waste materials at their point of generation for segregated collection and transport to the secondary materials dealer, or to specialized waste processing sites for recycling or final manufacturing markets (Lohani, 1984). In economically less developed countries, the major benefit of waste separation at source would be the retrieval of valuable items such as bottles and plastics from the valueless fraction before they enter the mixed waste stream. Scarcity of these products and marginal incomes encourage reprocessing activities and direct reuse. The practice of retrieving valuable items from waste is

actually widespread in low-income countries. The separation of waste into organic and non-organic fractions is much less common.

In many industrialized countries the separation of household waste into organic and non-organic fractions is gaining ground – for environmental and health reasons, and in particular to improve the quality of compost. In order to avoid contamination, efforts are now being made to convince the households of the benefits of separating their waste into two fractions. The study conducted by **Waste consultants** in 1993 in Cairo shows in a limited experimental project, 600 households is separating their organic and non-organic refuse before collection by zabbaleen. The resulting health and efficiency effects on the participating Zabbaleen community as well as the quality of the compost are being monitored. The simple sorting of refuse into dry (non-organic) and wet (organic) fractions makes the Zabbaleen's job easier and less dirty.

The collectors and reprocessors benefit from the separation of waste at source in a number of ways:

- 1) the incidence of injuries and waste related diseases is reduced;
- 2) the recyclable materials are cleaner and fetch higher prices;
- 3) it takes very little time to sort the various materials; and
- 4) The quality of end products such as compost, meat and vegetables is improved.

At the municipal level, the waste management system also benefits:

- 1) less waste has to be collected, which means lower transportation costs and less material that needs to be disposed of; and
- 2) When the wet (organic) part is kept separate, the heat value of the remaining fraction increases, which makes incineration a more interesting option for further treatment.

Solid waste management is a major challenge facing governments in developing countries. However viewed from the global context, limited attention has been bestowed on waste management in these countries, especially on the need

to develop an integrated approach such that it is both cost effective and efficient. In India, the situation is no different with about 17% of the global population and a staggering urban population of about 27% of the country's total population (*World Bank, 1998*), urban solid waste management in India represents a formidable challenge. The situation assumes more serious proportions if we consider the fact that while the country's overall annual population growth rate is about 2 percent, the estimated urban population growth rate is much higher around 3.5% per annum (*World Bank 1998*). State level urban population data for the major states indicate that Tamil Nadu is the most urbanized state with its urban proportion at 43.9%. It is followed by Maharashtra and Gujarat (*Premi, 2006*).

Although there is birth of precise and reliable data on waste generated in the country because of non-availability of such information at the municipal level, it is officially estimated that the country generates about 30 million tonnes of urban solid waste annually (*GOI 1998*). The per capita waste generation in India varies between 0.1 kg and 0.6 kg per day, with an average of 0.33 kg (*Bhide 1990*). According to a survey conducted by the Central Pollution Control Board (CPCB), the present annual solid waste generation in Indian cities has increased from 6 million tonnes in 1947 to 48 million tonnes in 1997 and is expected to increase to 300 million tonnes per annum by 2047 (*CPCB 2000*). This can be mainly ascribed to excessive urbanization. The sometime, there is large difference between urban and rural levels of waste generation and also between larger and smaller urban centers, which reflect the economic extremes existing within India society (*WHO 1999*). The larger cities are centers of major economic activity, reflected in the prosperity and the culture of consumerism among the residents and also greater waste generation.

Solid waste is non-liquid, non-gaseous disposed off matter. Most human activities create waste. Urban areas produce large volumes of solid waste. Quantity of solid waste generation depends on the size of population and the level of urban household incomes. The higher the income, the larger the amount of solid waste produced as growing income facilitate higher consumption of goods and services.

Solid waste generated from urban activities include those from households, street sweeping, commercial, industrial and institutional categories.

Solid waste may be categorized according to its source as —

- a) domestic solid waste,
- b) commercial and industrial solid waste, which is bulky but not hazardous,
- c) hazardous waste from industries and hospitals, and also to some extent from households that require special handling

The waste composition varies significantly across different areas within an urban centre, such as between residential, commercial market and industrial areas. Also, as in most low income developing countries, urban solid waste in India has high content of organic matter that amounts to anywhere between 30 and 75 percent of total generation (*Venkateswaran 1994*). But the percentage of luxury waste material such as paper, plastic, metal and glass is low (*Bhide and Sundaresan 1984*). Besides the fact that generation of more luxury waste materials is associated with economic prosperity, as observed in developed countries, another reason for its low content in the municipal waste materials are segregated at source for reuse, starting from the households where it is either reused or sold to the *Kabadiwalas* (itinerant waste buyers).

Given its high organic content and moisture, waste disposal and processing are important in waste management practices in India. It is argued that the best method for disposing garbage is by composting or in sanitary landfills (*Appaswami 1994*). However, the most common practice in the country is dumping at sites located around the city that are generally uncontrolled dumps. Dumping is also carried out illegally on private farm lands in the city vicinity. One reason for this is the lack of landfill space in the cities.

The challenge of waste management in our cities and towns is addressed by various agencies. The responsibility of collection, removal, and disposal of garbage from public places in urban areas and maintenance of dumping grounds, however

comes under the purview of the local municipal body which is the main formal stakeholder involved in the governance of solid waste management service in our cities. It is estimated that 10 – 40 % of the municipal budget is utilized for solid waste management. Yet it is generally argued that Indian waste management system is starved of resources when the demands of increasing urbanization are taken into account (Bhinde 1990). Other actors like private organization that are engaged in waste collection and processing works (for example, compost forming), and informal recycling system are also actively involved in the country's waste management process. Their presence in the delivery of solid waste management services in the cities is, however, dependent on the operation of the municipal bodies (Sudhir et al 1996). The services provided by the municipal authority are, for the most part, inefficient. It is estimated that, on an average, 30% of the disposed solid waste are left uncollected. This is beside the point that, as in most developing countries, there is an active informal network in the country that exists as a parallel system and contributes significantly to the overall waste management process in the cities. Comprised of waste pickers, itinerant waste buyers and junk dealers, the quantum of waste recovery by this informal sector is placed in the range of 6-7 % to around 15% of waste generated (Bhinde 1990).

To address the problem of solid waste management in the country, the Ministry of Environment and Forest (MoEF), Government of India, has brought into force the municipal waste (Handling and Management) Rules, 2000. This specifies that the primary responsibility to manage solid waste management in the cities will now rests on urban local bodies (ULBs). It also provides for the collection, segregation, storage, transportation, processing and safe disposal of municipal solid waste, excluding hazardous waste. The management of hazardous waste is under the purview of the Hazardous waste management rules, 1989, the Biomedical Waste (Handling and Management) Rules, 2001. However, though these rules emphasize environmentally sound management of municipal solid waste, it is with regard to their nature and type of regulations to ensure compliance with the delivery norms listed in the rules and also due to the inadequate information for monitoring providers, more often it is a case of rule violation.

Planning for urban solid waste management within the framework of sustainable development raises several intra-and-inter-generational issues such as public health, livelihood of actors in the informal recycling sector, present and future cost to society, conservation of resources both renewable and non-renewable, and environmental impacts of waste disposal.

Sustainable development is emerging as a dominant paradigm that is likely to play an important role in the design of urban policy. Provision of basic services, especially to urban poor, and ensuring their right to livelihood and access to resources, is central to the concept of urban sustainability in developing countries. One of the basic services that is receiving wide attention is solid waste management.

Urban Solid Waste Management (USWM) in developing countries comprises both formal and informal systems. The formal system consists of two actors:

- i) the municipal body that is responsible for waste collection, transportation and disposal, and
- ii) Private organizations interested in converting waste to marketable products such as compost or refuse-derived-fuel (RDF) pellets.

The informal system consists of many actors such as waste-pickers (rag pickers), itinerant buyers, small scrap dealers, and whole sellers, who together recycle about 20% of the waste. Householders also contribute to informal recycling by indulging in source separation, albeit, in a limited way. The challenge therefore, for urban planners is to identify approaches that are viable, i.e. satisfy short term objectives without compromising long-term objectives.

The governments in developing countries have been showing a great deal of interest in improving USWM. Several approaches are being suggested. They can be broadly categorized into “hard” and “soft” approaches:-

3.3.3 Hard Approach

In this approach, USWM is considered a responsibility of municipal body. USWM is treated as a large material handling problem. This technical perspective places an emphasis on the design of an efficient system that reduces multiple handling of waste, allows smooth flow of waste from various collection points to the disposal sites, and facilities disposal of waste in an environmentally safe manner. Such a system, it is believed could be sustained through appropriate mechanisms such as cost-recovery or contracting to private bodies. Municipal authorities observe that economies should not be criterion in safeguarding public health and environmental quality.

The techno-managerial approach treats waste-picking (scavenging) as an illegal activity. Waste pickers are seen as impediments in improving the efficiency and quality of SWM. Apart from this, reservations against waste-pickers are due to:

- i) The unhygienic nature of the activity.
- ii) Its potential to attract street children and
- iii) The uncertain nature of the activity arising out of market demand for recyclables and poor socio-economic conditions prevalent in urban centers.

Therefore, the protagonists of the techno-managerial approach argue that waste-picking should not be encouraged by a government body. The world-view that large scale improvement in performance of USWN through techno-managerial mechanism is feasible, and also desirable, thus signifies the “hard” nature of this approach.

3.3.4 Soft Approach

Gotih observes that USWM should not be viewed from the narrow perspective of collection and disposal, but *should instead be seen as a part of issues arising out of rapid urbanization*. Expressing a similar view point, Furedy states that USWM is basically a *socio-cultural problem*, which would limit the effectiveness of a techno-managerial approach. Furedy also observes that solid waste planning in developing countries does not focus on the concept of “*resource recognition*” i.e. treating waste

as an unused resource. She therefore calls for a non-conventional (“soft”) approach involving community-based initiatives and informal mechanisms to USWM. Another concern about the hard approach is that the planning process is top-down in nature, which as, Douglass notes, may not work in favour of the urban poor.

A few studies in USWM, conducted in Indian context observes that most of the interventions adopted for improving USWM aim at revamping the formal system, and ignore the role of informal waste-pickers in the field. They point out that failure to recognize the social and economic aspects of informal waste-pickers could upset the plans of municipalities. In a recent paper, Venkateswaram apices that SWM strategies in Indian cities have not been able to incorporate, to any significant extent, considerations of resource conservation, pollution reduction, health and employment generation. She also points out that the constraints and inefficiencies expended in SWM are due to the predominantly technology-oriented nature of SWM systems, which land to ignore social, ecological and economic characteristics.

3.4 SWM and related Environmental Factors- Linking Health

The problem of environmental pollution will plague Indian cities and towns even more seriously than it has been recognized so far. Fast increasing population and rapid industrialization create in urban centers slums in congested areas with deleterious structures un-served by sufficient water, drainage, sewerage, and minimum basic facilities and public amenities. Here are the areas where the poor who can not afford the city’s good life live in filth under unhygienic conditions. These landless poor, whether in urban or suburban or rural area, squat on the public land in hutments to live a sub-human life. It is more pressing to improve the environmental facilities of the slum dwellers than to do slum clearance (Joseph, 1977). To most people the word environment now invokes nightmares- the toxic effect of pollution, the pathological consequences of exposure to intense and unnatural stimuli, the behavioural disturbances caused by overcrowding and automated work and a host of evils of ecological crises. Physicians have long known that almost any kind of sudden change in man’s ways of life or his surroundings is likely to have damaging effects upon his physical and mental health. The modern environment threatens human existence for two different

reasons: firstly, it contains elements which are outrightly obnoxious and secondly, these substances changes so rapidly in composition and concentration in the atmosphere that man is not able to acquire the proper adaptive responses to them fast enough (Bhargava,1981)

It has been conclusively proved that pollution especially by sulphur dioxide and particulates are responsible for numerous respiratory diseases such as bronchitis, constrictive ventilatory disease, emphysema, bronchial asthma. It has also been proved during a brief period of weather stagnation that the effect of dust and sulphur dioxide is supplementary and nearly equal to the products of the two. Similarly hydrocarbons discharged from bituminous coal combustion, petrochemical manufacturing processes and automobile exhaust have boosted up the rate of incidence of lung cancer in many communities. Added to these are chemical additives in petrol such as lead, barium, manganese, etc. which are discharged by motor vehicles. These affect the health of the people far more extensively. The worst victims of this man-made catastrophe are children (Biswas, 1972). Human beings appear to be the worst sufferers due to air pollution. It causes lung cancer, irritates the skin, eyes and the upper respiratory tracks. Carbon monoxide, one of the chief components of car exhausts, appears to affect the nervous system. It has been found that the occurrence of chronic bronchitis is about three times as high in heavily polluted areas in comparison to cleaner areas.

3.5 Health and Environment Initiative

“Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature”. The first principle in the 1992 Rio declaration on environment and development of the United Nations Conference on Environment and Development (UNCED) signifies a major shift in developmental thinking from the past economic model to a more human centered paradigm. The declaration fully supports the social goal of “Health for All” and directly links health, environment and development. UNCED also adopted Agenda 21, a universal plan to action to achieve sustainable development in the 21st century.

Economic development contributes to improved health, but ill considered development also adds to health risks. Threats to health and development from deteriorating environmental conditions affect everyone. Polluted air and water, contaminated food, flooded settlements because of poor drainage; indiscriminate garbage disposal; poverty and inadequate water supply, sanitation and shelter; working lives shortened by crippling diseases; women and children made chronically ill by crowded and squalid living conditions; and industrial poisoning and accidents are reminders of the neglected investment in environmental improvement in the rush towards quick economic development.

The health sector has to take the initiative and join forces with other sectors to bring to fore the multisectoral health and environmental concerns in planning for sustainable development. Awareness of environmental causes of all health and advocacy for health can contribute significantly to maximize the benefits of development.

3.6 Healthy cities

Rapid population growth and migration of population into the cities are placing tremendous burdens on city services such as deterioration of city infrastructure and services, increased levels of air, water and noise pollution. And inadequate control of and capacity for urban expansion, already widespread are rapidly reaching a critical stage where new innovative approaches are required.

To address urban environmental issues, WHO Healthy cities initiatives strives to improve the health and living conditions in urban areas with local governments as key partners in the process. This approach has been initiated in Chittagong and Cox's bazaar in Bangladesh and Bangkok in Thailand and is being expanded to other urban centres in South-East Asia Region. Kathmandu in Nepal, Bangalore in India and Badulla in Sri Lanka are now taking steps to start their own processes of preparing and implementing healthy cities plans.

3.7 Government versus Private Waste Collection

From the view point of environmental health management, the collection and disposal of waste is usually considered to be the responsibility of the government or municipal institutions. However, municipalities in many low-income countries are often unable to cope with the ever growing volumes of waste due to inadequate public funds, increasing populations, the lack of equipment and spare parts, and often poorly trained staff.

To deal with these problems, municipalities often choose capital-intensive waste recovery options, and thus overlook the usually strong informal waste collection and recovery sector. The introduction of expensive compaction vehicles is an example of an inappropriate technology that usually has a negative impact on the informal system. In low-income countries compaction does not reduce the volume of waste very much (waste densities are already high because of the high proportion of organic material), but merely crushes the waste and mixes it thoroughly, so that scavenging, separation and recovery becomes more difficult. In some countries the contribution of informal sector to formal waste management system is slowly being recognized and valued, and ways are being sought to integrate public and private systems in order to avoid competition.

3.8 Privatisation in Solid Waste Management

Answers to the problem related the planning and management of solid waste are tried to be located in the framework of privatization. Privatisation that started in late 1980s with the transfer of state owned enterprises to private owners has been the political creed of 1990s. It was closely accompanied by the contracting out of an increasing array of public services – from rubbish collection to road repairs (Lee, 1997).

SWM did not remain aloof and a number of studies suggested privatization of SWM services in third world countries including India. For instance, in the aftermath of the 1994 plague outbreak in Surat, a former municipal commissioner of Bombay, when considering options for dealing with mounting rubbish in India's cities, suggested that with local authorities 'should.....think of privatizing garbage

collection and disposal' (India Today, 1994) with continuing poor financial wealth of municipal bodies in Indian cities....., the need for privatization of MSW is urgent (Rao, 1994). Privatization of SWM in other Indian cities has been suggested as the way it has been done in Bangalore.

A critical review of privatization has been provided by (Lee, 1997). He argues that still there are people who cannot afford to pay for basic services in the Asian cities. He took examples from certain Asian cities like Bangkok, Seoul, Rajkot etc. where basic services have been privatized. He questions the very 'proclamation of efficiency'. Moreover the sewerage system and waste disposal are unsuitable for direct charging on the basis of intensity of use because charging could lead to charge avoidance practice which would create health hazards (Amos, 1992).

3.9 Community participation

Waste disposal is not the sole responsibility of the municipality. Those generating the waste also have a contribution to make. For the smooth functioning of a waste collection and disposal system, it is first essential that the understanding and cooperation of citizens are obtained. They should be encouraged not only to dispose of their waste in the proper way, but also to cooperate by separating waste at home. The success of any effort in this direction needs the cooperation of the people. And much energy has to be invested in raising public awareness of the importance and benefits of participation. It is often difficult to motivate urban populations to work voluntarily. Changes in behaviour that involve extra effort can only be achieved with long-term and strategic information campaigns or with the introduction of incentives such as reduced prices for collection services.

For the residents of low-income areas, waste removal is rarely a priority. Their lives are dictated by survival economics and so are their reasons for taking any action. Therefore the information presented and the approach taken should emphasize the economic benefits. The increasing economic value of waste materials could provide an incentive for individual families to separate and save or sell certain items from their garbage. Although urban communities are already

reusing valuable waste items, this practice could be extended to separation in more and other waste fractions. One of the most important requirements for successful community improvements is the parallel provision of other (municipal) services as well as infrastructure. For example, the provision of regular and reliable waste collection services is indispensable for public cooperation in waste collection schemes. Also, if the waste is brought by members of the household to transfer points, the removal of waste to the dump site needs to be guaranteed.

3.10 Concerns Growing About Solid Waste Management

Municipal Solid Waste Management (MSWM) has a direct bearing on public health and environment. Its influence is being felt more in this era of rapid urbanisation, globalisation, commercialisation and consumerism. Waste has traditionally been considered a substance or object to be discarded as useless. Solid waste has been defined as a heterogeneous mass of useless material, which may originate from homes or commercial or industrial activities (Sinha 1997). It has been broadly classified into municipal waste, hospital waste, and industrial waste. Municipal Solid Waste (MSW) is all the solid waste generated in a community except the industrial and agricultural waste (Sinha 1997).

In the conventional sense, the objective of SWM is minimisation of the adverse impact of waste on health, environment and aesthetic quality of the landscape. The management of solid waste has meant management of the flow stream of waste from generation to disposal through the processes of collection, transportation, processing and final disposal. Public health being a responsibility of the local governments, people have generally expected them to manage waste in a centralised manner. In turn, public officials have been concerned only with quick removal and destruction of waste. Solid Waste Management in the conventional sense has always attempted to find answers to the question: 'how does one get rid of the waste'?

The traditional solutions were mostly confined to technologies that helped destroy or the dispose of the waste. These were improvisations of known methods

of waste disposal, namely dumping, burying, and burning. These crude forms of dispose of waste were not only highly polluting, but also labour-intensive. Technologists improved on these waste disposal methods and scaled them up so that disposal of larger quantities of waste was made possible at centralised sites. Some efforts were also made to minimise the impact on environment and public health. The end result of such pursuits was the development of huge waste-management facilities such as dumping yards, landfills and incinerators.

While many of the developed countries started taking cognizance of the problems posed by waste to public health, environment, and economy in the early part of the twentieth century itself, the developing countries woke up to the suffering from this malaise only as late as the last two or three decades of the century. The developed countries tried to deal with their burgeoning waste by creating landfills near most cities and towns. However, as waste generation multiplied with increasing consumerism and industrial activity, the size and numbers of such disposal sites also kept increasing.

Today, the developed world is saddled with scores of mega landfills containing millions of tonnes of waste – most of them leaching toxic chemicals into water sources and contaminating the air with toxic gases. For instance, one of the largest landfills, the fresh kills landfill in the state Island near New York City, today stands out as an epitome of man's wasteful ways. This landfill is the largest man-made structure visible to the naked eye from space. It covers 2100 acres and contains 2.9 billion cubic feet of garbage. First opened in 1947, Fresh kills is unlined and leaches thousands of pounds of toxic chemicals and heavy metals into the nearby estuaries each day. Before its closure in March 2001, it was reported that the New Yorkers were adding 12,000 tons of commercial and household waste into this landfill everyday. And this is only 0.02 percent of the waste US industry generates.

Despite such dismal evidence and experience of the developed countries, the developing and least developing countries tend to follow the same track of waste disposal. Today most towns in the developing countries are not too far behind their counterparts in the developed world on respect of their waste generation 'abilities',

they have their huge dumping yards and crude landfills, all of which operate in the name of waste management. And most of these dumping yards have become unsightly places that breed vermin and they have become hazardous for the surrounding human population and the environment. Public protests against such public hazards have become common. Still the governments of these countries have become so dependent on these dumping yards that they are reluctant to close them down.

Even as waste disposal was creating nightmares for waste managers, another world-view emerged. According to this view, when a person discards a material after having used it, another person could still put the discarded material to some productive use. From this perspective solid waste has been defined as the organic and inorganic waste materials, produced by households, commercial, institutional and industrial activities, which have lost their value in the eye of the first owner. This definition suggests the recovery value of a discarded material.

As early as in the 1960s, many developed countries realized the need to recover resources from waste, primarily driven by the fact that increasing consumption was creating increasing quantities of waste. They are finding it difficult to manage the waste generated with available facilities. Resources that could still be useful were rotting in huge landfills. In 1965 USA enacted its first federal solid waste management laws and in 1968 many companies began buying back containers and recycling them. The first Earth Day was celebrated in the USA in 1970 with the creation of Environmental Protection Agency (EPA) and enactment of the Resource Recovery Act (RRA). These Acts became the Resource Conservation and Recovery Act (RCRA) of 1976, which emphasized recycling and hazardous waste management.

However, most of the developed countries are switching from the disposal – centric SWM to a recovery-centric one. This paradigm shift requires some level of public participation, for instance, by regulating waste disposal behaviour. Many communities in the developed countries started segregating waste at source to enable efficient recovery. Thus, the approach to SWM is shifting from a technology and disposal – centric one to one that is integrated and process centric.

While recovery of resources from discards has involved much formal social organising in the developed world, the recovery rates were quite high in developing world even without any formal intervention. This was possible primarily because waste generation had still not reached alarming proportions and the informal sector, which included rag-pickers and secondary markets, played a big part in the waste management sector.

3.11 Poverty Statistics in Himachal Pradesh

Economic growth has crucial implications for poverty reduction. It is expected that the faster growing states would experience a rapid reduction in the proportion of their population below the poverty line. This section attempts to analyze the existing level of poverty and the performance of programmes for its alleviation in Himachal Pradesh as compared to other states and UTs. Poverty has been a matter of national concern. Various agencies both Pvt. and government, have been estimating poverty levels from time to time following different methodologies and drawing different conclusions. This has led to controversies over the reliability of the data. The Planning Commission has been providing estimates on poverty from time to time. These too are not free from controversy, yet these have been accepted as official and hence are analysed in this section.

The proportion of Himachal Pradesh's population Below Poverty Line declined from 26.39% in 1973-74 to 7.63% in 1999-2000, when the corresponding figures at the national level were 54.88% and 26.1%, 3.5 times higher than that of the state. Himachal Pradesh was ranked 6th among the States and UTs during 1999-2000, after J&K (3.48%) Goa (4.4%), Daman & Diu (4.44%), Chandigarh (5.75%) and Punjab (6.16%). The neighbouring state of Haryana had a higher poverty ratio than H.P. Himachal Pradesh with 7.94% of its rural population BPL ranks 7th among the States and UTs, only below Delhi (0.4%), Goa (1.35%), Lakshadweep (1.35%), J&K (3.43%), Chandigarh (5.75%) and Punjab (6.35%) and with 4.63% of such population in urban areas, it ranks second only below J&K (1.98%).

3.12 Economic profile of Himachal Pradesh

Himachal Pradesh had an average Per Capita Income of Rs.6507 in 1999-2000 at 1990-91 constant prices (Table 3.1). The district of Lahaul and Spiti with Rs.12,559 was at the top and Hamirpur with Rs.4243 at the bottom. Low density of population of high value-added cash crops in Lahaul and Spiti were the reasons for the high per capita income. The state average in 1990-91 was Rs.4,618. L&S was again at the top and Una was at the bottom.

Table: 3.1 District-wise PCI, 1990-91 to 1999-2000 at 1990-91 prices

District/ State	1999-2000 in Rs.	Rank 2000	1990-91 in Rs.	Rank 1991	Annual Growth Rate (1990-91 to 1999-2000)
Una	4480	11	2394	12	7.21
Solan	11231	2	6052	4	7.11
Bilaspur	7547	5	4515	7	5.87
Mandi	5313	10	3394	10	5.11
Hamirpur	4243	12	2753	11	4.92
Sirmaur	5650	9	3934	9	4.10
Kangra	5736	8	4128	8	3.72
Chamba	6058	7	4822	6	2.57
Shimla	8304	3	7525	3	1.10
L&S	12559	1	11417	1	1.06
Kullu	6098	6	6039	5	0.11
Kinnaur	7930	4	8746	2	-1.08
H.P.	6507		4618		3.88

Source: Computed from Human Development Report of HP, 2002.

Note: The districts are arranged in descending order of annual growth rate.

Shimla was the state capital, ranked third at both points of time. Solan being the centre of industrial activity ranked second in 1999-2000. During the nineties, the PCI in the State as a whole increased by Rs.1889. The highest increase in Quantitative terms was in Solan district (Rs.5,179). In Kinnaur, it decreased by Rs.816 during 1990-91 and 1999-2000. In Kinnaur because of failure of rains and natural disasters the production of horticultural and agricultural crops was low and that had an impact on its Per Capita Income (HPHDR, 2002).

During the nineties, the PCI in H.P. grew at an annual rate of 3.88%. Every district with the exception of Kinnaur (-1.08%) had a positive growth of PCI. It was the highest in Una district (7.21%) closely followed by Solan (7.11%). The PCI in Una district, which was almost at the bottom at both points of time was small, but even this small increase of Rs.2086 amounted to a faster growth. The PCI of Solan district was

2.5 times that of Una in 1999-00. This was significant. The secondary sector has dominated the economy of Solan district of the tertiary sector in Una. The growth of PCI in L&S and Shimla, which otherwise ranked first and third respectively, was among the slowest among all districts (1.06% and 1.10% respectively).

3.13 Industrial Workers

The number of industrial workers per thousand of population has been used as an indicator to measure the level of industrial development. At the State level, almost 13 persons per thousand of population were working in factories in 2000, as against seven in 1991 (Table 3.2 below) Solan district ranked at the top & Lahaul & Spiti at the bottom at both points of time. In fact, the ranking of every district at both points of time remained almost the same, indicating hardly any dispersal of industrial activity at the state. These have been concentrating in Solan district.

Table: 3.2 District-wise numbers of industrial workers per 1000 of population in H.P., 1991 & 2000.

District/ State	No. of Industrial workers per 1000 of population, 2000	Rank 2000	No. of Industrial Workers per 1000 of population 1991	Rank
Solan	88.12	1	33.77	1
Sirmaur	17.32	2	14.01	2
Kinnaur	9.04	3	7.84	3
Una	7.86	4	6.51	4
Kangra	6.77	5	6.08	5
Shimla	5.31	6	3.77	7
Mandi	4.74	7	4.98	6
Bilaspur	3.09	8	2.16	8
Chamba	2.04	9	1.62	9
Kullu	1.60	10	1.56	10
Hamirpur	0.84	11	0.93	11
L&S	0.00	12	0.00	12
H.P.	12.56		7.09	

Source: Computed from different issues of statistical abstract of HP, Directorate of Economic & Statistics, Himachal Pradesh & Census of India.

Chapter IV

Solan and Solid Waste Management- Field Data Collection, Presentation and Analysis

4.1 Evolution of Solan Town and Agencies of SWM

4.1.1 Growth of Solan Town as an Urban Entity

As mentioned earlier Solan town is the districts headquarter situated on national highway number 22 between Chandigarh and Shimla. In recent three decades Solan has seen tremendous increase not only due to natural growth of its population but also due to rural-urban migration. The urban population of Solan town has increased from 10120 persons in 1971 to 34206 persons in 2001. The phenomenon of urban sprawl is well evident in Solan. It is constantly on rise and can be observed in the form of new industrial towns like Baddi, Barotiwala, Parwanoo etc. coming up on the national highway. Culled out from census 2001 the ward wise urban population of Solan town is depicted in the following table:

Table: 4.1 Ward wise population of Solan Town

Wards	Area	Persons	Males	Females	Sex ratio
Solan (M C) - Ward No.1	Urban	2,974	1,670	1,304	781
Solan (M C) - Ward No.2	Urban	2,468	1,392	1,076	773
Solan (M C) - Ward No.3	Urban	3,141	1,839	1,302	708
Solan (M C) - Ward No.4	Urban	3,144	1,723	1,421	825
Solan (M C) - Ward No.5	Urban	1,561	888	673	758
Solan (M C) - Ward No.6	Urban	2,855	1,572	1,283	816
Solan (M C) - Ward No.7	Urban	2,324	1,261	1,063	843
Solan (M C) - Ward No.8	Urban	3,237	1,838	1,399	761
Solan (M C) - Ward No.9	Urban	2,459	1,335	1,124	842
Solan (M C) - Ward No.10	Urban	1,759	938	821	875
Solan (M C) - Ward No.11	Urban	2,542	1,339	1,203	898
Solan (M C) - Ward No.12	Urban	2,056	1,093	963	881
Solan (M C) - Ward No.13	Urban	3,686	2,129	1,557	731

Source: Census 2001.

4.1.2 Evolution of Solan

The district derives its name from Solan town which came into existence after the construction of the cantonment around last quarter of the 19th century. The Mohan

Meakins brewery was set up in 1855 A.D. after the establishment of the cantonment here. The railway line became functional in 1902. The evolution of town can be spelt out in the following order or sequence:-

- i) Setting up of a cantonment area at Solan.
- ii) Establishment of a brewery on account availability of excellent mineral water in the year 1855.
- iii) Shifting of the headquarters of Baghat State from Bhoch to Solan
- iv) Start of Kalka-Shimla rail line in 1902.
- v) Start of vehicular road movement on Kalka-Shimla road.
- vi) The urban local body i.e. M.C. Solan came into existence around 1950.
- vii) Consequent upon re-organisation of districts in Himachal Pradesh, Solan became an independent district on 1st September, 1972 and Solan town became its natural headquarter.

4.1.3 Brief history of Municipal Council of Solan

Municipal Council Solan is spread over an area of 896 hectares with a residential population of 34,206 persons as per 2001 census. The council area is thickly populated excepting the Solan cantonment area which is outside the purview of H.P. Town and Country Planning Act, 1977 as well as H.P. Municipal Act, 1994. The Solan town exhibited a growth rate of 57.23% during the decade 1991-2000. The urban local body here is not very sound from financial point of view. The chronological order of Municipal Council Solan can be observed as under in Table 4.2:

Table 4.2: Brief History of Municipal Council

Sr. No.	Description	Nos./Amount
1	Notified Area Solan constituted Total elected member Nominated member	1949 6 3
2	Municipal Council Solan Constituted Elected Body Administrator	1952 1952 to 1982 1982 to 1995
3	First elected body after 74 Amendment Total elected member Nominated members	Dec. 1995 13 Nos. 3 Nos.
4	Area of Municipal Council Solan	896 hectares
5	Total population 2001 census	34206

Source: Information collected from Municipal Council Office.

4.2 Demographic and Socio-Economic Profile of Solan Town

4.2.1 Demography of Solan Town

As mentioned earlier Solan is the districts headquarter of Solan district. It is rapidly growing town of Himachal Pradesh during the last 20 years. Although the growth rate has declined from (66%) in 1981-1991 to (58%). As is evident from the table below:-

Table 4.3: Decadal growth rate of District Headquarter towns during 1981-1991 & 1991-2001

Sr. No.	Name of Town	Growth Rate 1981-1991 (%)	Growth Rate 1991-2001 (%)
1	Solan	65.69	57.53
2	Shimla	56.31	39.12
3	Hamirpur	42.59	37.27
4	Bilaspur	31.58	23.08
5	Una	31.08	32.49
6	Chamba	24.98	13.13
7	Mandi	24.04	15.76
8	Kullu	22.75	25.65
9	Dharamshala	20.46	8.81
10	Nahan	8.90	18.71

Source: Town and country planning department

The exceptionally high growth rate of Solan town is evident from the table. It leads the rest of the district headquarters in terms of growth rate of population during the decade 1991-2001 as well as 1981-1991. However, the growth rate was about 30% during 1971-1981. The sudden spurt in the growth rate of population may be attributed to the tax holiday given to the industries which attracted rapid industrialization in and around Solan district. This led to influx of population into the urban areas. The growth rates for previous decades of Solan town are given below:

Table 4.4: Growth Rate of Solan town since 1971

Sr. No.	Year	Population	Growth Rate (%)
1	1971	10120	54.17
2	1981	13127	29.71
3	1991	21751	65.70
4	2001	34206	57.23

Source: Census of India, and town and country planning department

Table 4.5: Nearest Medical Facility

Sr. No.	Description	No. of Households	percentage
1	Sub centre within 1 km	524	5%
2	Sub centre within 2 km	100	1%
3	Dispensary within 1 km	695	7%
4	Dispensary within 2 km	656	7%
5	District hospital within 2 km	4166	42%
6	District hospital over 2 km	3633	36%
7	Without medical facility	196	2%
	Total	9970	100.00

Source: Town and country planning department.

Housing

As per the survey conducted by town and country planning department Solan out of total 9,970 house holds, 41 % are owners and 59 % are tenants. This shows that the tenants are more in number than the owners. This suggests the influx of in migration in Solan town in increasing number over the years and the significance of Solan town which caters to the different needs of its population.

Table 4.6: Housing

Sr. No.	Occupied By	No. of house holds	percentage
1	Owners	4075	41
2	Tenants	5895	59
	Total	9970	100

Source: Town and country planning department

4.2.2 Disposal of Garbage

A survey was conducted by town and country planning department over 9970 households in 1999. It shows that out of total households only 26% of the households had door-to-door garbage collection facility whereas 74% households did not have this facility. It was also observed that 57% of the households had the garbage collection facility from the common garbage container and 43% of the households are not availing this facility. The table below shows some of the findings of the survey:

Table 4.7: Availability of Garbage Disposal facility

Sr. No.	Description	No. of house-holds	percentage
1	Garbage collection facility from house	2623	26
2	Households not having garbage collection facility from house	7347	74
	Total	9970	100
3	Households having facility from common containers	4212	57
4	Households not having garbage collection facility available from common containers	3135	43
	Total	9970	100

Source: Town and country planning department.

Table: 4.8: Local Municipal bodies in Himachal Pradesh

No. of Municipal Corporations	01
No. of Municipal Councils	20
No. of Nagar Panchayats	28
No. of Cantonment Boards	07

Table: 4.9: Status of Municipal Solid Waste in Himachal Pradesh

Quantum of Municipal Solid Waste generated per day in H.P.	1200-1800 tonnes/day
No. of Waste Processing facilities operational in H.P.	9 Being used by 12 no. of local bodies in districts using the waste processing facilities are Shimla, Solan, Nahan, Kullu/Bhunter, Manali, Una, Kangra/Nagrota, Bilaspur/Ghumarwin, Hamirpur etc.
No. of waste disposal facilities in H.P.	None

Information collected from Himachal Pradesh Pollution Control Board office, Shimla.

There are 20 municipal councils; one municipal corporation at Shimla, 28 Nagar Panchayats and 7 cantonment boards. There is no officially recognized waste disposal plant/Landfill for the final dumping of waste. There are 9 waste processing units in 12 districts of Himachal Pradesh.

4.3 Methods and Material

Primary data through personal observation at the garbage disposal/treatment plant and dumping site situated in Salogara, field photography, interviews with the help of semi structured questionnaires and interview schedule were administered to a selected sample in resident population of Solan town, workers and managers at plant site run by Jan Seva Ashram; a Non-Government Organization, the Safaikaramcharis and other employees working with municipal committee, sanitary inspectors, executive officer etc. and the less recognized but the significant contributors in waste management system; the informal sector i.e. rag pickers and kabariwalas. The varied perspectives of the resident population about garbage generation, disposal, services and facilities provided by local municipal committee have been recorded through filling up the questionnaire and in the field itself and finally jotting down the experiences in the field diary. This was designed for an in depth understanding of the problem. Five separate semi structured questionnaires were prepared viz. the community/household for the resident population, municipal committee workers and employees, rag pickers, the NGO employees who are running the plant, and the hospital/clinic selected designator just to get a glimpse of the medical waste handling system.

Information was gathered through personal interviews from the rag pickers who pick up polythene, plastics, iron and other constituents from the different collection and final disposal site of the Solan town. They gave an idea about the constituents of the garbage and about its size.

Local municipal committee was the source of information regarding the number of dustbins, vehicles and Safaikaramcharis has been collected from. The committee officials also provided information about the history of garbage disposal in Solan town. Photographs were taken up from different sites and location to get an idea of the grave problem of garbage. Data about the ward wise population, per capita income has been collected from municipal committee, town and country planning office, census of India, Himachal Pradesh pollution control board.

The present study is based upon primary information collected through a field survey. The household level data from 13 wards has been generated through canvassing a structured questionnaire from 65 households of the Solan town selected through a purposive grab sampling. It was assumed that the households close to garbage bins will be able to provide better information regarding its collection and disposal. Thus the households near garbage bins were purposively selected. Among the members of the households any responsible member who was available and consented to respond was interviewed. Thus the grab sampling technique was employed. Distance of garbage bin from the household was taken care of. The household particulars, information regarding services provided by local municipal committee and problem related to garbage disposal have been included in the questionnaire. Some information based on personal observation has also been taken into account while analysing the data.

Every research problem involves people and therefore ideas related to its solution can be obtained by enquiring people about the problem. The method involving the administration of structured questionnaire to the selected sample population used presently ensures speed and economy in data collection and resultant research work. In such method the researcher has greater control over data gathering techniques. The objective in the design of a questionnaire is two-fold to obtain the relevant information pertaining to the research study undertaken to understand the problem of garbage generation and disposal; and to acquire this information with highest degree of accuracy. Appropriate combination of open-ended and closed ended responses has to be prepared, keeping in view the information needed. Although the open ended questions are difficult to classify but offer variety of answers to respondents who are free to give their opinion. The close ended questions on the other hand, are appropriate when the investigators objective is to classify the responses. After studying the literature and discussion a comprehensive questionnaire was prepared.

To gather information pertaining to garbage generation, disposal and different services provided by municipality some Safaikaramcharis and local people of the town were interviewed. This proved helpful in collection of information about garbage generation and disposal in the study area. Some information about

the garbage generation and disposal of the town were collected by direct observations. The observations were also recorded in form of photographs taken in the field. It proved in asserting the authenticity of the responses given by various respondents.

Data and information used in present dissertation also included those already collected, recorded and reported in already existing sources. These secondary sources included data collected by various governmental agencies and also the one posted on internet. Finally the data has been presented in the form of contingency tables, relevant bar diagrams, pie charts and line graph

4.4 Solid Waste Management System in the context of Public Health

The concept of 'Public health' is largely a product of twentieth century and the social crisis created by the epidemic diseases that ravaged the human landscape of urban industrial capitalism (Ross, 1994). Managing waste is a challenging task. As the cities grow, it becomes indeed more complex. There is a confusion and illusion of tourism. Traffic and transport chaos persists. Haphazard infrastructure development is a hard reality. Intrusion and collusion of trade and commerce is a vicious issue. Institutional complexes are overcrowding. There is a blind race for housing, and scene on slopes is critical. The green cover is under tremendous stress. Upcoming ribbon development along the highways and major roads emanating from the city calls for stringent measures.

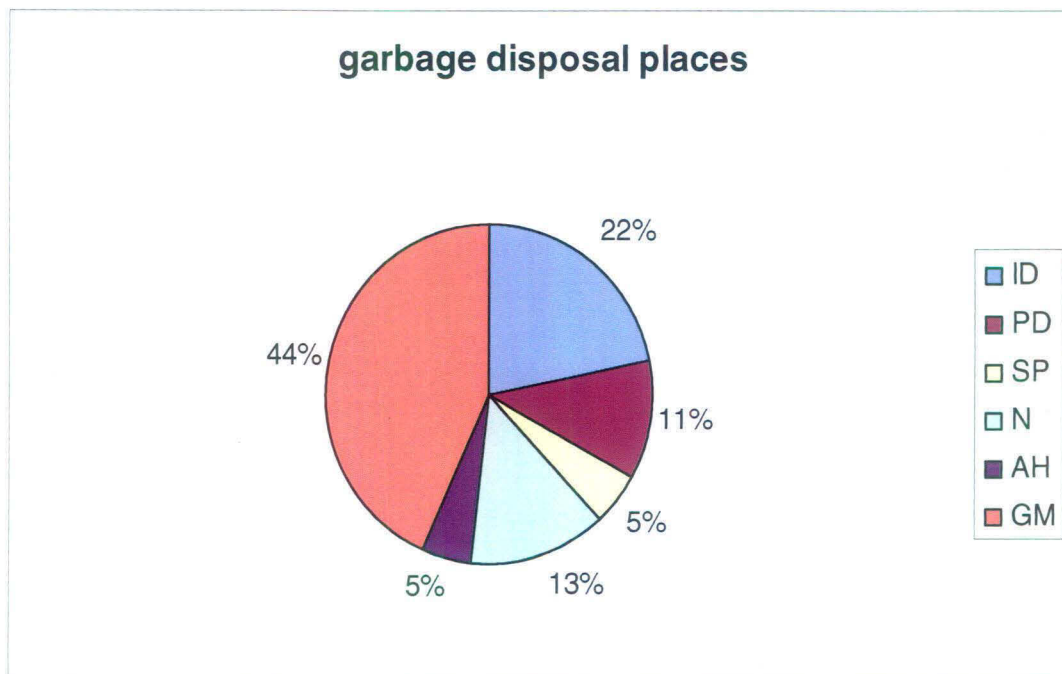
The population of the town and migration to it have increased manifold. The housing stock, water supply, transportation, sewerage, electricity supply and tourist infrastructure is under stress. Every conceivable space has been utilized for constructions and to cater for infrastructure requirements. Though ban on charcoal and polythene has given a slight relief, yet lack of proper disposal of the solid waste calls for a concrete action. The inherent wastefulness in many modern societies is the parallel problems of population growth and its pressures on resource use and waste production. The three related issues of population growth, consumerism and affluence are leading to a potential crisis in waste production and the need for

improved waste management. Viewing from this perspective an attempt is being made to understand the link between society and waste, and explore how a better understanding of this relationship is a vital step to design and deliver more appropriate waste management services in today's context.

Garbage Disposal Places

Places where garbage is disposed are important because approach and accessibility to them determines their use. It is evident from Fig. 4.1 that 44% households use garbage bins put up by municipality, 11% disposes it in public drains, 13% in Nallah, 22% households dispose their garbage indiscriminately only 5% dispose their garbage in soak pits. Out of the respondents responses regarding the use of garbage bins for throwing waste at collection points, the following pie diagram has been generated which clearly shows the waste discarding mechanisms away from households.

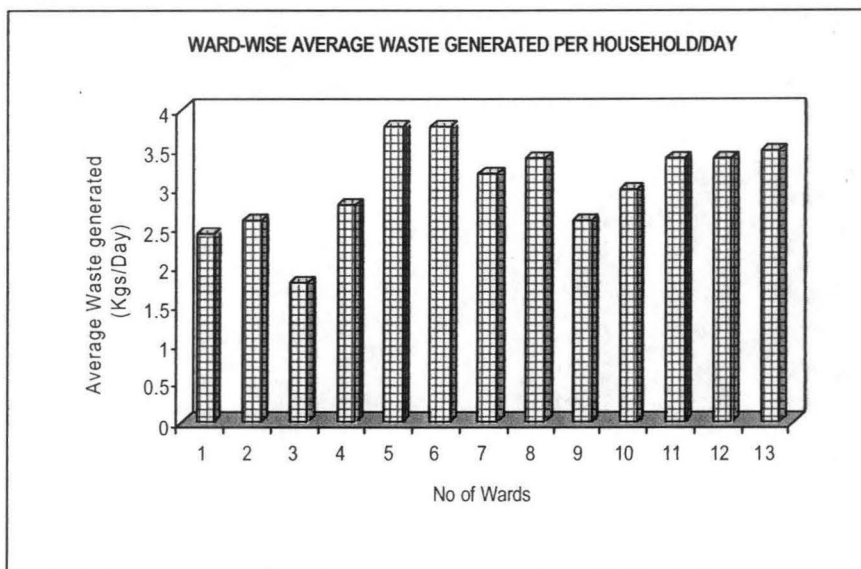
Figure: 4.1: Garbage Disposal Places



ID – Indiscriminate, PD – Public Drains, SP-Soak Pits, N-Nallah, AH- Around the house, GM- Garbage bins put up by the municipality. (Source: Field Survey)

Source: Field Survey

Figure: 4.2: Average waste generated per ward per household



Source: Field Survey

Average waste per household per ward

The average waste generated per household per ward, which on an average comes to 3.5 kg per household. As regards the spatial variation in waste generation, the wards 5 and 6 together generate maximum waste per day per household. These are the wards where most offices, institutions and residential areas are located. The smallest quantities (average) are generated in ward 3 (Fig. 4.2). It is a matter of concern that only 44% household use the garbage bins put up by the municipality, despite the fact that the garbage bins are in the vicinity of about 2 km.

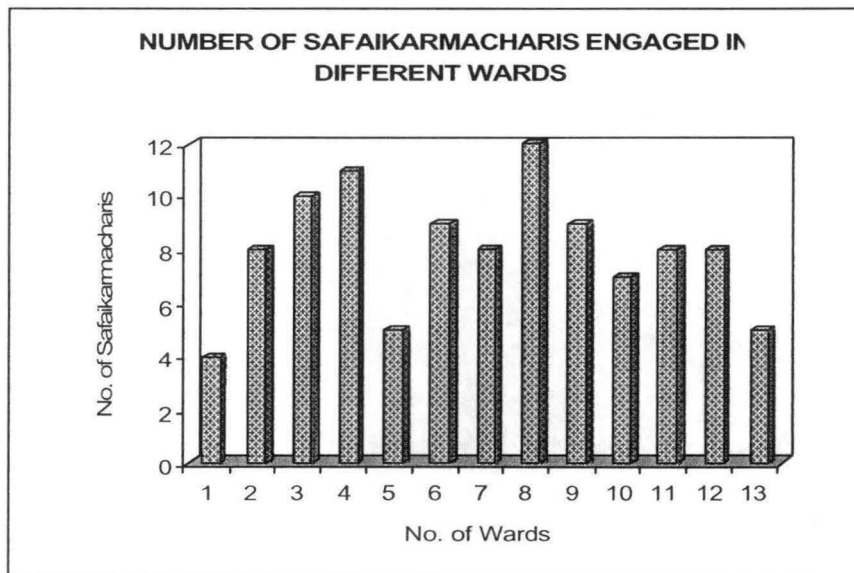
Table: 4.10 :Frequency of Garbage Disposal

Garbage removal by M.C. (Frequency)	Ward wise Percentage													Total (%)
	WN 1	WN 2	WN 3	WN 4	WN 5	WN 6	WN 7	WN 8	WN 9	WN 10	WN 11	WN 12	WN 13	
Everyday	20	40	60	0	0	80	20	100	100	60	0	40	20	41.53
Once in a week	80	0	0	60	20	0	0	0	0	0	20	20	0	15.38
Twice in a week	0	20	20	40	20	20	60	0	0	40	60	20	40	26.15
Thrice in a week	0	0	20	0	20	0	20	0	0	0	20	20	0	7.69
Whenever it suits M.C.	0	40	0	0	40	0	0	0	0	0	0	0	40	9.23
	Total													100

Questionnaire Survey Results about Garbage Removal by M.C.
Source: Field Survey

In order to measure the frequency of garbage disposal from the collection points at different places in the town, the responses were calculated to find out the percentage break up of the frequency of garbage removal from the different collection points and garbage bins. Table 4.10 shows the results of field survey about the frequency of garbage removal by Municipal Committee. Nearly 43% respondents responded that the garbage is removed from the designated places everyday.

Figure: 4.3: Safaikaramcharis Deployed



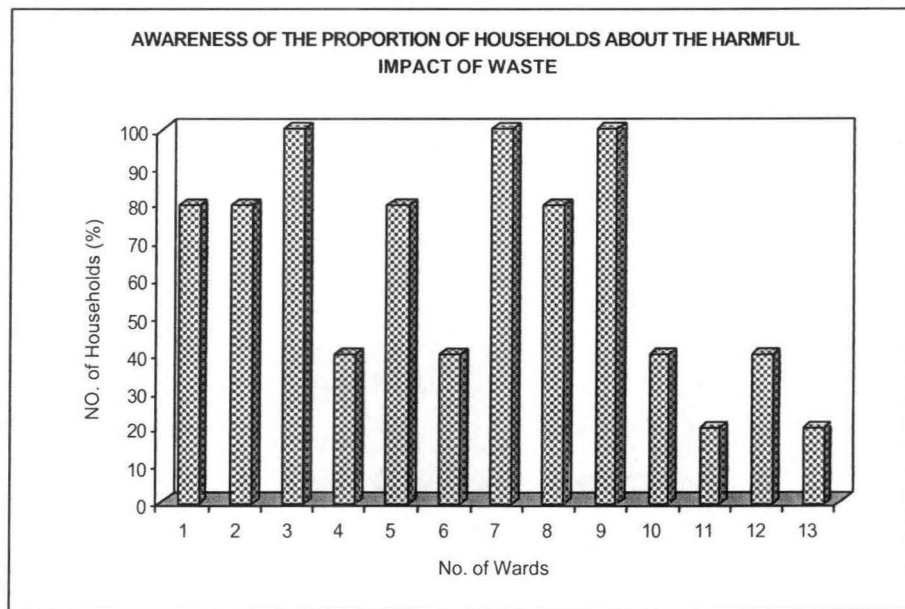
As regards the personnel involved in garbage collection, it is evident from Figure 4.3 that ward 8 has most Safaikaramcharis. Ward 5 and 6 which generate maximum waste per household (Fig. 4.2) have 5 and 8 Safaikaramcharis respectively. Ward 1 and 13 also have fewer Safaikaramcharis but due to a different reason. In Ward 1 and 13 services have been privatized. Since 1991 there has been no regular recruitment in municipal council safaikakaramchari staff, it has been on daily wage basis. The future plans of the municipal council are to privatize rest of the wards as well (as mentioned by M.C. officials during discussion).

4.5 Awareness about the harmful impacts of improper disposal of waste

Most of the respondents were aware of the harmful impacts of the indiscriminate and improper disposal of waste. But despite this there have been instances of

littering the waste indiscriminately. The piles of littered waste can be seen all around on empty lands, in public drains and nallahs. It is interesting to note that ward number 6 where waste generation per household is among the highest, awareness about the harmful impacts of improper disposal of garbage is low. Ward 1 and 13 where disposal services have been privatized, the former has high awareness while the later has low (Figure 4.4), it may be interesting to investigate the outcome of privatization in the two wards at a later time point.

Figure: 4.4: Awareness about the harmful impacts of the garbage disposal



Source: Field Survey

4.6 Spatial Variation in SWM in Solan

A collective analysis of all the factors which affect Solan has been attempted in the following section. An index of variation in solid waste management has been used to reflect the different levels of SWM in Solan.

Developing Composite Index

A Composite index was developed on the selected variables to identify the variation in solid waste management existing in Solan town. The composite index was constructed as follows:

4.6.1 Index of SWM

Weights have been assigned to 16 selected variables classified under the following categories:

Table: 4.11: Selected Variables and Factors

Sr. No.	Category	Variable	Factor
1	Waste Generation a) Average waste generation b) Nature of waste	V1 V2	F1
2	Garbage Disposal Techniques Indiscriminate disposal, Public drains, Soak pits, Nallahs, Around the house, Garbage bins put up by M.C.	V3-V8	F2
3	Presence of Municipal Body a) Deployment of Safaikaramcharis b) Placement of Garbage bins by M.C.	V9 V10	F3
4	Use of bins & frequency of garbage disposal a) Garbage bins used b) Garbage collected by M.C.	V11 V12	F4
5	Awareness about harmful impacts of garbage disposal	V13	F5
6	People's satisfaction a) presence of covered bins b) checking sanitary conditions c) satisfaction	V14 V15 V16	F6

4.6.2 Assigning the weights

Variable V-1 (waste generation) has been assigned weight on the basis of the quantum waste generated in each ward, assuming that more waste generation has negative implication on SWM. More waste generation was given low weight and less waste generation was given high weight. The waste generation less than 2 kg (<2 kg) was given the highest weight '3'; waste generation between 2.5kg to 3 kg was assigned a weight of '2' and waste generation above 3 kg was given the lowest weight. Therefore the product of the waste generation and its corresponding weight was the score for that ward. Thus, the score for waste generation was computed as follows:

$$\text{Score of ward X} = \text{Amount of waste generated in ward X} \times \text{Weight}$$

Scores thus obtained were arranged in descending order and divided into three categories of High, Medium and Low waste generation.

The weights were assigned to the selected variables in the following manner:

1	I) Waste generation (Factor1)		
	i) Average waste generation	weight (Kg/day)	weighted Value
	assigned		
		< 2.5	3
		2.5 – 3.0	2
		>3.0	1
2	Nature of waste		
	Biodegradable		3
	Non-Biodegradable		1
	Recyclable		3
	II) Disposal Technique (Factor 2)		
3	Garbage Disposal		
	Indiscriminate disposal		1
	Public drains		3
	Soak pits		5
	Nallah		3
	Around the House		1
	Garbage bins put up by M.C.		6
	III) Presence of Municipal Body (Factor 3)		
4	Safai Karamcharis deployed	Yes	No
		10	0
5	Garbage bins by M.C	5	0
	IV) Use of bins and frequency of disposal (Factor 4)		
6	Garbage bins used	5	1
7	Garbage taken by M.C		
	Everyday		5
	Once in a week		4
	Twice in a week		3
	Thrice in a week		2
	Whenever it suits M.C,		1
	V) Awareness about harmful impacts (Factor 5)		
8	Awareness about harmful impacts	Yes	No
		5	1
	VI) People Satisfaction (Factor 6)		
	Garbage bins covered	5	0
	Sanitary conditions checked	5	0
	Satisfaction	10	0

Variables were given weights in two ways. Use of garbage bins and awareness were weighted between 1-5, Best scenario was given maximum weight – using the bins (V11) and being aware (V13). They denote positive implication on SWM. Not using the bin and not being aware were given the low weight denoting negative implication. They were given a score of '1' instead of Zero on the basis of the assumption that

- a) if garbage bin was not there, and
- b) awareness was not there

Some alternative would be used and complete unawareness was virtually not possible. For the remaining dichotomous variables, the weights ranged between 0-5. If the bin was not covered or sanitary conditions were not checked or there was no satisfaction, there could not be an alternative. So '1' was replaced with '0'.

Scores for each ward for each set of variables (factors) were summed. The summation of each factors were averaged. Thus, average score of factors (F1-F6) is equal to:

$$F1 = (V1+V2)/2$$

$$F2 = (V3+V4+V5+V6+V7+V8)/6$$

$$F3 = (V9+V10)/2$$

$$F4 = (V11+V12)/2$$

$$F5 = (V13)/1$$

$$F6 = (V14+V15+V16)/3$$

This computed the Composite Index (C.I.) of SWM,

$$C. I. \text{ of SWM} = \text{Average scores of } (F1+F2+F3+F4+F5+F6)/6$$

Composite Index was arranged in descending order to categorize the wards in High, Medium, and Low Solid Waste Management areas.

Table: 4.12: Ward wise Composite Score of all the variables

Sr. No.	Composite Score of all the variables	Ward Number
1	14.81	Ward No. 1
2	12.62	Ward No. 2
3	15.50	Ward No. 3
4	7.91	Ward No. 4
5	10.5	Ward No. 5
6	10.47	Ward No. 6
7	14.21	Ward No. 7
8	16.84	Ward No. 8
9	14.65	Ward No. 9
10	10.02	Ward No. 10
11	6.59	Ward No. 11
12	7.71	Ward No. 12
13	9.75	Ward No. 13

After arranging the ward wise composite index in descending order, the ranks obtained are as follows:

Table: 4.13: Ranks of the wards in descending order of composite index

Rank	Ward	SWM
1	11	High
2	12	
3	3	
4	13	
5	10	Medium
6	6	
7	5	
8	2	
9	7	Low
10	9	
11	1	
12	3	
13	8	

Wards 11, 12, 3, and 13 have high levels of SWM compared to other wards. Ward number 10, 6, 5, and 2 have medium level of SWM, whereas ward number 7, 9, 1, 3 and 8 have relatively low levels of SWM which means these wards needs the inputs for improvement.

4.7 Formal Waste collection in Solan

The formal agency dealing with SWM is Municipal Council Solan. The garbage collection and transportation is undertaken by Municipal Council. Then this waste is transported to the waste processing plant at Salogara. Municipal council Solan is having a brigade of 104 safaikaramcharis for waste collection in different wards and then collected waste is transported to Salogara with the help of two tippers and one dumper. Here it is processed at plant set up and managed by an NGO named Jan Seva Ashram. Though slight segregation is done at the plant by a family dealing with rag picking and has sought a contract for a year for waste segregation against some payment on monthly basis. Finally the waste is left for few days and then treated in processing plant to prepare compost out of it.

4.8 Disposal of Solid Waste in Solan

The safe disposal of waste remains a problem area, as most of third world countries divest large proportion of funds towards collection of solid waste. The cost of collection in India tends to be a very large part of overall solid waste budget. The city of Ahmedabad with three million population and 1260 tonnes of solid waste per day, spends 85.8% of its budget on collection, 13.4% on transportation and only 0.8% on final disposal (Jain and Pant, 1994). The solid waste in Solan is disposed off at Salogara, where the garbage treatment and processing plant is situated. Solid waste from all the 13 wards of Solan town along with the waste from domestic units, nearby restaurants, dhabas, and other institutions is dumped into this plant site, though they do not come under this municipality. Safe solid waste management is not limited to the disposal of garbage only. Agenda 21 declares that environmentally sound waste management must go beyond safe disposal or recovery of waste. There is a need to address the root cause of the problem by attempting to change unsustainable pattern of production and consumption (Amos, 1992).

4.9 Scope for Informal Sector

The limited resource of municipalities in developing countries for solid waste management increases the need for cost effective options to manage urban waste.

Parallel with formal waste collection authorities, informal collection of waste for recycling and reuse is a typical feature in most of the cities in the developing countries. The guiding principal behind this practice is partly the incidence of chronic poverty and partly the notion that all the waste need not be disposed off into the environment and some waste can be recycled or returned to the production cycle. Solid waste is often understood as the result of using disposable items by the modern materialistic societies, instead of reusing and recycling of using reusable items.

In western countries separation of waste is done at the source of generation and this provides clean material for the recycling industry. In the developing countries like India this process is not followed. Often some households and certain enterprises separate recyclable matters before dumping the waste and sell these materials to street hawkers and specific vendors. From there the material enters the recycling stream. Additional recycling of waste is also practised by the safai karamcharis during waste transportation activity. This though is not an institutionally recognized process. Recycling not only reduces the amount of waste to be discarded but also provides a means of livelihood to a major portion of urban population. Municipalities in the developing world seem to be ignorant of this fact and rarely recognize the benefits of waste recycling and recovery.

4.10 Reflections on SWM scenario in Solan

- 1) Solan town presents a gloomy picture in terms of SWM. It generates 20 tonnes of solid waste per day. But the municipal body is able to collect only 75 percent of the generated waste.
- 2) With increasing commercialization and industrialization, it is natural that generation of waste has grown at a much faster rate than the growth of population.
- 3) Quantity of collection of solid waste has increased overtime but rate of increase has not been consistent.
- 4) The wards with efficient population are served better in a better way than the one that are towards the periphery.

- 5) The 3 R principle's benefits i.e. Recovery, Reuse and Recycling, have not been formally recognized in SWM system in the town.
- 6) In such situations when municipal bodies are not able to manage the burden of solid waste effectively, the active participation of informal sector is an evident and necessary phenomenon.
- 7) In developing countries solid waste is considered as solid asset, which is recovered directly or indirectly through informal stages for reuse and recycling.

4.11 Solid Waste Management in the informal sector in Solan

Informal sector plays a significant role in Solan in handling Solid waste. Though there is no statistics either with Municipal council or any other government and no governmental agency for that reason. But still the contribution of this section is tremendous in resolving the solid waste management problem. On the basis of interviews that were administered on some of the rag pickers, thekedars and itinerant buyers very pertinent aspects of this problem have come up and the interactional role of the informal sector has been discussed in the later section.

4.12 Interplay of various actors engaged in waste picking

There are various actors engaged in the business of waste picking right from the rag pickers to the kabariwalas and then thekedars. Though apparently the relationship between them seems to be exploitative but it is equally cooperative as rag pickers do not have any complaints against them. The respondents who were interviewed during this study from amongst rag pickers, kabariwalas, and thekedars, most of them were not bonafide residents of Himachal Pradesh.

4.12.1 Perceptions of the waste pickers about Thekedars

Though the qualitative techniques that have been used to highlight some aspects of planning the SWM. It is important to understand the propensity of interactions taking place between different actors at different stages. Understanding the perceptions of community and the service providers in this case, waste pickers, directly or indirectly become important. Therefore their perception has also been

taken into account. This section of ongoing exercise deals with the perception of waste pickers about kabariwalas (itinerant buyers), with whom they are competing and about the thekedars (dealers) to whom they sell their collected waste materials. They are directly related to each other as far as their socio-economic relationships are concerned.

Waste pickers were not critical about the role of dealers rather they argued in favour of dealers, who otherwise seem to be exploiters to us. Waste pickers express that the thekedars usually help them in number of ways. Based on in depth interviews with waste pickers, their responses have been clubbed into the following categories: a) *As bank*- for waste pickers the dealers act as the bank, where they keep their extra income and take loan in case of emergency. They argued that if they fell ill or damaged their hand or feet in the process of waste collection, nobody would come forward to help them other than their trusted and tested thekedars. He lends the required money and waste pickers repay it in installments. b) *One who provides them shelter* – some waste pickers were found living in godown of thekedar, who usually do not charge rent from them. Waste pickers argued that dealers are providing a free living space even godown is of great help to them. They cannot afford an accommodation with their little income, a part of which they send to their family, which is staying in the village.

4.13 Willingness to avail Health and Educational facilities

Waste pickers have shown willingness to utilize public health facilities, if easily available to them. They do not have the courage to face a hostile system for free health care service, as their toleration gets entirely exhausted in the process of waste recovery. They were interested in knowing the benefits of education and showed the willingness to put their children to school, if they can manage their two square meals a day without their help in waste collection.

Availability of accessible and affordable health and educational facilities to the waste pickers is of immense importance and in making their lives better. Only with access to health facilities, can they be kept apart from the cycle of

indebtedness and with the education they can be made aware about their ongoing exploitation.

4.14 Impact of poor health on the economic condition of waste pickers

The problems of waste disposal are severe in cities as well as in small and medium towns of developing countries. Door to door collection in expensive and municipalities are unable to afford it. Collection points can easily become small garbage dumps, especially when collection is intermittent. Most domestic solid waste is not a direct threat to health like industrial waste, which contains hazardous chemicals. However fecal matter is often mixed with domestic waste, which gets contaminated. Solid waste is not kept in close containers and often is not removed regularly. In such a scenario, solid waste often creates one of the most visible environmental problems in low income communities the health risks to the people who come in contact with this, and the most commonly affected group is that of waste pickers in various parts of the city. An individual's health may be affected by problematic practices which can result in infections from humans, injuries from sharp objects like broken glass blades, syringes etc. in garbage and so on. Waste pickers in most cases are exposed to the following mentioned kinds of health hazards while discharging their duties in Solan:

- Snake, scorpion bites.
- Cuts from sharp wastes leading to infections.
- Chemical burns or wounds.
- Toxication, cancers from exposure to hazardous waste, gases etc.
- Chronic respiratory, ophthalmic diseases from exposure to dust, gases etc.
- Viral (Dengue, Yellow fever) or parasitic (Malaria, Filariasis) diseases transmitted by vectors breeding in waste generated ponds.

The poor health of waste pickers often has been reported as the limiting factor for their deteriorating economic condition. Health risks are abysmally low in the priority list amongst this section of the people, who are lacking the basic needs of survival like food, shelter and clothing. They have no money to take preventive measure of health for their children or for themselves. Even the curative measures put them a continuous cycle of indebtedness.

4.15 Waste picking as a compulsion or vocation

Evidences from the in depth interviews and discussion with the rag pickers and itinerant buyers suggest that economic deprivation is one of the major determinants of taking up rag picking as a vocation. The outcome of interactions can be listed as follows:

- 1) Root cause of poverty is unemployment. The poor people work with waste material for survival as they are denied access to resources including job opportunities that are available to better offs.
- 2) Waste is a flexible source of employment in third world cities. Waste recovery and recycling not only serves the production cycle but also enable poor to meet some of basic needs without any payment for capital.
- 3) The economic status of waste pickers is directly linked with their working hours, which vary for different groups. Dealers do not pay appropriate amount to children due to their unawareness about the prevailing market price.
- 4) Waste pickers are vulnerable to various types of exploitation. They become victims of different types of subjugated behaviour besides economic and social exploitation.
- 5) Capitalization of dealer has increased manifold over the years due to which many people face difficulties in entering into this trade.
- 6) Itinerant buyers enjoy a better social space in the society but in economic terms they are marginally better than the waste pickers. Dealers form the main link in chain of waste recovery and recycling processes.

4.16 Non Formal Sector Initiatives in SWM

The rise of non formal organization and their initiatives is not uncommon in various aspects of life. Their participation has been significant in the process of SWM at different levels. Some of them have been involved in the development of the collection and disposal system to make the city better. At the same time certain institutions have extended their helping hand in the development of waste pickers.

The social implications of inefficient waste management process have been highlighted by these institutions.

Experiences over the past few years have shown that community led initiatives help in the decentralisation of waste management and make it workable as well as sustainable at local levels. It has become imperative as municipal services have often been related to the socio-economic conditions of the resident group.

4.17 Characteristics of Non Formal Institutions engaged in SWM

Voluntarism has played an important role in building of India's social history. Voluntary work has its roots in the social reforms movements that began to challenge the repressive system during nineteenth century. Failure of development processes in the past few years has made the planners realize the importance of involving the local communities in decision making. Without the active participation of these stakeholders in policy formulation as well as its implementation, the plan would hardly serve its purpose.

Recent years have witnessed a growing interest among communities as well as governments and the donor agencies in the development initiatives of NGOs in popular use. The term NGO refers to those private organizations registered as public trusts or societies, which is voluntary association of people working at the grassroots to help the poor and needy through charitable or development work on a non profit basis (Sunder 1994, pg 312). The common characteristics of NGOs can be listed as mentioned below:

- In development parlance NGOs have provided an alternative to the bureaucratic process of large scale programme.
- The average NGO is not bureaucratized and can respond flexibly to a required situation.
- It can and it does experiment with new ideas and approaches while taking up different initiatives.
- In several instances, NGOs have tried to reach and in many cases have successfully addressed the need of the poor who are not served by the government programme.

- They encourage and ensure public participation in the community based programmes.

Rooted in this idea of Humanitarian services, the approach of the NGO is to put people at the centre of the scheme. The basic difference in the government and non governmental approach lies in the sense of motivation. Contrary to government, the NGOs encourage close and intimate contacts with their clients. They have consciously tried to target and give priority to the most vulnerable sections of the society.

Some of the Delhi based NGOs working in the field of Solid Waste Management are Chintan, Toxic link, Hazard centre, Vatavaran etc. these organizations have made their significant contributions in the respective field. Solan is comparatively new in its experience of private/voluntary sector in SWM. It may be useful to examine a case to compare and contrast with Solan. An attempt is being made to profile the NGO 'Vatavaran'.

4.18 Vatavaran

Vatavaran is a non formal NGO which works in the field of environment conservation. Vatavaran at present runs three types of programmes:

- 1) Community management of domestic waste in residential colonies.
- 2) Awareness building about municipal waste management and composting, and
- 3) Exchanging recycled products with non degradable domestic waste at the individual household level.

The community garbage management initiatives of Vatavaran were started in 1994 with only 150 households of Asiad village, an upper middle class residential colony. This organisation has grown manifold in few years and at present Vatavaran serves about 5 lakh people in about 15 residential colonies. The programme launched by Vatavaran mainly depends upon field staff viz. supervisors and cleaning boys. Consequently it neither needs nor has large office staff or space.

The entire garbage management operation is conducted in three stages. The 'cleaning brigade' first collects the garbage from households in the operation area from 8.00 a.m. to 12.00 noon everyday except on Sunday (on Sunday and national holiday working hours are reduced). Segregation of garbage into degradable, recyclable, and inert matter is done at the collection point itself. At the end stage, degradable material is taken to the composting pit or to the bio gas plant. The recyclable materials are sent to small recycling industries or are sold to kabariwalas. At third stage the composting pits are maintained and compost is taken out from the pits when ready and is packed in small packets for use.

In Jawaharlal Nehru University campus, is one of the field areas of Vatavaran. It started its operations on April 1st, 1995 and has been managing waste satisfactorily. The cleaning brigade in JNU campus comprises of 29 boys who collect garbage, 6 deputy supervisors and 1 field supervisor. JNU campus has an area of 1000 acres, with a population of 15000, and generates everyday garbage of 2000kg – 2800kg. The recyclable waste material comprises 48 percent of it (Malik, 1998). The university has allotted land to Vatavaran for composting. The Energy Research Institute (TERI) installed a biogas plant.

The required salary of the 'cleaning brigade' comes from the client groups. Contributions from the residents are the major source, which comes in the form of pre decided amount every month. The amount varies from area to area depending upon the number of residents to be covered and the type of work to be done. In any case rate does not go beyond Rs 50/- per month and starts at Rs 40/-. The households residing on upper floors have to pay more for the services. For example in Vasant Kunj, residents at ground floor pay Rs 40/- and those on top floor pay Rs 50/ per month.

The projects in JNU and University of Delhi are operated under a different arrangement. JNU pays a sum of Rs 80,000/-, while DU pays a sum of Rs 64,000/- to Vatavaran every month as 'Running cost'. The cost is partially retrieved by the universities from the residents from their monthly salaries with a rate varying proportionately with the income of different sections of employees. The second source of income is the earning from the sale of recyclable items to kabadiwala.

According to field supervisor of JNU project, Vatavaran earns about Rs 10,000/- to Rs 15,000/- per month from selling of the recyclable materials. A small amount is also earned from the selling of manure and some plants (Chaudhary, 2002).

4.19 The initiatives by Non Formal sectors in SWM in Solan

Municipal council of Solan has been handling solid waste from the beginning as one of its responsibilities. With rapid urban growth and increasing population, the problem of solid waste had also got intensified. The usual practice is that after the collection of solid waste from the different collection points it was dumped at Salogara since 1967. In 1997 solid waste processing plant was installed at Salogara by Jan Seva Ashram, an NGO, with the financial aid from Norwegian Aid Agency (NORAD) and H.P. State Science, Technology and Environment, Shimla. Some contribution was contributed by M.C. Solan also. Plant is running with Cooperation of M.C. Solan. Plant processing capacity is 20 tonnes per day.

At present 10 workers are working in the plant including a chemical engineer, an assistant manager and rest 8 workers. Out of these 8 workers six are female workers who work in the processing plant. The head office of this NGO is in Delhi, since it is a Delhi based NGO. This plant manufactures compost out of the dumped or discarded waste at Salogara. But there are certain inherent limitations like the space provided is not sufficient, the plant runs on 1.5 acre land and the waste reaching the plant site everyday is 13 to 17 tonnes. The waste is segregated properly neither before reaching the plant site nor after reaching there as well. Given the nature of waste, this is largely organic, biodegradable in composition, there is a need for preparing vermin composting out of it, which this plant has no provisions for that.

As per the estimates prepared by this NGO, 25% of the waste is going to local land filling and to the drainage i.e. 4 tonnes per day the reason being stated is the scattered residences on hilly topography.

The present scenario of the city waste at the waste management Institute Salogara, Solan as given in Tables 4.14 and 4.15:

Table 4.14: Average weight of waste measurement in one dumper

Sr. No.	Dumper	Weight of waste (Kg)
1	1	950
2	1	850
3	1	900
	Total	2750

Source: Jan Seva Ashram estimates given to Municipal council.

Average weight of waste = $2750/3 = 916.66$ Kg/dumper

Total reaching number of dumper per day = 10

Hence total weight of waste from the dumper = $916.66 \times 10 = 90166$ tonnes/day

Table 4.15: Average weight of waste measurement in one tipper

Sr. No.	Tipper	Weight of waste (Kg)
1	1	3050
2	2	3156
	Total	6206

Average weight of waste in one tipper = $6206/2 = 3.103$ kg/tipper

Total number of tipper reaching per day = 1

Weight of waste from tipper = 3.103 tonnes/day

Total waste reaching up to the plant = $3.103 + 9.166 = 12.263$ tons/day

4.20 Waste Pickers

Waste picking is one of the marginalized informal activities done by the poorest section of the society. The two contributing factors for this are inability of local bodies to collect entire waste and the prevalence of acute poverty along with unemployment determines the extent of this profession in various cities across third world countries including India. The significance of the role of the waste picking in solid waste management has to be recognized as it accepts a part of the burden of municipalities in removing waste.

4.20.1 Social Aspects of Waste Picking

Socio-economic and health related issues connected with recovery and trade of waste has attracted the attention of scholars since 1980 (Chakraborty, 2000). The concern is about the health problems and social alienation that these rag pickers have to face on a regular basis. Relationship between different informal sector activities in the public system has been an important area of various studies as it not only reflects the social relations amongst different groups but also shows the interplay of the economy at different levels. Being a labour intensive activity waste picking tends to be an integral part of SWM in urban areas. It also plays a significant role in environmental protection and conservation. A sizeable population is involved in this activity and they work under unsanitary conditions in absence of civic regulations and institutional support.

Women and children need a special attention in the groups within waste pickers, as they are more prone to health problems and also to the exploitation.

4.20.2 Economic Aspects of Waste Picking

It is not easy to examine performance of informal sectors in SWM partly due to unavailability of official records and due to the fact that the actors do not want to answer about economic aspect of the profession, especially to the researchers. Despite these bottlenecks still the contribution of waste pickers in the recycling economy through supplying raw material is well evident. Economic performance of the informal sector in waste management has been analysed. Waste pickers have remarkable contribution to the waste trade and recycling economy in large cities like Bangalore, Calcutta and so on (Bose, and Blore, 1993).

4.21 Privatisation in Solid Waste Management

Answers to the problems related to the planning and management of solid waste are tried to be located in the framework of privatization. Privatisation that started in late 1980s with the transfer of state owned enterprises to private owners has been the political creed of 1990s. It was closely accompanied by the contracting out of an increasing array of public services- from a rubbish collection to road repairs (Lee, 1997).

Plate 4

A) Man collecting food item for animals(pigs) from garbage



B) Women rag pickers at processing plant

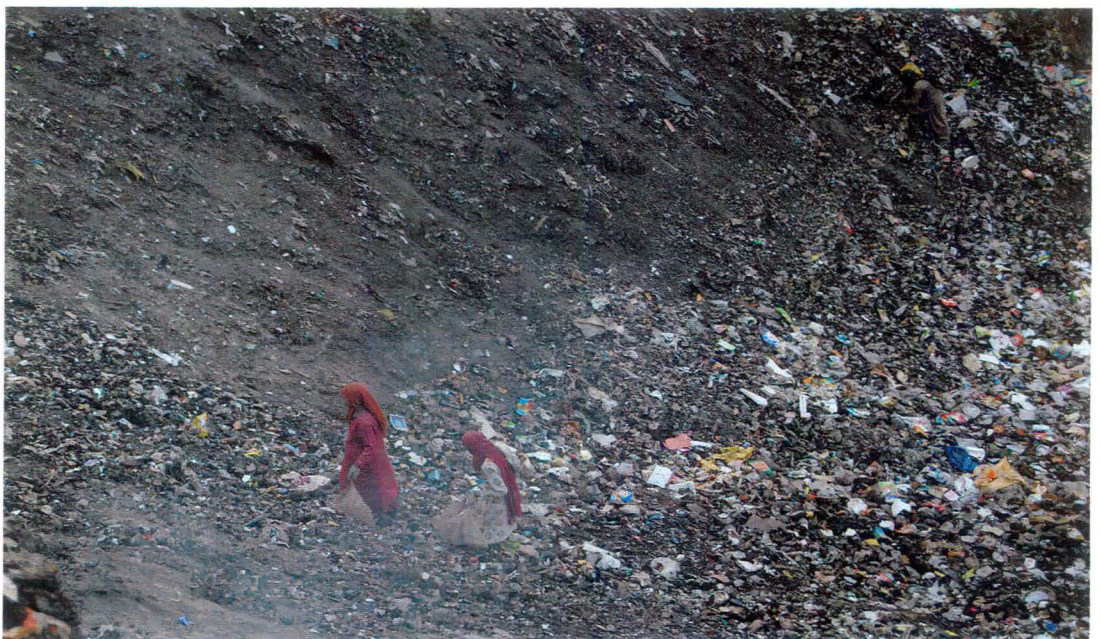


Plate 5

A) Bio-compost prepared at Processing Plant



B) Hoardings put up by forest department

बन्दरों का आतंक
बन्दर तभी तो आते हैं, जब हम कूड़ा-कर्कट फैलाते हैं।



बन्दरों के उत्पात से निजात पाने के लिए हमें सहयोग दें।

वन्यप्राणी प्रभाग, हि. प्र. प्रचार वन मण्डल, शिमला-२

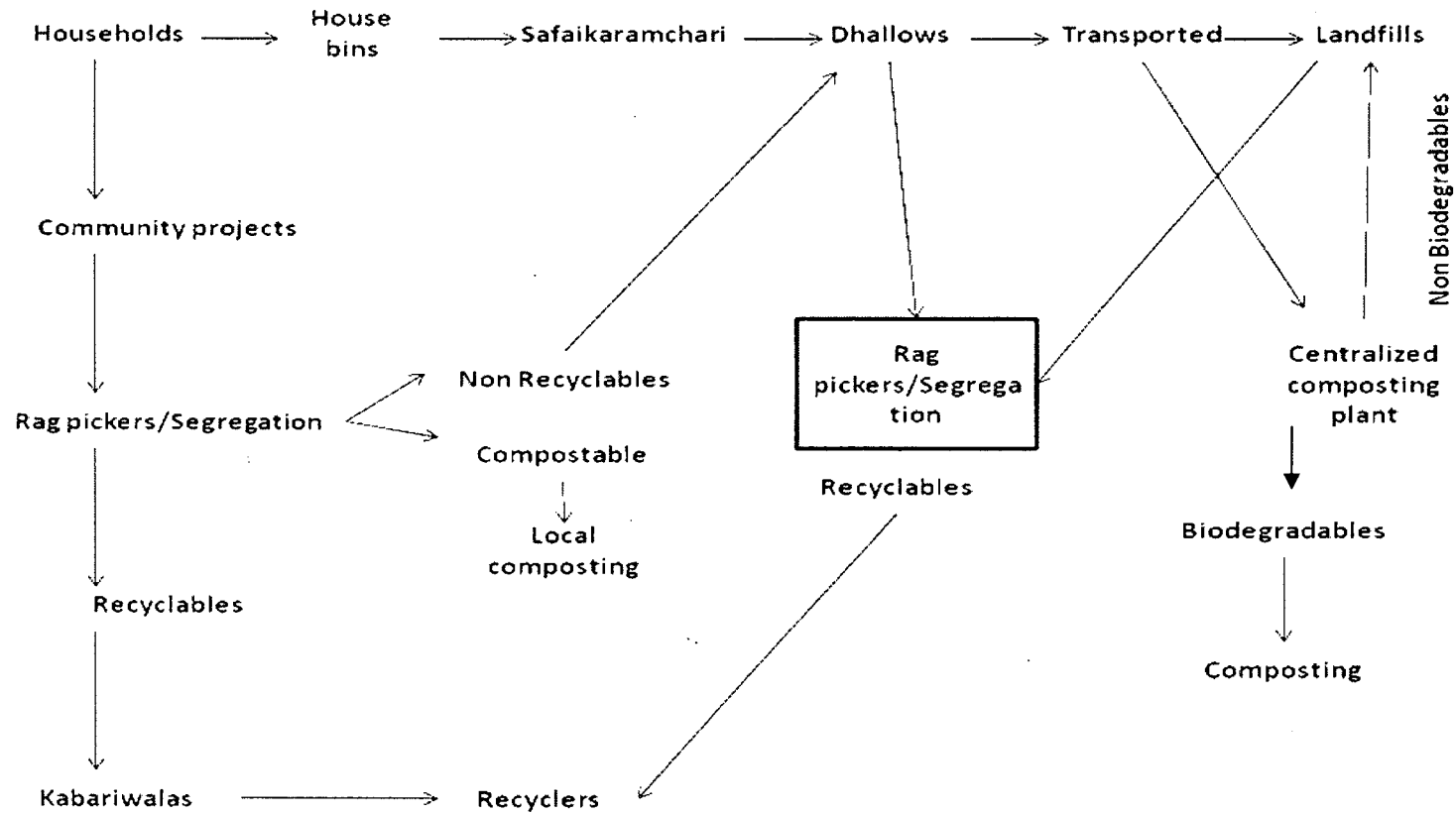


Figure 4.5 : Process of Waste Management

Solid Waste Management did not remain aloof and a number of studies suggested privatization of SWM services in third world countries including India. In the aftermath of the 1994 Plague outbreak in Surat, a former municipal commissioner of Bombay, when considering options for dealing with mounting rubbish in India's cities, suggested that with local authorities 'should.....think of privatizing garbage collection and disposal' (India Today, October 31, 1994). With continuing poor financial wealth of municipal bodies in, the need for privatization of MSW is urgent (Rao, P.S.N. 1994). Privatisation of SWM in other Indian cities has been suggested as the way it has been done in Bangalore.

A critical review of privatization has been provided by Lee (1997). He argued that there are people who cannot afford to pay for basic services in the Asian cities. He took examples from certain Asian cities like Bangkok, Seol, and Rajkot where basic services have been privatized. He questioned the very 'proclamation of efficiency'. Moreover the sewerage system and waste disposal are unsuitable for direct charging on the basis of intensity of use because charging could lead to charge avoidance practice which would create health hazards (Amos, 1992).

4.22 Solid Waste Management in Formal sector

Waste management is a prominent basic amenity and service for the living population. It is also essential for the efficient functioning of the city and its economy. There is a high degree of interdependence between this service and the management of the cities. Waste picking has thus been a subject of much study and experimentation in terms of planning and management in urban areas. No city can develop without managing its waste especially the solid waste. In most of the cases Urban Local Bodies (ULBs) owe the responsibility of making the facilities available and accessible to all of its citizens. As per our constitution subjects like water supply, sewerage, sanitation, solid waste management etc. are state subjects. After adaptation of 74th constitutional amendment Act, ULBs have been given greater autonomy in planning and assessing the basic amenities and services. It is therefore the prime responsibility of the state governments and ULBs to plan, design, execute, operate and maintain waste management systems.

Understanding urban problems brings out a distinctive view point that emphasises socio-economic forces in their cultural and historical settings. The present study has tried to view the contemporary urban crisis not as something inherent in urban life but as a confluence of certain factors such as unplanned development, inadequate infrastructure, unsustainable growth, poverty and unemployment etc. and that too within a 'generally affluent' society.

In the nature of creation and destruction, all processes are cyclical, where waste does not accumulate. The matter, living and non-living, decomposes and become new matter. Nature could well be the best example of a sustainable process in action. Human beings are the only specie on earth that generates the real waste in the process of conquering the nature. Dealing with waste should follow the natural process of replenishment and renewal rather than destruction and disposal. For a sustainable system of waste management, we have to stop⁵ looking at discards as waste that needs to be removed from sight and begin looking at their use. Waste can even help build communities, as the path to reuse, reduction, composting and safe recycling passes through essential social and political processes, networks and micro level interdependencies.

In this era of rapid Urbanisation of second tier cities like Solan, it is inevitably the right time to take a fresh look at waste and instead of adopting the crude disposal methods of indiscriminate dumping, incineration and landfills we must go for integrated solid waste management system. We should go for an approach that is participative, integrative, functional, and sustainable. From the existing studies and the experiences in the field study one can infer that waste management can follow two different perspectives, which certainly are not mutually exclusive. One is centralised techno-managerial approach, which failed simply because it did not have the public participation. The other one is the process

centered approach which focuses on sources of waste and aiming at some sort of integration of the various social, political and environmental processes. The needed technologies are only part of the process. The primordial objective in the process centered approach is to ensure participation of the stakeholders in waste management. Public participation avoids putting into place mechanisms, which are incompatible with public perceptions and attitude.

For incorporating this paradigm shift into the health and sanitation functions of Local Self Governing Bodies (LSGBs), an immense political and administrative effort is needed, mainly to change the mindset and behaviour of planners, administrators, and other involved players. In principle, and as a policy, the practice of waste disposal needs to be stopped. The source of waste should become the focus of operations more than waste per se and the discards should be handled according to their type. Efforts should be put in developing Salogara so as to cater to the expanding solid waste generation consequent of Urbanisation in Solan. This means that the organization of waste management system by LSGBs should change and their efforts should shift to creating public awareness, imparting training to workers, and designing and building proper in-house and community discards collection mechanism. The focus of planning and managing waste should be at the sources themselves with full participation of the producers of waste, thereby ensuring the decentralisation of SWM in real sense.

Segregation at source is the most important step and the rest of the system follows from that. Responsibility and participation have become very important subjects in the waste management regime. Resource conservation, resource recovery and waste reduction should get incorporated into policy statements, and action plans must spell out how they can be achieved. In Solan's treatment plant too, many materials used today are toxic; their production and use need to be reviewed and reduced to the extent possible, as they contaminate the waste stream and affect safe resource recovery. The involvement of the farming community in the rural peripheries of Solan can be a vital link in the organic cycle process and its needs and perceptions of reviving the fertility of the farming land also needs to undergo appropriate change. In place of costly and contaminating chemical fertilizers, the farmer should be provided with good quality manure generated from

organic urban waste. While the benefits of recovery processes are obvious, they need to be assessed and quantified in terms of financial benefits as well as resource use reduction. This investigative approach further provides good scope for research because one needs to know the impact of this change in approach on society and economy.

With rapid growth of urban areas due to industrial revolution and population explosion, the problem of garbage collection and disposal has assumed significance and has drawn the attention of civic authorities and government to standardise the system to make it applicable at the national level. Solid Waste is generated in association with almost every human activity. The problem of urban solid waste has become very acute in large cities and towns especially because of limited disposal facilities. Consequently the solid wastes are dumped in a haphazard manner in various parts of the city and town causing thereby not only the environmental problems but also serious health hazards. The composition and properties of these wastes reflect the diversity of human action. Characterisation of waste is usually associated with broad description of sources of waste. Solan is facing a similar problem. The only positive aspect of Solan is its magnitude in comparison to other big cities.

Managing waste is a challenging task and as our cities grow it will become indeed more complex. Waste and the problems associated with its disposal are largely urban phenomenon, especially in a country like India. In rural India most of the waste that is generated are biodegradable in nature like agricultural waste, animal litter, food scraps etc. this waste is either composted or fed to animals. The rural folk manage their waste by themselves. One does not in fact come across huge garbage dumps with rotting wastes in villages, a common sight in cities. However, with growing consumerism, disposable items like plastic bags, bottle and packaging waste have also started making its appearance in most parts of rural India.

Findings

The present study focused on the interaction between the different agencies dealing with garbage generation and disposal in Solan. It has tried to understand the problem in an integrated and comprehensive perspective taking into account the perceptions of

communities (the recipients) and the agencies i.e. the municipal committee and N.G.O; (the providers). This study reveals that the problem of garbage disposal in Solan is acute and in dilapidated condition. The problem of garbage disposal is not the new one it has been there since the very beginning. The population of town has increased tremendously in last 20 years and simultaneously the amount of garbage has also increased. Solan town has a large number of populations living with high standard of living. There is large number of shops, restaurants, and government institutions, private and commercial institutions that also generate a huge amount of garbage. Along with these, the residential area of town is primary source of garbage generation. Besides this there are other areas also which are contributing in garbage generation such as commercial areas, industrial units, hospitals, nursing homes and some slum pockets as well. Solid wastes are collected from different collection points by the Safaikaramcharis, carried in dumpers to the disposal and treatment plant at Salogara.

The life style and eating habits of the people of Solan town have changed considerably. People now mostly prefer fast food, eating out packed food and bakery items. Therefore, in last two decades keeping in the broader trend visible, disposable plastic and thermocol plates are more in trend now which is certainly not biodegradable. There are large scale variations in the population distribution, per capita income and garbage generation from one ward to another. Highly populated wards having high per capita income generate more waste than the one with low population and low per capita income. There are serious concerns regarding the garbage disposal. Cleanliness is important for good health. Placing covered bins and improving the existing mechanised device for collection and disposal of solid waste is an immediate requirement. The public lavatories should be provided to cater to the needs of squatters such as construction workers.

Only 44 percent of the sample house holds of the town used garbage bins put up by the municipal committee, remaining sample population did not use these garbage bins for different stated reasons such as more distance from the houses, collection of all kinds of waste in single bins, not removing the waste everyday etc. and thereby throwing garbage haphazardly at different places. The insufficient and damaged or broken garbage collection bins brimming with refuse, extend open

invitation to birds and animals. Even at waste disposal site and manure making plant regular movement of birds and stray animals is apparently common. The number of Safaikaramcharis has been reduced, since 1991 onwards there has not been any government recruitment of Safaikaramcharis in the municipal committee only the daily wage karamcharis are recruited. The municipal committee disposes the collected waste at the treatment plant and makes compost from these wastes. There is no proper system of segregation at plant site for obvious reasons, one it is very difficult to segregate such a huge quantum of waste at the end point, and secondly the space is too limited which is almost filled up. Over deposition of this kind is thus finally burnt. Even Safaikaramcharis also burn the garbage at the places of their collection. This unsafe mode of burning the waste releases the poisonous gases in the surrounding which results in air pollution.

The hospital waste and the waste generated from the medical institutions are collected by an NGO named '*Vatavaran Shuddhi Sanstha*'. This NGO collects the waste from these institutions in the town on alternate days and carry it to the incinerator at Shimla. However, many a times the medical waste can be found in garbage collected by the municipality and especially at the treatment plant site. Though the industrial waste is not allowed to be dumped in the plant site but despite this, certain units illegally dump their waste in this plant site. In Nut shell findings can be highlighted as:

- Only 44 percent of the sample house holds of the town use garbage bins put up by the municipal committee.
- As regards, the spatial variation in waste generation, the wards 5 and 6 together generate maximum waste per day per household. These are the wards where most offices, institutions and residential areas are located.
- Ward 1 and 13 where disposal services have been privatized, the former has high awareness while the later has low (Figure 4.4), it may be interesting to investigate the outcome of privatisation in the two wards at a later time point.
- The population of town has increased tremendously in last 20 years and simultaneously the amount of garbage has also increased.
- Highly populated wards having high per capita income generate more waste than the one with low population and low per capita income.

Policy Recommendations and Suggestions

In order to make the SWM system participatory in true sense, there is a stringent need for adoption of integrative comprehensive approach, an approach that is people-centric and which represent the people in every aspect at different levels. All the agencies whether private or public need to work in coordination with each other. The NGOs in such sector may be good in 'software' (interacting with the people), but they were ill equipped in 'hardware' (expertise or resources) to give the long lasting results and to attain sustainability.

The primary requisite for introducing this paradigm shift, we need to ensure responsible governance from the public authorities. While the provision for proper sanitation and clean living conditions is the prerogative of the citizens, a shift of responsibility can be suggested. In the waste management system, citizens become responsible for their waste, while the government concentrates on larger welfare aspects of the people. The role of the government, in this context is to provide the right kind of environment, social infrastructure, institutional capacities, and legal framework for the public to take up and implement the waste management schemes. New capacities, infrastructure and training facilities need to be developed for composting, recycling, and recovery. The capacities of formal system can be enhanced by increasing the role of informal sector. The legal framework of waste management in the country also needs to be reviewed. The relevant laws should focus on a resource conservation and recovery approach and clearly spell out guidelines for waste management. The newer instruments of waste management such as Extended Producer Responsibility (EPR), take-back policies, and packaging laws need to be included in the relevant rules and laws. The tax payer's money should not go to buy 'obsolete' or 'dumped' technology, but should go towards investment in an infrastructure that clearly aims at recovery of resources as well as financial returns. Apart from this there is inevitably the need for creating mass awareness about the proper handling of garbage with responsibility, this could be done through direct interaction programmes and grass root level campaigns. These local actions should be based upon a global vision and should incorporate the global changes in paradigms of material use and management.

On the basis of literature review and the field study undertaken, the following suggestions can be made for dealing with the problem of garbage disposal in India in general and specifically in Solan town:

- To encourage the segregation of solid waste or garbage at the household level itself. For this purpose marked bags should be provided. Biodegradable waste may be processed and utilized as compost. Non-biodegradable and recyclable waste should be channelized through organized waste pickers.
- Door-to-door collection should be practised either by municipal committee Safaikaramcharis or through a contractual arrangement or voluntary organizations/NGOs and also by encouraging the public participation in the collection of garbage.
- To adopt the suitable means of collection of waste generated by traders dealing with the trade in fruits, vegetables and fast food corners etc.
- Slaughter house waste should be properly regulated and the solid waste they produce should be prevented from mixing with community waste.
- Hospital and other infectious waste should not be allowed to be dumped in community bins. Bio-medical wastes should be disposed off in consonance with the standards and guidelines laid down under the bio-medical rules.

Conclusion

'Alma Ata' declaration way back in 1978 had envisioned "Health for All by 2000" irrespective of their paying capacity. The Alma Ata declaration views Health as a means for development and not as the end result of development. Therefore every individual has the fundamental right to seek a healthy environment to live in. Associated with fundamental rights are fundamental duties, so every individual has the fundamental duty to keep the environment safe and free from pollution. Creating environmental awareness among general masses is equally important. There is a need to sensitize masses towards the environment and related problems by inculcating environmental ethics and

creating civic sense. Since the benefits of 3R's i.e. Recovery, Reuse and Recycling, have not been formally recognized till now in SWM system in the town, so there is an inevitable need to adopt three R's principle at each level.

The solid waste affects the natural environment to a large extent and poses a serious threat as these materials remain in one particular place for a relatively longer period of time unless removed, burnt, washed away or otherwise destroyed. As of today solid waste has become a major environmental problem for want of proper waste management techniques, which involve all the appropriate and cost effective methods for waste reduction and above all lack of coordination between the dealing agencies. According to the nature of solid waste appropriate and effective methods can be used for its management at the source generated and during the process of disposal. The solid wastes produced from different sectors have different properties; some of them are highly toxic. The "contamination at home" continues to be an area of great concern. The greater production of waste has posed the problems concerning their management which includes collection, transportation and safe disposal.

Storage of the waste is an extremely important link in generation and disposal of waste. Municipal committee should ensure the adequate number of garbage bins placed at reasonable distance to the residential localities. It would be advisable to replace conventional, concrete or brick bins with modern scientifically designed ones, which would suit the tipper or dumper whatever be the convenience to transport the waste out of it.

These community bins should be well maintained and regularly inspected by the sanitary staff. The civic bodies should ensure to curtail the entry of stray animals near the vicinity of scouring community bins and inside receptacles. Spillage of garbage, entry of stray animals and unorganized rag picking should be prohibited. Along with this the civic authorities should be vigilant enough to check out the indiscriminate disposal of garbage at non designated or unidentified places. In such cases penalizing violators will act as a deterrent.

Manual handling/lifting of waste should be prohibited; multiple handling of waste should be avoided, if unavoidable, gloves and masks should be provided to the Safaikaramcharis. Throwing away the wastes in open sites should be prohibited. Movable bins should be kept for collection of wastes at sites of social gathering like marriage party etc. Municipal committee should provide bins in commercial areas as well as in official complexes. Market associations could be involved in the upkeep of civic facilities. Roping in the market associations will also lead to the participation of the local business community and also help in penalizing offenders, in form of levying fines.

BIBLIOGRAPHY

Primary Sources:

- Directorate of Census Operations, H. P. (1981); Himachal Pradesh Town Survey Report Solan, Part- X B, Series- 7
- Directorate of Census Operations, H. P. (1991); District Census Handbook Solan, Himachal Pradesh, Series- 9, Part XII – A & B.
- Economic Survey (2006-07); Government of India, Ministry of Finance Economic Division, New Delhi
- GOI (2005); Guidelines for Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Government of India, Ministry of Urban Development, New Delhi, December 2005
- Government of India (1998); Launching a clean city campaign in the states in the 50th year of independence. A Brochure published by the Ministry of Urban Affairs and Employment (Department of Urban Development) in the Quarterly Journal of the All Indian Institute of Local Self-Governance, LXIX (2): 96-105.
- Government of India (1998); Launching a clean city campaign in the states in the 50th year of Independence, A Brochure Published by the Ministry of Urban Affairs and Employment (Department of Urban Development) in the quarterly journal of the All India Institute of Local self governance, LXIX (2): pp.96-105.
- Government of India, Ministry of Environment and Forests (2000); 'Municipal Solid Waste (management and handling) Rules, 2000' SO 908 (E) of the Gazette of India, September 25, 2000
- Government of India, Ministry of Urban Development,, New Delhi, Jawaharlal Nehru National Urban Renewal Mission: Guidelines for Projects under Urban Infrastructure and Governance Sub-mission, published in *Spatio-Economic Development Record*, Vol. 13, No. 2, March-April 2006.
- Government of India, Overview of Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Government of India, Ministry of Urban Employment and Poverty Alleviation, New Delhi (Downloaded from Internet).

Gupta, J.P. and Manoj K. Teotia (2003), Urban Management in a Hill Town: A Case study of Manali in Himachal Pradesh CRRID, Chandigarh (Draft Report Submitted to NIUA, New Delhi under FIRE (D) Programme of USAID).

Himachal Pradesh Development Report (2005); Chapter 20, 'Urban Development' in HPDR-2005 published by Academic foundation under agreement with planning commission, Government of India, pp.339-376

Registrar General of India, Census of India, 1981. District Census Handbook. Solan

Registrar General of India, Census of India, 1991. District Census Handbook. Solan

Registrar General of India, Census of India, 2001. Primary Census Abstract. Himachal Pradesh. Compact Disk. Digital Data.

State of Environment Report- Himachal Pradesh (2000); State Council of Science, Technology and Environment, Shimla

Town and Country Planning Department, (2004); Govt. of Himachal Pradesh Shimla, Development Plan for Solan Planning Area 2003-2021.

Books:

Bakshi, P. M. (2007); The Constitution of India (Eighth edition), Universal Law Publishing Co. Pvt. Ltd. Delhi

Bhargava, Gopal (1981); Urban Problems and Policy Perspectives (ed.), Abhinav Publications, New Delhi

Bhide, A. D. and B.B. Sundaresan, (1984) Solid Waste Management in Developing Countries, New Delhi: Indian National Scientific Documentation Centre.

Bhide, A.D. (1990) Regional Overview on Solid Waste Management in South East Asia Region, World Health Organisation, New Delhi.

Borgatt, Edgar F. (ed.), (1984) Encyclopaedia of Sociology, vol. 1-4.

Bose, Ashish (1980); India's Urbanization 1901-2001, Tata McGraw-Hill, New Delhi.

Bose, Ashish. (1974) Studies in India's Urbanisation: 1901 – 1971. New Delhi: Tata McGraw Hill.

Casters, M. (1977) The Urban Question, Edward Arnold Publications, London.

- Corvalan; C.D. Briggs, and G. Zielhuis (Eds.) (2000); *Decision-Making in Environmental Health*, published on behalf of WHO by E & FN SPON, London and New York
- CPCB (2000) *Management of Municipal Solid Waste*, New Delhi: Central Pollution Control Board.
- Dak, T.M. (1991) *Sociology of Health in India*, Rawat Publications, Jaipur, New Delhi.
- Glass, Ruth (1970); *Urban Sociology in Society: Problems and Methods of study* (Ed) by Welford, A. T., Routledge and Kegan Paul, London,.
- Guha, Ramachandran (1994); *Sociology and the Dilemmas of Development*, published by Indian Council of Social Science Research, New Delhi.
- Harpham, T and M Tanner, (1995) *Urban Health in Developing Countries-Progress and Prospects* Earth Scan Publication Ltd, London
- Hoyt, H. (1939); *The Structure and Growth of Residential Neighbourhoods in American Cities*, Government Printing Press, Washington D. C.
- Lal, Banwari and M. R. V. P. Reddy, (Eds.) (2006); *Wealth from Waste: Trends and Technologies* (Second Edition), TERI Press, New Delhi.
- Lardinois, I. and A. V. Klundert, (Eds.) (1993); *Organic Waste- options for Small Scale Resource Recovery*, Urban Solid Waste Series 1, Technology Transfer for Development Waste Consultants, Gouda.
- Majumdar, Paramita (2004); *Dynamics of Urban Development The Changing face of Lucknow*, Abhijeet Publications, Delhi.
- Malik, Iqbal (1998); *Vatavaran JNU: A success story*, compilation available with Centre for Science and Environment.
- Misra, S.G. and Dinesh Mani, (1993); *Pollution through Solid Waste*, Ashish Publishing House, New Delhi.
- Mitra. Ashok. (1974); *Functional Classification of India's Town*, Institute of Economic Growth, Delhi
- Moreno, J. A.; F. R. Rios, and I. Lardinois, (1999); *Solid Waste Management in Latin America*, English Translation by Muriel McCullough de Delgado, Urban Waste Series
- Nair, K. N. and Sridhar, R. (2005); *Cleaning up Kerala: Studies in Self-help in dealing with Solid Waste*, Daanish Books, Delhi

- Oliveau, Sebastien (2005); Periurbanisation in Tamil Nadu: a quantitative approach, Publication of the French Research Institutes in India, CSH Occasional Paper No. 15
- Pacione, Michael (2000); Urban Geography- A Global Perspective, Routledge, London and New York
- Park, R. E. (1925); 'Suggestions for investigation of Human Behaviour in an Urban Environment' in R. E. Park, E. W. Burgess, R. D. Mackenzie (eds), The City, Chicago, University of Chicago Press.
- Ramachandran, R. (2001); Urbanisation and Urban Systems in India, New York: OUP.
- Ramchandran R. (1990); Urbanisation and Urban Systems in India, Delhi: Oxford University Press.
- Rao, M. S. A. (ed.), (1994) Urban Sociology in India, Orient Longman, New Delhi
- Rao, M. S. A. (ed.), (1991) A Reader in Urban Sociology, Orient Longman, New Delhi
- Ray, C.N. (2003); Liberalisation and Urban Social Services: Health and Education, Rawat Publications, New Delhi
- Shah, Ghansayam (1997); Public Health and Urban Development- The Plague in Surat, Sage Publications, New Delhi.
- Sharma, R.N. and Sita, K (2001); Issues in Urban Development: A case of Navi Mumbai, Rawat Publications, Jaipur and New Delhi.
- Sharma, S.K. (2003); Globalization, Development and Environment in North Western Himalayas in Development, Gender and Diaspora edited by Paramjeet S. Judge, Sharma, S.L. and Sharma, S.K., Gurpreet Bal. Rawat Publications, New Delhi-2003, pp.92-112
- Shevky, E. and M. William (1949); The Social Areas of Los Angeles, University of California Press, Los Angeles.
- Shevky, E. and W, Bell (1955); Social Area Analysis; Theory, Illustrative Application and Computational Procedure, Stanford California, Stanford University Press.
- Simmel, George. (1978) The philosophy of money, London: Routledge & Kegan Paul.
- Sinha, Chhabi (1997) Open Burning of Urban Municipal Solid Waste: A State level Analysis, New Delhi: TERI

- Sivaramkrishnan, K.C., A. Kundu, and B.N. Singh, (2006); Oxford Handbook of Urbanisation in India, Oxford University Press
- Umashanker, P.K. and G. Mishra, (Eds.) (1993); Urban Health System, Reliance Publishing House and I.I.P.A. (centre for urban studies, New Delhi)
- Urbanization and its implications for Child Health: Potential for Action, Published by W.H.O. in Collaboration with UN Environment Programme.
- Vishwakarma, R. K. (1981) Urban and Regional Planning Policy in India, New Delhi: Uppal.
- W.H.O. (1991) Regional Overview on Solid Waste Management in South East Asia Region, New Delhi: World Health Organisation.
- W.H.O. Geneva (1978); Primary Health Care, Report of the International Conference on Primary Health Care Alma-Ata, USSR, 6-12 September 1978.
- Weber, Max. (1961); The Urban Community in Theories of Society (Vol – 1), New York: The Free Press of Glencoe.
- Wirth, Louis. (1938). 'Urbanism as a Way of Life', in R. Sennett (ed.) Classic Essays on the Culture of cities, New York, Appleton-century-crofts.
- World Bank (1998); World Development Indicators, Washington DC: The World Bank.
- Zorbaugh, H. W. (1929); The Gold Coast and the Slum, Chicago University Press, Chicago.

Articles:

- Agamuthu, P (2004) Solid Waste Management in Developing Economies — Need for a Paradigm Shift (Editorial) in *“Waste Management and Research”* November 2004.
- Amos, J. (1992) 'Planning and managing urban services', in N. Devas and C. Rakodi (eds.) *Managing fast growing cities*, Longman, pp. 134-152.
- Andrew, D. Emery et al (2003) An in depth study of the effect of socio-economic conditions on household waste recycling practices; *“Waste Management and Research”*, 21, pp.180-190.
- Appaswamy, P. (1994) Institutional options in the provision of Urban Services: The case

of Solid Waste Management in Indian Cities'. A Paper presented at the workshop on Linkages in Urban Solid Waste Management, 18-20 April, Indian Institute of Science, Bangalore

- Bekin, C., M. Carrigan, and I. Szmigin, (2006); Empowerment, Waste and new consumption communities, in *International Journal of Sociology and Social Policy*, Vol. 26, No. 1-2, Pp. 32-47.
- Biswas, Sanat (1972); 'Future Perils of Pollution', *The Hindustan Times*, 5 September 1972.
- Chaudhary, B. K. (2002); Solid Waste Management: A case study of waste pickers in Delhi, M. Phil Dissertation, Centre for the Study of Regional Development, School of Social Sciences, JNU, New Delhi.
- Central Pollution Control Board (2000); Management of Municipal solid waste, New Delhi: CPCB.
- Chettiyappan, Visvanathan et al (2005), Landfill in Asia: improving sanitation of landfill sites published in "*Waste Management and World*" July-August 2005, pp.87-96.
- Furedy, C. (1989); Appropriate Technology for Urban wastes in Asia: Avoiding past mistakes, *Biocycle*, July 1989.
- Furedy, C. (1990); Social aspects of solid waste recovery in Asian cities, *Environmental Sanitation Reviews*, No. 30, December 1990
- Hogland, W., V. Chettiyappan, M. Marques, and R. Manandhar, (2005); Landfill in Asia- Improving sanitation of landfill sites, in *Waste Management World*, July-August 2005.
- Hunt, Caroline (1996); Child waste pickers in India: the occupation and its health risks, in *Environment and Urbanization*, Vol. 8, No. 2, October 1996.
- Joseph, V. V. (1977); 'Ecological Balance in Urban India', *The Economic Times*, 4 January, 1977.
- Karn, S. K., S. Shikura, and H. Harada, (2003); Living Environment and Health of Urban Poor, in *Economic and Political Weekly*, August 23, 2003.
- Kundu, Amitabh (2003); Politics and Economics of Land Policies, in *Economic and Political Weekly*, August 23, 2003.
- Kundu, N. K. and T. Kanitkar, (2002); Primary Healthcare in Urban Slums, in *Economic and Political Weekly*, December 21, 2002.
- Lee, Y.F. (1997) 'The privatization of solid waste infrastructure and services in Asia', *TWPR*, vol. 19, Number-2, pp. 139-161

- Lohani, B. N. et al (1984); Recyclig of Solid Wastes, *Environmental Sanitation Reviews*, No. 13-14, September, 1984.
- Menon, S. (2003), 'Managing the urban environment' published in *Geography and you*, vol.3, no.10&11, pp.16-18.
- Musgrave, Nemone (2005); Value Judgement – Getting the most out of waste, in *Waste Management World*, July-August 2005.
- Nadkarni, M. V. (2000); Poverty, Environment, Development: A Many-Patterned Nexus, in *Economic and Political weekly*, April 1, 2000.
- Nath, K. J. (1999); Environment and Health: Challenges of the New Millenium, in *Indian Journal of Public Health*, Vol. XXXXIII, No. 3, July-September, 1999.
- Patel, Almitra H. (2005); Recycling and ecomark legislation in India, in *Waste Management World*, July-August 2005
- Premi, M.K (2006) India's Urbanisation and its Future Implications in *Man and Development*, March 2006.
- Priya, Ritu (1993); Town Planning Public Health and Urban Poor: Some Explorations from Delhi, *Economic and Political Weekly*, April 24, 1993
- Quadeer, I. (1985); Health Services System in India: An Expression of Socio-Economic Inequalities, in *Social Action*, Vol. 35, July-September 1985.
- Raghunandan, D. (1987); Ecology and Consciousness, in *Economic and Political Weekly*, Vol. XXII, No. 13, March 28, 1987.
- Ramalingaswami, Prabha (1990); Social Sciences in the Health Field in India, in *The Indian Journal of Social Science*, Vol. 3, No. 1, Sage Publications, New Delhi.
- Rao, P.S.N. (1994) 'Privatization in Solid Waste Management' *Nagarlok*, vol. 26, Number-1, pp. 67-75.
- Read, Adam (2005); Public Participation- Community involvement is essential to improving waste management, in *Waste Management World*, November-December 2005.
- Reichenbach, Jan (2005); Pay as you throw- Options, economics and prospects across Europe, in *Waste Management World*, March-April 2005.
- Romesh, Dutt (1998); 'waste disposal plant turns a waste' in *The Tribune*, September 26, 1998, Sunday.

- Ross, Eric (1994); *The Origin of Public Health: Concepts and Contradictions*, in Peter Draper (Ed) *Health through Public Policy – The Greening of Public Health*, London, Green Print.
- Routray, S. K. (2003); *Urban Planning and Public Health- Consequences for poor migrants: A study of Delhi*, M. Phil Dissertation, Centre of Social Medicine and Community Health, School of Social Sciences, JNU, New Delhi.
- Sankhyan, A. R. and Sharma, R. k. (2006); *Urban Renewal through the Instrument of Development Plan: Case study of Shimla*, in *Spatio-Economic Development Record*, Vol. 13, No. 2, March-April 2006.
- Scoff, Sandra (2002); *Public Perception of Healthcare Waste*, in *Waste Management World*, November-December 2002.
- Sekhar, M (2004) *keeping our cities clean: Urban Solid Waste Management in Karnataka*, *Journal of Social and Economic Development*, July-December 2004, vol.6, no.2
- Sengupta, Amit (2003); *Health in the Age of Globalisation*, in *Social Scientist*, Vol. 31, No. 11-12, Nov.-Dec. 2003.
- Shah, Ghanshyam (1995); *Diseases, Doctors and Urban Public Health System: A Study of Surat City* in IASSI, Vol. 14, No. 1 and 2, July-December 1995.
- Sharma, Ambika (2004); 'waste plant runs into rough weather' in *The Tribune*, December 14, 2004 Tuesday.
- Sharma, R. N., and Amita Bhide, (2005); *World Bank Funded Slum Sanitation Programme in Mumbai - Participatory Approach and lesson learnt*, in *Economic and Political Weekly*, April 23, 2005.
- Sheel, Sanghmitra (1994); *Social Area Analysis of Delhi Metropolitan City*, Ph. D. Thesis, Centre for the Study of Regional Development, School of Social Sciences, JNU, New Delhi
- Staff Reporter (2007); *Improper waste disposal a big hazard*, in *The Hindu*, June 18, 2007, Monday
- Sudhir, V., V.R. Muraleedharan, and G. Srinivasan, (1996) *Integrated Solid Waste Management in Urban India: A Critical Operational Research Framework*. *Socio-Economic Planning Science*, 30(3):163-81.

Terris, Milton (1985); The Distinction between Public Health and Community/ Social/ Preventive Medicine, in *Journal of Public Health Policy*, December 1985.

Venkateswaran, S. (1994) Managing Waste: Ecological, Economic and Social Dimensions in *Economic and Political Weekly*, XX (19): 2907-11.

Vigneswaran, S. and M. Sundaravadivel, (2002); Sustainable MSW management in developing countries - The experience of smaller towns in India, in *Waste Management World*, November-December 2002

Internet Sources:

<http://www.jstor.org>, accessed on June 4, 2007

<http://www.himachal.nic.in/welcome.asp>, accessed on June 4, 2007

<http://www.himachal.nic.in/Depts.htm#Departments>, accessed on June 4, 2007

http://hpurbandevlopment.nic.in/list_munci.htm, accessed on June 4, 2007

<http://himachal.gov.in/tcp/welcome.htm>, accessed on June 4, 2007

13 What are your suggestions about the proper management of garbage in your area?

14 Are you satisfied with the facility? Yes/No

15 Over a period of time has the facility improved/deteriorated/no change at all/any other comment. For last 1-2years/2-3yrs/3-4yrs/4-5yrs/more than 5 years.

16 Do you keep the waste separately before disposal (Biodegradable/Non-biodegradable/Recyclable) Yes/No/Do not know.

Appendix – 1I

QUESTIONNAIRE FOR WASTE-PICKERS/INFORMAL SECTOR

- 1 Name
- 2 Age
- 3 Gender
- 4 Since when are you doing this work?
- 5 Are you native of this place?
- 6 Where from do you pick up the waste door to door/garbage stations/open dumping sites.

- 7 Do you collect selected/segregated waste or weight waste?
- 8 Where do you sell it?
- 9 In an average how much waste do you collect everyday?
- 10 In an average how much do you earn per day by selling this waste?
- 11 Do you use masks/gloves or other equipments?
- 12 In case of injuries/infections/diseases where do you go for treatment?
- 13 Are you happy with this occupation?
- 14 If No? Is it compulsion?

- 15 How many members in your family are engaged in this work?
- 16 Would you want your children, if any, to do this work?

Appendix – III

QUESTIONNAIRE FOR MUNICIPAL COMMITTEE

- 1 Name
 - 2 Designation
 - 3 Where does Municipality collect the waste from -door to door/garbage stations/dustbins.
 - 4 Mechanism for waste collection and disposal.....domestic/industrial/health care.

 - 5 Are separate bins installed? or Is it collected in the same bins?
 - 6 When vehicle picks up the waste is it segregated? Yes/No
 - 7 Who segregates the waste? Formal/informal sector
 - 8 Is waste dumped into landfills? (Reasons)
 - 9 Fleet of vehicles engaged in this work.
 - 10 Fleet of Men/Women engaged in this work.
 - 11 What are the measures for segregation of waste?

 - 12 What are the difficulties in implementing the programme for SWM in the city?
 - personnel
 - strategy/mechanism
 - machines/vehicles
 - any other (specify/elaborate)

 - 13 What can be done to improve the present waste disposal mechanism?
 - 14 Vision for SWM for the city.
 - 15 Mechanism needed for execution of the Plan (SWM).
- Comments

Appendix – 1V

QUESTIONNAIRE FOR HOSPITAL PERSONNEL

- 1 Name
- 2 Designation
- 3 How much waste is generated on an average?
- 4 What is the nature of waste generated?.....(Recycleable/Non-recycleable)

- 5 Where do you store it?

- 6 How is it transported?

- 7 Which agency is involved in transportation/disposal?

- 8 Expenditure incurred in this, if any.
- 9 In your opinion how is the present situation of waste?

- 10 Is there any need for improvement?
- 11 How can it be further improved?

- 12 How will it benefit the people?

Appendix - V

QUESTIONNAIRE FOR NON-GOVERNMENTAL ORGANISATION

- 1 Name
- 2 Designation
- 3 Please let me know about the different plants that the N.G.O. has for waste management. Where are they located? What is the nature of services rendered by them?
- 4 Since when are you involved with the municipal committee/waste disposal?
- 5 Which are the agencies you work for?
- 6 What is the nature/composition of waste you receive/collect?
- 7 Is it segregated? All units/plants
- 8 How has the community responded to presence of your plant site?
- 9 What are your funding resources?....self sustaining/municipal committee support/INGO/any other.
- 10 How many employee are working in your plant?
- 11 Please describe briefly the nature of their work.
- 12 Where do you go if any accidental injury happens?
- 13 Are you satisfied working here? Why?
- 14 What, in your opinion, can be done to improve waste disposal in your locality?