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Solid Waste Management in Ludhiana City of Punjab

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ABSTRACT- Generation of solid waste at a very large scale has been a key issue in various countries of the world. Managing the municipal solid waste is a daunting and uphill task in various cities all over the world. Inadequate management of solid waste in India poses serious consequences to environment as well as to human health. For municipal authorities of various Indian cities, solid waste management is a complex challenge to tackle due to increasing pressure of population and different development perspectives. This uphill task of managing solid waste has influenced the Ludhiana city of Punjab. To investigate the current scenario and to carry out the implementation analysis of solid waste management in the city, the present study was undertaken. This study investigates the situation of waste management of the city and concentrates on identifying the causes of rising challenge from the perspective of various stakeholders involved in the waste management of the city. Despite implementation of various solid waste management programs by the municipal corporation Ludhiana, most of these have been unsuccessful. This study focuses on analysing the factors that are responsible for hindering successful policy implementation of solid waste management in the city. For research purposes, a mixed methodology of quantitative and qualitative analysis was adopted. This research found out various financial, human resources, political and logistical constraints affecting the successful implementation of solid waste management program in the city. At the implementation stage of solid waste management administrative constraints such as lack of modern technology and equipment's, insufficient of land for dumping and disposal, lack of integrated solid waste management program play a great role in being hindrances to the successful implementation. Based on the implementation analysis, the study proposes various policy recommendations to work out the challenges faced in successful implementation of solid waste management in the city.

KEYWORDS: Solid Waste, Environment, Human Health, Challenge.

I. INTRODUCTION

The complex process of urbanisation of course provides new opportunities and growth for countries but is also accompanied with social and environmental issues. One of the major problem associated with urbanisation that challenges municipal authorities is management of municipal solid waste. Municipal solid waste (MSW) generally described as garbage and trash is a non-hazardous and disposable waste that may be generated from residential, agriculture, industrial or other sectors. Municipal solid waste management includes all the processes associated with collection, transfer and transport, treatment and recycling and finally the disposal of solid waste. Municipal solid waste management is becoming a complex problem in cities of developing countries. In developed countries, the municipal solid waste management is efficient even if the average generation rate in the various industrialized countries is in the range 0.8-1.4 kg/person/day. Compared to developed countries, the average generation rate of municipal solid waste in developing countries is 0.30.5kg/person/day, but the management is inadequate and improper. So, the management of solid waste in various cities if developing countries is becoming a complicated challenge.

II. BACKGROUND OF THE STUDY

With uncontrolled urbanization in India, various cities of the country are suffering from socio- economic, environmental problems. Among all the major cities of India, Ludhiana city is also facing problems of physical and environmental nature. Ludhiana city is a trading and industrial city of state Punjab. This city is famous for its Hosiery significance, and its cultural variation that has roots in its tradition and social harmony. The city lies in district Ludhiana, a centrally located district of Punjab. It is almost rectangular shaped with a length of 96km from east to west and breadth of 39 km from North to South. District Ludhiana is located between latitude 30º35′ and 31º32′ north and longitude 75º18′ and 76º20′ east. In the north of the city lies river Sutlej, district Firozpur and Moga lie on the west of the city. Sangrur on the south, Fategarh sahib on the southeast and Ropar on the east. The city lies between latitude 30º52′10″N & longitude 75º46′60″E and latitude 30º57′21″N & longitude 75º56′20″E. The city is spread over an area of 310.0 Km and according to 2011 census, the city has a population of16.13 lakhs. Ludhiana is also called as "Manchester of India" and "Industrial capital of small scale industry in the country". Ludhiana city is well connected through railways and roadways. National Highway-1 Grand trunk road connects the city to National Capital and other important cities.

The climate of city is semi-arid with maximum temperature reaching 45-46 ºC. 5.8 ºC has been recorded as the average minimum temperature in the month of January and hottest month as June with average temperature rising to 41.2 ºC. In the summer, southwest monsoon winds and in winter, westerly and north-westerly winds influence the city. Ludhiana receives 49.5 rainfall days at an average of 733mm per year. The month of July receives the most of rainfall for around 11.6 days. October is the driest month of the city with 0.5 days of rainfall.

A. Population And Its Projections

Ludhiana city had a population of just 48,650 in 1901 and in 1991 the population crossed amillion figure. In 2001, the population was 13, 95,053. As per census 2011, Ludhiana city population was found to be 16, 13,878. Various demographic status of city from 1951 are shown in table 1.

Table 1: Population of Ludhiana from 1951-2011 with its increment (Source:DPR Ludhiana)

Year	Population	Increment	Decadal increase in %	Incremental Increase
1951	200000			
1961	251000	150000	25.50	
1971	401000	205000	59.76	99000
1981	606000	436740	51.12	55000
1991	1042740	352313	72.07	231740
2001	1395053	21885	33.79	-84427
2011	1613878	1413878	15.69	-133488
				167825

III. LITERATURE REVIEW

The literature review on the solid waste management is presented in three sections in this chapter. In the first section, basic definitions and concepts are discussed. The second section discusses the problems of solid waste management. The third section of literature review discusses various studies that have been conducted to analyse the implementation of solid waste management in relation to social and environmental justice.

A. Concepts and definitions in solid waste management

i. Waste

Waste as any undesired thing or material left after something is used. (*Dictionary of environment and sustainable development*, 1996) elaborated the definition as "Every undesired and unusable leftovers or products produced at any particular time and place, any material or substance discarded into the surrounding[1].

Solid waste as anything neither liquid nor gas and discarded as unwanted [2]. Waste as undesired substances generated from human activities and thrown away into the environment[3]. Further argues that no properties are inherent in any substance or material that gives it as an identification of waste…., any material or substance turns into waste when the owner or possessor denies further responsibility for it[4]. So, waste as any material that is without a possessor or owner[5]. Added that "what some sections defined waste is considered as a source of value and income by others"[6].

Basal Convention on Control of transboundary movements of Hazardous Waste and their disposal [1], defined waste as any material or objects which are discarded or aimed to dispose of under the provisions of various national regulations. Noted that the waste flow is in actual means fall of resources that go into the wrong direction. From various definitions and views expressed by various authors and researchers, the study uses the definition of waste as any material [liquid, solid, gaseous] thrown away into the environment as undesired, causing nuisance and negative effects on environment. **S**olid waste as undesired or useless substances usually solid that are generated from animal and human activities. This category of waste may include municipal garbage, commercial wastes, mining leftovers, demolition and wastes from agricultural use. Defined solid waste as any refused material, garbage, or other unwanted solid material arising from commercial, agricultural or industrial activities excluding dissolved material[3].

Categorised solid waste predominantly domestic waste with inclusion of wastes from commercial activities managed by the municipal corporation in the given area[4].

IV. POPULATION DENSITY

Population distribution in the city of Ludhiana is categorized into highly dense areas (more than 300

people per hectare [pph], medium density area [100-300 pph] and low density area [less than 100 pph]. Total area of Ludhiana city is 153.97 km . Out of this, 9% is highly dense area, 32% is medium dense area and 54% is low dense area. The remaining 5% area constitutes of military and institutional area.

V. INTEGRATED WASTE MANAGEMENT

World resource Foundation report[5] defines integrated waste management as a new approach that uses a wide range of waste management activities instead of using a single approach. In other terms integrated waste management not only relies on technical methods but on different ranges of complimentary solution with holistic approach. In this integrated waste management approach, every stakeholder involved and effected are brought to participate in waste management. In the design of integrated waste management project, social, environmental, economic constraints are taken into consideration.

Functional, elements of integrated solid waste management are waste prevention, reduction, reuse and recovery, recycling, composting, incineration with and without recovery of energy and disposal in sanitary landfills.

Chavan et al. [6] has placed the functional elements of IWM into a waste hierarchy model (Fig. 1) and pointed the order as from best to worst in terms of environmental friendliness.

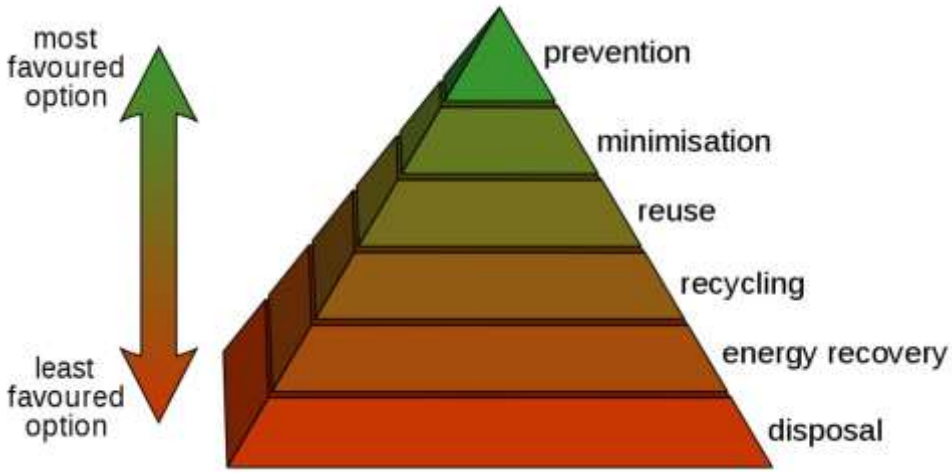

Figure 1: Functional elements of IWM into a waste hierarchy model

A. Theoretical framework for the study

An implementation analysis is carried out in this study within the context of social and environmental justice to find out the problem of solid waste management in Ludhiana city of Punjab. This study however holds other theoretical frameworks also such as factors like political, economic and social factors affecting the managing of solid wastes in the city. Management of resources for waste management, involvement of private sector, their regulations etc. are also evaluated in the context of study. Sustainable waste management can also be a suitable framework to study Sustainable waste management can also be suitable framework to study the waste management implications besides effects due to ill management practices. Considering the above discussed points a single study cannot embed all the areas so a choice was made among all the related contexts. From the existing research and studies, it was found that concept of implementation analysis in the field of solid waste management had received little attention. So keeping in view the social and environmental justice violations due to unscientific waste management practices, an implementation analysis to examine the problem in Ludhiana city was carried out.

VI. OBJECTIVES OF THE STUDY

The objective of this study was to analyse the implementation of solid waste management in the Ludhiana city of Punjab, with the aim of promoting and increasing understanding of the waste problem with its associated issues and identifying possible solutions and suggestive measures. In other sense this study is an effort to answer the question "why are municipal corporations or local governing bodies unable to regulate effective waste management within their domain". In line with the above purpose, some specific objectives for the guidance of the investigation are-

- Investigating the current process of waste management at administrative level, household level, waste collectors level, and waste disposal level.
- Analyze the various programs being designed for solid waste management of the city and the extent to which these policies and programs are actually being implemented
- Identifying major factors and challenges affecting successful policy implementation of solid waste management [SWM] and suggesting ways to improve the solid waste management in the city.

VII. STATEMENT OF RESEARCH PROBLEM

The worsening situation of solid waste in Ludhiana city of Punjab is the research problem investigated in this study. The continuously growing population and business establishments in the city is associated with enormous increase in generation of solid waste from activities of production and consumption. Municipal Corporation of the city is unable to facilitate adequate solid waste management within their domain as can be observed from the mounting waste around the city periphery. This situation of solid waste is becoming intractable and a threat to the public health and surrounding environment. A casual observation within the city domain can conclude visible features of mounting solid waste problem like garbage heaps, street and road litter, and waste chocked drains, waste obstructed streams and water bodies and malodorous gutters etc. From the investigation it was revealed that various concerns were raised frequently by public institutions, business institutions, residents but the waste situation of the city is still worsening and constituting alarming threats to public and environment also. This study was hence undertaken to analyse the issues with the implementation of solid waste management in the city in order to suggest rectifying measures for this waste menace in the city.

VIII. JUSTIFICATION FOR THE STUDY

The intensifying solid waste problem in various cities of India has recently attracted recognition among population with even parliamentarian ministers and various higher officials showing worry about the problem. Media has intervened through newspapers, discussions, television etc. frequently discussing and highlighting various solid waste and disposal issues. Even with the implementation of Smart city mission in the country, various cities still seem to be drowning in the sea of solid waste. Environmental NGO's, individuals and groups expressed the growing concerns of solid waste in the country. Environmental justice and social justice has not prevailed in various cities and it seems like justice in terms of social and environmental wellbeing is compromised. Considering various issues associated with poor management of solid waste throughout the country, it has become obvious to conduct research and training programmes to tackle the issue. Research and studies in the issue will intensify the issue and likely find a sustainable solution. Till now from various Indian cities, study had been undertaken to assess the municipal solid waste management practices. These studies have of course investigated in-depth problems associated with the poor management of solid waste.

However no such study has been undertaken in Ludhiana city of Punjab. With the view of above situation, this study is justified on the basis that it will develop an understanding of the issue of solid waste in order to find sustainable ways to tackle the issue. This study will find shortcomings on the ground level and find the reasons that actually hinder the scientific management of solid waste in the city.

A. Respondents for the study

After the phase of identification of key stakeholders in the city, the next step was selecting who would actually participate in the data collection techniques such as interviews, questionaries' and discussion. For this a conceptual diagram in figure shows the stakeholders who actually participated in the study.

B. Business establishments and Institutions

The managers of any business establishments that generated solid waste such as markets, shopping malls, hotels, restaurants were provided with a questionnaires'. No sampling technique was employed, rather business establishments and institutions were selected by ease and whoever gave a consent were interviewed. A target of 20 institutions were interviewed through a structured questionnaires.

C. Communities around waste disposal Facilities

Interviews were held with residents living near final waste disposal facilities in order to know their problems associated with the location and maintaining of disposal facilities near them. The communities living around Jamalpur and Jainpur waste disposal facilities were interviewed. A convenience method of sampling was employed and the households living near Jainpur and Jamalpur disposal facilities were targeted. So in the entire course of interviewing residents around waste disposal facilities, 20 households were a target, but only 10 households from the two disposal facilities were interviewed due to some constraints such as time and consent of respondents. Thus 5 households were interviewed near Jamalpur and five near Jainpur disposal facilities.

D. Waste Pickers

Waste pickers including men, women, and children were directly involved in the waste picking near collection points. Many unemployed residents of the city make their livelihood through waste picking by salvaging recyclable materials such as metals and plastics. Informal discussions were held with some waste pickers during the visit to waste disposal facilities, interviewed 20 waste pickers by means of convenient and random sampling.

IX. RESULTS AND DISCUSSIONS

Keeping in mind the objectives and aim of the research field survey was done in Ludhiana city of Punjab in order to gather primary data on implementation analysis of solid waste management in the city. On analysis of the data it was revealed that the city has a very poor solid waste management. From field observations the city has very poor environmental conditions because of scant waste disposal practices. From all the data gathered in the city it confirmed unscientific waste management that adversely effects public health. Some reported media notice also indicated disturbing situation of solid waste in the city. As for the general city waste situation which is bad, this research founded differences in management of solid waste among wealthy and informal sectors of the city. The wealthy and official areas of the city are generally cleaned because of regular waste services. However in low income areas and commercial areas like

markets, they lack regular waste collection and disposal services which ends up accumulating waste in the city. A cursory look around the city of Ludhiana shows heaps of garbage, blocked foul smell gutters, polluted water bodies, overflowing solid waste containers, and litter on streets, stinking chocked drains. So there is an increasing level of worry about the filthy waste situation of Ludhiana.

The sites of final waste disposal are just the dumping grounds where waste laden trucks are unloaded which becomes the matter of concern for the residents living around. So overall the waste situation of the city is a complex challenge for the municipal authorities.

X. GENERATION OF SOLID WASTE-SOURCES COMPOSITION AND QUANTITY

As Ludhiana is an industrial hub of Punjab and popularly known as "MANCHESTER" of India. Due to high rate of production and consumption activities the city generates high amount of solid waste on daily basis. Several factors like uncontrolled urbanization, population growth, increased income levels contribute to the enormous waste generation in a city. Waste leaden products like eatables, consumer goods, products for household use produce large quantity of solid waste in the city which dominates the capacity of municipal corporation Ludhiana.

XI. WASTE GENRATION

In 2019 the waste generation reported by MCL was 1150 TPD. The MCL collects solid waste from the city limits. Population and MSW from Ludhiana city is given in table.

Table 2: Population and generation of solid waste in Ludhiana (Source-DPR Ludhiana)

S no	CITY Average MSW (Tons per day) 1150	POPULATION(census 2001)	POPULATION (2011 Census) 1486	TOTAL WASTE QUANTITY TPD in 2019
1	LUDHIANA	1395053	1613878	1150

For estimation of future generation of solid waste, average daily generation of 1150 TPD has been considered as the base figure. Considering the above generation of solid waste and the projected population per capita generation of solid waste comes to be 720 grams per day. Based on above per capita generation of MSW, generation of MSW for the next years is estimated in table.

XII. CONCLUSION

The study undertaken to analyse the implementation of solid waste management in Ludhiana city of Punjab was guided by 3 objectives as: -

- Investigating the current process of waste management at administrative level, household level, waste collectors level, and waste disposal level
- Analyze the various programs being designed for solid waste management of the city and the extent to which these policies and programs are actually being implemented
- Identifying major factors and challenges affecting successful policy implementation of solid waste management [SWM] and suggesting ways to improve the solid waste management in the city.

Guided with the above objectives the current study found that the solid waste management in Ludhiana city is very poor. In the city, the first observation one can conclude is having a cursory look around the city. The study found that waste generated in the city outstrips the capacity of municipal authorities. As claimed by senior officials that about 70% of the waste is collected from the city limits, however the validity of these numbers cannot be justified as most of the waste remains uncollected each day. The study found that waste collection services are not appropriate as some areas even lack collection of waste service. The few communal containers serving a very large population are never cleaned on schedule which always makes them overflowing with waste. There is also a concern of social justice as rich communities are said to receive regular waste collection service while low income communities have little or no waste collection service. The study also found that indiscriminate disposal of solid waste is not checked or regulated by enforcement of national by laws. Congestion in various areas of city due to chaotic housing development further hinders the regular waste management services in the city. The concerns of environmental justice do arise due to poor management of final disposal sites in the city. The study found various causes responsible for poor solid waste management in the city. The 67 factors included in the study are lack of political commitment and attention, scarcity of resources like funds, tools, logistics, personnel, land space for final disposal, lack of enforcement of national by laws and chaotic urban Development.

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