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Urbanization and Sanitation: A case study of Solid Waste Management in Ludhiana, India

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*Unprecedented urbanization coupled with stress on environmental resources is causing compromised sanitation in urban areas. The study based on primary and secondary data tends to analyze the level of sanitation with respect to solid waste management in Ludhiana. The field survey revealed that Municipal Corporation Ludhiana is providing services of public conveniences, sewerage and solid waste management to its citizens. However, public conveniences lacks accessibility and maintenance, gap between availability of sewerage facility and sewerage connection issued to households, lacunas in following systematic patterns of solid waste management and unscientific disposal of solid waste compromises the objective of sanitation service thereby posing threat to public health and environment. In light of these findings the study suggests that gap between access and use of toilet should be minimized to eradicate open defecation by ensuring 24*7 operational facility, all toilets must be connected to the sewerage network with due care of timely maintenance and regular cleaning of sewerage drains by adopting latest techniques and the systematic pattern of solid waste management should be strictly followed including regular door to door collection, transfer to dumping site, proper processing and scientific disposal of solid waste.*

Keywords: Urbanization, Environment, Sanitation, Solid Waste Management and Public Conveniences

Urbanization is a multi-dimensional process which is sociological and geographical in nature. For attaining the balanced regional development, pattern of urbanization needs to be structurally regulated and coordinated. The process of urbanization has been closely linked with the process and pattern of economic development in the country. The World of 21st century is becoming more urbanized. India is part of the global trend towards increasing urbanization in which more than half of world's population is living in cities and towns (National Institute of Urban Affairs, 2019).

Rapid urbanization in India is exerting pressure on land use pattern, urban infrastructure, urban civic services and most importantly on environment. People prefer to settle in urban areas due to better job opportunities, economic growth, adequate provision of services and quality of life. India's urban system is a second largest in the world in which approximately 31 percent of its population lives in urban areas. India is the second most populous country in the world having population of 1.31 billion and providing environmentally safe sanitation in such a highly dense populated country is a challenging task (Singh and Mishra, 2018). Cities being the commercial hub allure underprivileged people to migrate into urban settlements causing high density of population which ultimately results in concentration of poor population residing in unhygienic environment (Kaur, 2017). Rapidly

increasing urbanization raising severe environmental issues including climate change, global warming, carbon emissions in environment, water pollution, excessive solid waste generation and ineffective sanitation which leads to environment degradation. It is in this backdrop that present study has been conceived. The paper is divided into four parts. Part I deals with objective, methodology and locale of the study. Theoretical framework is discussed in part II while part III contains major findings. Concluding observations and suggestions are documented in part IV.

I

Objective, Methodology and locale of the study

The specific objective of the study is to analyze the level of sanitation with respect to; access to toilets, access to public conveniences, sewerage connection and solid waste management in Ludhiana, India and suggest policy measures for improving the level of sanitation.

The present study is based on both primary and secondary data. For drawing the comparisons between urban and slum areas, 10 wards were selected for primary data collection, out of which 7 wards are from urban area and 3 wards from slums. The perceptions of 500 citizens regarding sanitation level were solicited through structured questionnaire. Secondary data has been collected from relevant research books and journals, surveys and government reports of State finance commission, Department of Urban Local Body, Budget, etc.

Municipal Corporation Ludhiana situated in state of Punjab is the largest municipal corporation in Punjab as well as in northern India having population density of 975 persons per square kilometers. The state has an area of 50.362 square kilometers with population of 27,704,236. The Punjab has 1.53 % of the total geographical area of the country and 22.89 % of the population. In Punjab 62.51 % of the people lives in rural area and 37.49 % of the people lives in urban area (Govt. of Punjab, 2016).

The state of Punjab has 37.49 percent urban population against the total 31.16 percent of the country's urban population and interestingly ranked seventh in the urbanization setup prevailing in the country with continuous rapid growth in urban population. The state has 10 Municipal Corporations, 99 Municipal Councils and 167 Nagar Panchayats.

Punjab has 22 districts and Ludhiana is the most populous district having population of 34,98,739 inhabitants with population density of 978 covering area of 3578 square kilometers, having 59.16 per cent of urban population. Ludhiana being large industrial city in the north Indian state of Punjab has not grown only in terms of economy but has also attracted large proportion of migrant population from within Punjab, the neighboring state of Haryana, Himachal Pradesh, Jammu & Kashmir, Rajasthan and majorly from Uttar Pradesh. Ludhiana being the largest Municipal Corporation as one of the fast growing cities has increased pressure on civic body to provide various services which consequently affects the performance and delivery of basic civic services to the citizens. Thus, it provides suitable rationale for selecting Ludhiana as the locale of the study.

II

Theoretical Framework

"Decentralisation is the transfer of authority and responsibility for public functions from the central government to intermediate and local governments or quasi-independent government organizations and/or the private sector" (World Bank, 2019). There are basically three variants of decentralisation within the public sector namely *Political Decentralisation* is the transfer of political power and decision-making authority to sub national levels such as elected village/urban councils, district councils and state level bodies. *Fiscal Decentralisation* involves a level of resource reallocation to local government which would allow it to function properly and fund allocated service delivery responsibility, with arrangements for resource allocation usually negotiated between local and central authorities. *Administrative Decentralisation* involves the transfer of decision-making authority, resources and responsibilities for the delivery of selected public services from the central government to other lower levels of government, agencies, and field offices of central government line agencies.

De-concentration is the transfer of authority and responsibility from one level of the central government to another, with the local unit accountable to the central government ministry or agency which has been decentralized.

Delegation, on the other hand, is the redistribution of authority and responsibility to local units of government or *agencies* that are not always necessarily branches, or local

offices of the delegating authority, with the bulk of accountability still vertically directed upwards towards the delegating central unit (Olsen, 2007).

Devolution is the transfer of power from central government to local government or from main organization to lower level in order to promote participation in decision making for efficient and effective over-all development (Amah, 2018). The local government/body has authority in decision making, personnel administration, finance and in other development activities (Ghuman and Singh, 2013).

The classical model of Tiebout (1956), which states that individuals make their choice between municipalities offering different set of public services, led to an elegant theorem of Oates (1972). Charles Tiebout described a model of mobile households that select a community of residence based on their preferences for local public services. He showed that there exists a class of local public services for which a mechanism is there under which individual choice results in a Pareto efficient outcome. People effectively divide themselves into groups that are homogeneous in their demands for local services. He found that most metropolitan areas have a multiplicity of local governments, each providing a unique mix of public services, so the consumers can reveal their preferences for local public services by their choice of Municipality in which to reside. In other words, Tiebout's work was an examination of ways to optimize the efficiency, quality, and responsiveness of local service provision. Problems related to service governance primarily involve making improvements to service delivery mechanisms while keeping local boundaries intact (Howell-Moroney, 2008).

Wallace E. Oates propounded that "under certain prescribed (sufficient) conditions, a different pattern of outputs of local services in accordance with local needs will be Pareto superior to an outcome characterized by a centrally determined, uniform level of output across all jurisdictions". The theorem provides that the alternative to local provision is a centrally determined, uniform level of outputs of public services. The assumption is however possible only in case of perfect information environment in which the central government, through its own agents, establishes the Pareto-efficient levels of output of local public goods in each jurisdiction (Oates, 2005).

The literature, in economics, political science and public administration has historically advanced two kinds of arguments against this outcome. The first argument is that local governments are closer to their constituencies. Therefore they have a superior

knowledge of the preferences or demands of local residents and of other local conditions which is very difficult to achieve in case of central government. Thus, there exists an inequality of information as the local governments know the preferences of their own residents and other local circumstances, but the central government does not. The second argument justifies the assumption of a uniform level of output under centralized provision which is more political in character. This argument suggests that there are political constraints on the central government that typically prevent it from providing more reasonable outputs in one jurisdiction than in another. The fundamental theory 'equal treatment for all' makes it impossible for the central government to provide different levels of various public services across jurisdictions. Hence, political constraints prevent the central government from establishing a Pareto-efficient pattern of outputs across different areas (Murali, n.d.).

Also, the theorem is based on the assumption that the cost of providing a given level of output in a particular jurisdiction is the same irrespective of the fact that these are provided by the central or local government. Therefore, it eliminates the economies of scale (economies of scale are the cost advantages that enterprises obtain due to size, output, or scale of operation, with cost per unit of output generally decreasing with increasing scale as fixed costs are spread out over more units of output) from central government provision (Oates, 2006).

Thus the underlying idea behind the theorem is that a public service can be efficiently provided by the higher levels of the government only in case of homogeneous nature of demand in the corresponding jurisdiction, where the corresponding jurisdiction is a subset of nation as a whole. The work of Oates translated the text of the model into the language of public economics, which gained immense popularity not only among economists but also among the policy makers by establishing the link between levels of governments which are closer to the users of the services due to their more knowledge about the demands of the users (Murali, n.d.).

III

Major Findings

The modern institution of urban local government as it exists in its present form in India has its origin in British Administration before the advent of Independence. In 1687 the first municipal corporation was set up in Madras to have elected non-governmental members,

indirect state control was recommended and so as to mobilize financial resources for local bodies (Maheshwari, 1994).

During post independence era the foundation of local self government was grounded in the Indian Constitution and various committees/commissions were constituted to set up local government in India. In order to give constitutional status to local government the first effort was initiated in 1989 as 66th Constitutional Amendment Bill; which subsequently lapsed. Finally in 1992, Parliament of India provided the Constitutional status to the urban local bodies by passing the 74th Constitutional Bill (Bakshi, 2010). With the advent of the 74th Constitutional Bill there are 4,657 urban local bodies formed in India.

The act aimed at revitalizing and strengthening the urban governments so that they can function effectively as units of local government. Twelfth Schedule of the Indian constitution pertaining to the Act contains the powers, authority and responsibilities of Municipalities. Article 243W under Twelfth Schedule provides 18 subjects under which the major functions are urban planning, planning for economic and social development, urban poverty alleviation, water supply, fire services, sanitation and solid waste management, slum improvement and up-gradation, protection of environment, construction of roads and bridges, provision of urban amenities, registration of births and deaths etc.

Sanitation and solid waste management is one among the eighteen subjects provided in Twelfth Schedule. Sanitation is the hygienic means of promoting health through provision of facilities and services for the safe disposal of human urine and faeces, prevention of human contact with the hazards of waste as well as the treatment and proper disposal of sewerage waste water and solid waste management. Sanitation means public cleanliness - using clean and safe toilets, keeping water sources clean, and disposing of garbage safely. Cleanliness in the community is just as important as cleanliness for individuals and families.

The performance of Municipal Corporation Ludhiana in terms of sanitation is evaluated on the basis of parameters namely, number of public toilets, satisfaction of citizens' with the provision and maintenance of public conveniences, provision of household toilets, provision of sewerage facility, number of sewerage connections, satisfaction of citizens' with the provision and maintenance of sewerage, waste segregation at source, primary collection frequency, secondary storage sites, satisfaction of citizens' with the collection and cleanliness of garbage.

Toilets in Households

Toilets are essential for clean and healthy communities and contribute to the social and economic development of the nation. When human waste (feces) is not managed well, it pollutes water, food, and soil with germs, and leads to diarrhea and other serious health problems. Poor sanitation causes a great deal of unnecessary sickness and death. Using toilets prevents germs from getting into the environment, and protects the health of the community as a whole. Moreover, health is not the only reason to build and use toilets, people also want privacy, safety, comfort, cleanliness and respect. There are instances of open defecation amongst some of the members in spite of having toilets. These members are either not using the toilet or using it irregularly as they preferred the freedom of open defecation (Govt. of Punjab, 2019). The poor sanitation is still prevailing because sanitation is neither a felt need nor is open defecation a socio-cultural taboo. Construction and using the toilet is not a priority as of now for many of them and they defecate in the open.

During field survey it was reported that in Municipal Corporation Ludhiana there were 3.20 lakh households but 87.57 % households have toilets in their premises and the remaining 12.43 % households depends on public conveniences or they defecate in open spaces. There are 29 open defecation spots identified in Municipal Corporation Ludhiana including Buddha Nullah, Railway Line, Dugri canal, Jassian road near railway bridge, Bharat Nagar Chowk, Grain market in Jhuggian, New Sabzi Mandi, BRS Nagar, Khokha Market, Sham Nagar railway crossing, Damoria bridge, Dana Mandi, Gill road and Gill Canal Bridge.

Public Conveniences

The overall purpose of good sanitation is to provide a healthy living environment for everyone, protect natural resources such as surface water, groundwater, and soil, and provide safety, security, and dignity for people when they defecate or urinate. Public conveniences play a vital role in community health and individual well-being. Public convenience is better known as public toilet especially situated at public place. A public toilet is a room or small building containing one or more toilets and possibly also urinals which is available for use by the general public. Public toilets are commonly separated by gender into male and female facilities, although some can be unisex, particularly the smaller or single occupancy types. Increasingly, public toilets also incorporate accessible toilets and features to cater for people who do not have toilets at their home. In some public toilets, service is provided by the local

authority whereas some are maintained by the private companies and they charge a meager usage fee for the service.

Availability of Public Convenience

Public conveniences are required for the households who cannot afford to have toilet at their home and by general public during the time when they are not at home. During field survey it was found that out of total 500 respondents, majority 383 (76.6%) respondents expressed that there is public convenience in their locality, whereas 117 (23.4%) respondents revealed that there is no public convenience in their locality (Table 1).

Table 1

Information Shared by Citizens Regarding Public Convenience

Citizen's Response Regarding Availability of Public Convenience	Yes	No	Total
	383 (76.6)	117 (23.4)	500 (100)

Note: Figures in parentheses represent percentages

It was ironically found that slum areas being ignored in having public conveniences and it ultimately results in open defecation, whereas being concentrated with poor population there is utmost necessity of public convenience.

Satisfaction of citizens' with maintenance of Public Conveniences

Mere construction of public toilets may not help in achieving the goal of total sanitation. The toilets need regular maintenance and upkeep so as to render service effectively. Out of total 500 respondents, 383 respondents reported availability of public convenience. The responses of these 383 respondents were solicited regarding maintenance of public convenience, and majority 67.9% respondents were satisfied, 22.5% gave neutral response, whereas 9.7% respondents were dissatisfied with the maintenance of public convenience in Municipal Corporation Ludhiana (Table 2).

Table 2

Information Shared by Citizens Regarding Satisfaction with Maintenance of Public Convenience

Citizen's Response	Satisfied	Neutral	Dissatisfied	Total
Regarding Satisfaction with Maintenance of Public Convenience	260 (67.9)	86 (22.5)	37 (9.7)	383 (100)

Note: Figures in parentheses represent percentages

It was reported that floors were wet due to leakage of water from damaged taps and pipes, mirrors were broken, urinal pipes were detached, toilets were dirty and in unhygienic condition. No disinfectant was used to clean the toilet and soap was not available to clean the hands. Moreover, many times the toilets were found locked and no attendant was there to provide access.

Perception of citizens' regarding privatization of Public Toilets

Privatization has received much attention in past few years due to consequence of poor performance of public services. By adopting the privatization of public services, it is expected that there will be efficiency and effectiveness in delivering the services to users. Citizens' perception were solicited regarding privatization of maintenance of public conveniences and it was revealed that out of total 383 respondents, majority 310 (80.9%) respondents opposed the privatization of maintenance of public convenience in Municipal Corporation Ludhiana. It clearly indicated that citizens do not want the privatization of public convenience as it would put extra economic burden on them and they expect the better public services to be provided by corporation only. 73 (19.1%) respondents favoured the privatization of maintenance of public convenience as they assume that privatization would ensure adequate provision, 24*7 access, regular cleaning and regular maintenance of public convenience.

Sewerage

The basic principles of sanitation is to remove all decomposable matter, solid waste, liquid or gaseous away from the premises of dwellings as fast as possible after it is produced, to a safe place, without causing any nuisance and dispose it in a suitable manner so as to make it permanently harmless. The sewage system has a very important role in our lives as it protects both our health and the environment. The sewage system is used to collect the waste water and human excreta, and to clean it before returning it to the environment. Sewage as we all know comes from our body and kitchen and toilet waste. There is a tendency for outbreak of different epidemics and sicknesses if it is not handled properly. Another advantage of sewerage system is the prevention of pollution and maintaining rivers and streams in a healthy and ecologically sound condition. Municipal Corporation Ludhiana has 3,20,000 households and it has issued 2, 56,165 sewerage connections, which constitutes 80.05% sewerage connectivity.

Provision of Sewerage Facility

Sewerage facilities are provided through network of sewers in area having various infrastructural components like manholes and chambers. In order to provide sewerage facility to citizens, sewerage connections are given by connecting household to sewerage network through drainage lines. In order to access the provision of sewerage facility, study revealed that out of total 500 respondents, majority 492 (98.4%) respondents expressed that there is sewerage facility, whereas only 8 (1.6%) respondents revealed that there is no sewerage facility in Municipal Corporation Ludhiana (Table 3).

Table 3

Information Shared by Citizens Regarding Sewerage Facility

Citizen's Response	Yes	No	Total
Regarding Sewerage Facility	492 (98.4)	8 (1.6)	500 (100)
Regarding Sewerage Connection	479 (95.8)	21 (4.2)	500 (100)

Note: Figures in parentheses represent percentages

Sewerage connection is provided by installing an underground pipe connecting to sewerage network for transporting sewage from household to sewerage. The survey regarding sewerage connection reported that out of total 500 respondents, majority 479 (95.8%) respondents expressed that they have sewerage connection, whereas 21 (4.2%) respondents revealed that they don't have sewerage connection in Municipal Corporation Ludhiana. There are 98.4% respondents who expressed that availability of sewerage in their locality whereas 95.8% respondents stated that they have sewerage connection. The gap of 2.6% between availability of sewerage facility and sewerage connection issued to households suggest that even though the toilets are there but due to less number of sewerage connections the objective of sanitation service can not to be fulfilled and it causes great threat to public health and environment. Moreover, 87.57 percent households having toilets reported that 73.23 percent among them have piped sewerage and 26.77 percent households have septic tanks in their premises.

Satisfaction of respondents with maintenance of sewerage

Sewerage requires regular maintenance in terms of cleaning the drains, manholes, repair of cracked or damaged sewerage lines and up gradation of sewerage network. In case of satisfaction with maintenance of sewerage, out of total respondents, majority 337 (70.3%) respondents were satisfied, 80 (16.7%) gave neutral response, whereas only 62 (13%) respondents were dissatisfied with the maintenance of sewerage in Municipal Corporation Ludhiana (Table 4).

Table 4

Information Shared by Citizens Regarding Satisfaction with Maintenance of Sewerage

Citizen's Response	Satisfied	Neutral	Dissatisfied	Total
Regarding Satisfaction with Maintenance of Sewerage	337 (70.3)	80 (16.7)	62 (13.0)	479 (100)

Note: Figures in parentheses represent percentages

It was found that it takes a long time to resume the sewerage service once it gets clogged or ruptured. It is also noteworthy to mention that cleaning of sewerage should take place following annual, biannual or monthly intervals as per the requirement of area. Hydro jetting and automated sewerage cleaning mechanism are more prevalent and effective than the traditionally practiced drain snake and manual cleaning methods.

Ludhiana is an industrial center of northern India and also known as Manchester of India. Municipal Corporation Ludhiana has dual carrier sewerage which carries both domestic and industrial waste. Municipal Corporation Ludhiana use super sucker machines for cleaning the sewerage lines, which cleans 35-40 meters sewerage pipe in 20 hours. The cleaning of sewerage takes place once in four years. There is no separate sewerage network for industrial waste and due to hazardous bio-mechanical waste; the mechanical process has to be followed for cleaning the drains in Municipal Corporation Ludhiana.

Privatization of maintenance of Sewerage

Regarding privatization of maintenance of sewerage, it was revealed that out of total respondents, majority 413 (82.6%) respondents opposed the privatization of maintenance of sewerage in Municipal Corporation Ludhiana. There are 17.4% respondents favoured the privatization of maintenance of sewerage as it would ensure proper drainage, regular cleaning and regular maintenance of sewerage.

Solid Waste Management

Solid waste refers to the range of garbage arising from animal and human activities that are discarded as unwanted and useless (Leblanc, 2018). Waste can be categorized based on material, such as plastic, paper, glass, metal, and organic waste (Jaysawal and Saha, 2014). Solid Waste Management is defined as the discipline associated with control of generation, storage, collection, transport or transfer, processing and disposal of solid waste materials in a way that best addresses the range of public health, conservation, economics, aesthetic, engineering and other environmental considerations. The primary goal of solid waste management is reducing and eliminating adverse impacts of waste materials on human health and environment to support economic development and superior quality of life. The solid waste management is very important and decisive factor for effective sanitation, public health and overall hygiene in the concerned city. The various components of municipal solid waste have an economic value and can be recovered, reuse or recycled cost effectively. The informal sector known as rag pickers picks up the solid waste from road side and community bins to earn their livelihood. **S**olid waste management mainly includes the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and spread diseases. The tasks of solid waste management present complex technical challenges. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved.

The Ludhiana city produces approximately 1100 tonnes of solid waste per day. Municipal Corporation Ludhiana has contracted out service of solid waste management to A2Z waste management limited company in 2011 for 25 years. It installed solid waste treatment plant and started operation in year 2012 for 18-20 hours by treating approximately 800 tonnes of solid waste per day. Solid waste management has been taking place by systematic pattern including regular door to door collection, transfer to dumping site, proper processing, scientific disposal of solid waste and finally power generation from waste.

Waste Segregation at Source

Waste segregation is the process by which waste is separated into different kinds like dry waste, wet waste and hazardous waste. Waste sorting can easily be done manually at the household by keeping the waste in different bins. Solid Waste Rules, 2016 gave it legal shape

and Swachh Bharat Abhiyan has provided practical form by recommending different coloured bins to keep the waste categorically. As per rules green colour bin is to be used for biodegradable waste, blue for non-biodegradable, and black for domestic hazardous waste. Effective segregation of waste would result in less waste goes into landfills, which is very important for public health and environment. To analyze the practice of waste segregation at source/household a field survey was conducted. It was found that out of total 500 respondents, majority 324 (64.8%) respondents stated that they do not segregate waste at home, whereas 176 (35.2%) respondents stated that they follow the practice of waste segregation at home in Municipal Corporation Ludhiana (Table 5).

Table 5

Information Shared by Citizens Regarding Waste Segregation at Source

	Yes	No	Total
Citizen's Response Regarding Waste Segregation at Source	176 (35.2)	324 (64.8)	500 (100)

Note: Figures in parentheses represent percentages

The respondents stated that they do not follow the practice of waste segregation because the waste collector has no mechanism to keep the waste segregated and while collecting the waste from house, they usually mix the segregated waste. They also stated that there is no awareness generation campaign has been made in order to follow the practice of waste segregation and no separated bins are provided to keep the waste segregated.

Frequency for Garbage Collection

Waste collection is very important for the protection of environment and health of the public. Decaying waste produces harmful gases which pollutes the environment and causes respiratory problems in people. Solid Waste Management Rules 2016 has made mandatory provision for door to door collection of segregated waste on the daily basis by using recommended machinery on the basis of geography and local conditions of the area, e.g. handcarts, tricycle, containerized auto rickshaws etc. The survey revealed that out of total 500 respondents, majority 265 (53%) respondents expressed that the garbage has been collected daily, 72 (14.4%) respondents revealed that the garbage has been collected twice in a week, 58 (11.6%) respondents stated that the garbage has been collected once a week, 83 (16.6%)

said that the garbage has been collected twice in a month, 9 (1.8%) respondents asserted that the garbage has been collected once in a month, whereas 13 (2.6%) respondents disclosed that the garbage has not at all been collected in Municipal Corporation Ludhiana (Table 6). It clearly shows that the garbage collection pattern was not uniform at all. Some localities has the good services whereas some localities were left un-served causing environment degradation and lead to various diseases.

Table 6

Information Shared by Citizens Regarding Frequency for Garbage Collection

Citizen's Response Regarding Frequency for Garbage Collection	Daily	Twice in a Week	Once in a Week	Twice in a Month	Once in a Month	Not at All	Total
	265 (53.0)	72 (14.4)	58 (11.6)	83 (16.6)	9 (1.8)	13 (2.6)	500 (100)

Note: Figures in parentheses represent percentages

Satisfaction with Garbage Collection

The satisfaction level of citizens with garbage collection has been analyzed. The study reported that out of total 500 respondents, majority 363 (72.6%) respondents were satisfied, 73 (14.6%) gave neutral response, whereas 64 (12.8%) respondents were dissatisfied with the collection of garbage in Municipal Corporation Ludhiana (Table 7).

Table 7

Information Shared by Citizens Regarding Satisfaction with Garbage Collection

Citizen's Response	Satisfied	Neutral	Dissatisfied	Total
Regarding Satisfaction with Garbage Collection	363 (72.6)	73 (14.6)	64 (12.8)	500 (100)

Note: Figures in parentheses represent percentages

Secondary Storage

After collection of waste from door to door and community bins, it is brought to the secondary storage centers or waste storage depots. As per Solid Waste Rules, 2016 the secondary storage points shall have covered containers and there shall be arrangement for keeping the segregated waste. Secondary storage centers are centralized facilities wherein waste is unloaded from smaller collection vehicles and re-loaded into larger vehicles for

transport to a disposal or processing site. Storage facilities shall be user friendly and shall be so designed that it ensures compaction of waste and that the waste stored is not exposed to open atmosphere. There are around 283 secondary storage centers in Municipal Corporation Ludhiana including 73 open area spots being used as secondary storage.

Waste Transportation to Dumping Site

Solid Waste Management Rules, 2016 provides that the segregated waste shall be transferred to dumping site for the processing. The waste transportation vehicles are of such design and technology that the manual handling of waste can be reduced and the vehicles shall be covered while transferring the waste. The study revealed that un-segregated waste from secondary storage centre has been transported to the dumping site. The manual loading and unloading of waste is in practice. The latest technology vehicles had reduced the manual handling of waste but very less number of advance technology vehicles are used for transportation. Moreover, the waste is transported in open vehicles like trucks and tractor trolleys without even covering it with sheets, which results in waste spillage on the roads. The transportation mechanism also lacks in service due to poor maintenance of vehicles and thereby lying un-operational in the company workshops.

Waste Treatment at Dumping Site

The practice of segregation of waste is not effectively practiced before it reaches to dumping site. So before treating the municipal waste the segregation of waste is necessary. Municipal solid waste automatic sorting system is suitable for efficiently separating the stuff from a large number of municipal solid waste, such as organic matter, plastic, metal, construction materials and other substances. In Municipal Corporation Ludhiana Solid Waste Treatment Plant has been installed by private company named, A2Z waste management limited ludhiana and started operation in year 2012. After entering the field, the municipal solid waste is unloaded on the discharge platform, the garbage is sent into screening machine by belt conveyor for screening treatment. The machine segregates the waste like organic waste, iron products, clothes, wood, long sticks, brick and stones, bottles, etc. The iron objects in waste are extracted out by the hanging magnetic separator. The composting system is used to recycle the organic matters. The residual waste is processed by Refuse Derived Fuel (RDF) method which is very effective in preparing an enriched fuel feed for thermal processes like incineration or industrial furnaces. The RDF pellets can be conveniently stored and

transported long distances and can be used as a coal substitute at a lower price. As pelletization involves significant Municipal Solid Waste (MSW) sorting operations, it provides a greater opportunity to remove environmentally harmful materials from the incoming waste prior to combustion.

Privatization of Sanitation Service

In order to enhancing the efficiency and effectiveness of sanitation, citizens' perception regarding privatization of sanitation service was sought through field survey. It was found that out of total 500 respondents; majority 396 (79.2%) respondents opposed the privatization of sanitation, whereas 104 (20.8%) respondents favoured the privatization of sanitation in Municipal Corporation Ludhiana as to avoid the financial stress on them. Some respondents favoured the privatization in which 19.6 percent respondents favoured privatization as it would ensure adequate provision, 29.9 percent gave reason of regular garbage collection, 31.8 percent gave reason of proper garbage collection, whereas 18.7 percent respondents expressed the reason of proper disposal of garbage in support of their view regarding privatization of sanitation service in Municipal Corporation Ludhiana.

Factors responsible for poor Sanitation Service in Ludhiana

Extent of sanitation in Municipal Corporation Ludhiana is interplay of stakeholders such as citizens and local government. During field survey it was found that majority of the respondents have stated that they have access to public toilet and personal toilet within their locality. Majority of the respondents also expressed that there is sewerage facility within their locality. Respondents also affirmed that there is proper solid waste management in Municipal Corporation Ludhiana.

However, there are certain factors which inhibit the proper sanitation scenario in the city. Mere availability of toilet at home does not ensure their usage as it was found that despite availability of household toilets there exists a considerable gap between access and use of toilet due to various reasons like lack of proper privacy-providing super structure, lack of proper design, lack of maintenance or lack of required awareness to use toilets. Many of such toilets have been found actually dysfunctional. Many toilets have been reported to be used as store houses for dry cow dung cakes or for other purposes. There is uneven placement of public conveniences in localities. In some localities the condition of public conveniences is very poor, not maintained and so unclean that it can't be used, especially in slum areas.

Whereas some are inaccessible as they remain locked most of the time. Public toilets are not maintained properly. There are found smelly, chocked, stained and in unhygienic condition.

In spite of availability of sewerage, households are not connected with sewerage network. Many households constructed toilets connected to septic tanks, which emits foul smell and needs frequent cleaning. There is no regular cleaning of sewerage. Moreover, sewerage lines are not maintained and many gutters and manholes are found without lid causing life threatening risks to public. In rainy season gutters causes back flow consequently leads to health hazards and environment degradation. The industrial waste water without any scientific treatment is drained in sewerage line and gets mixed with household waste water. The untreated waste water is drained into Budha Nala which afterwards gets mixed into satluj river.

Citizens are not following the practice of keep the waste segregated and waste collector has no mechanism to keep the waste segregated. There is no training imparted to them and no separate bins are provided to keep the waste segregated. Irregular garbage collection especially in slum areas causing environment degradation and lead to various diseases. Community bins are not uniformly placed in the city. Bins are unable to keep the waste in due to poor maintenance and are not replaced timely. It leads to dysfunction and due to lack of community bins, the residents through the waste by road side, open spaces or around the community bin.

Secondary storage depots have temporary structures without gates thereby stray animals have open access to stored waste, which scatters the waste around the spot. Another challenge is caused by rag pickers, which scatters the stored waste and extracts the valuable waste for their livelihood. There is no segregation takes place of un-segregated waste collected from household. There is no arrangement to keep the segregated waste categorically. Some open area spots are also being used as secondary storage. The waste is not lifted daily from these centers, which causes unhygienic conditions, polluting the air and leads to environment degradation. The waste workers are not using personal protective equipments such as masks, gloves, shoes etc. during handling of waste which is mandatory as per Solid Waste Management Rules (2016). Municipal Corporation Ludhiana is making responsible the A2Z company for not providing the recommended equipments as they have contracted with it for solid waste treatment.

Un-segregated waste from secondary storage centre is transported to the dumping site in uncovered and over loaded waste carriers which spills the waste on roads during transit. The waste carriers and handling machinery lacks in performing service due to poor maintenance of vehicles and thereby lying un-operational in the company workshops, consequently hinders the effective solid waste management.

Solid waste management process is not able to cope up with rising population thereby compromising the sanitation process in slum areas more prominently. Solid waste treatment plant is running short by treating approximately 800 tonnes of solid waste per day to its maximum capacity, whereas the production of solid waste in Ludhiana is approximately 1100 tonnes per day. There are heaps of solid waste lying untreated at dumping site, which may not get their turn to be treated and degrading the environment. Moreover, the treatment plant has seasonal limitation as it stops working in rainy season due to incapacity to treat wet waste. The process, however, is energy intensive and not suitable for wet municipal solid waste during rainy season. Unscientific disposal of solid waste, burying in land and dumping of solid waste at dumping sites, uncontrolled dumping of solid waste at some vacant places in urban vicinity leads to water pollution, air pollution and health issues.

IV

Concluding Observations and Suggestion

Municipal Corporation Ludhiana is struggling to manage standards of sanitation in the city. The unplanned city growth due to migration from other states undermines the capacity of Municipal Corporation Ludhiana. However, during filed survey it was found that people have access to public toilet, household toilet, sewerage connection and provision of garbage collection. All these factors are instrumental in maintaining hygienic environmental condition in the city. Despite all these mechanisms there are certain factors needs to be improved for strengthening the sanitation level.

In order to minimize gap between access and use of toilet, and to ensure proper use of toilets, awareness is required which is highly important for the public health and national progress. The awareness campaign should be made to make the people understand the use and importance of the toilet. The various health hazards due to open defecation should be explained to them in a way that they must adopt the culture of using toilets regularly. The public toilets should be placed rationally keeping in view the need and usage of the area

especially in slum areas. The maintenance and cleanliness of public conveniences should be at priority. Public conveniences should also remain operational and accessible for public. Attendant should be present to maintain the hygienic and ensure whole time accessibility.

It is needless to emphasize that for attaining the goals of good sanitation, sewerage system is very essential. All the toilets must be connected to the sewerage network rather than operational with septic tanks. Sewerage drains should be maintained timely and cleaned regularly by adopting latest techniques like Hydro jetting and automated sewerage cleaning mechanism. Waste water should be treated before it gets mixed with other water sources in order to protect from contamination. Being the large industrial city, separate sewerage network should be installed for hazardous industrial waste.

Authorities should strengthen upon household segregation of waste. The training needs to be imparted to citizens to keep the waste segregated and separated bins should be to follow the practice of waste segregation at source. There should be proper mechanism to collect and keep the waste segregated by waste collector. Uniform pattern of solid waste collection must be adopted practically. Authorities should regularly undertake garbage collection in slum areas so as to improve the sanitation level in these areas as these areas are susceptible to diseases and poverty burden. Community bins needs to be uniformly placed in the city. Timely maintenance and replacement of bins should be ensured to keep them functional. The residents must be made aware to stop throwing the waste by road side, open spaces or around the community bin.

Secondary storage depots must have proper structures with gates so that the stray animals and unauthorized access by rag pickers can be restricted. There shall be proper arrangement to keep the segregated waste categorically. Municipal Corporation Ludhiana should ensure in restricting the open area spots being used as secondary storage. Regular waste collection from secondary storage centers must be done to maintain the hygienic conditions, to limit the air pollution and protect the environment degradation. The waste workers should follow the mandatory provisions of Solid Waste Management Rules 2016 by using personal protective equipments such as masks, gloves, shoes etc. during handling of waste. The segregation of waste must be done before it is transported to the dumping site or solid waste treatment plant. The vehicles used for transportation should be covered in order to protect the spilling of waste during transit. The waste carriers and other related machinery

should be maintained properly and timely to effectively perform the service of solid waste management.

The capacity of solid waste treatment plant should be enhanced keeping in view the growing population and garbage disposal rate. The capacity of the treatment plant should be enhanced from generating power to compost making and there shall be arrangements to keep the dry waste stored so that the plant remains operational in rainy season. There shall be no unscientific disposal of solid waste so that the vicinity can be safeguarded from water pollution, air pollution and critical health issues. The required impact of sanitation and waste management can be achieved through social mobilizations supported by socio-culturally acceptable and economically affordable technology. By adopting this model of solid waste management, the intensity of harmful gases like methane and carbon monoxide in the air can be reduced and would help to create a greener and cleaner environment for all.

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