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A study of environmental condition and sustainable solid waste management in Gurugram City

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Abstract---Environmental problem is a global concern. It doesn't stop anywhere. All over the world, people are being educated about how to protect the environment. One of the main reasons why the environment is getting worse is because of how solid waste is handled. In many parts of the world, it is a major source of pollution and disease. There is no long-term solution to environmental problems. The only thing we can do is reduce and control the amount of waste we make by being aware and doing the right things. The most important thing in this situation is to take care of the trash in the right way. Waste management is a science that looks at how to get rid of trash, how it affects the environment, how it affects society, and how much it costs. So the purpose of the present research is to study the impact of solid waste has on the environment in the study area and to study the environmental condition and what kind of pollution problem arises in the Gurugram city.

Keywords---Environmental problem, Municipal Solid Waste (MSW), pollution problem, Sustainable solid waste management.

Introduction

It is common practice in India to dispose of Municipal Solid Waste (MSW) in low-lying locations, which results in Open Dumps (also referred to as Landfill sites), without taking any preventative measures or implementing any operational controls. The improper disposal of municipal waste in this unscientific manner has a negative influence on the health of humans as well as all other aspects of the environment (Rathi, 2006; Sharholly et al., 2005; Ray et al., 2005; Jha et al., 2003; Kansal, 2002; Kansal et al., 1998; Singh and Singh, 1998; Gupta et al., 1998). The poisoning of groundwater resources as a direct result of these open

dumps is one particular topic that researchers and scientists from all around the world are focusing their attention on. The waste that is deposited in landfills or open dumps will gradually release its original interstitial water. Additionally, some of the byproducts of the waste's breakdown will trickle into ground water as it moves through the waste deposits. The term "leachate" refers to this type of liquid, which can contain a wide variety of organic and inorganic substances. Leachate is produced when the moisture content of the biodegradable fraction of municipal solid waste (MSW) is high enough. Leachate contains a number of toxic chemical compounds that, in the absence of any lining, are capable of directly penetrating the underground strata and affecting the ground water quality. In recent years, a number of studies (Saarela, 2003; Abu-Rukah and Kofahi 2001; Looser, 2003) have been conducted to investigate the effect that landfill leachate has on both the surface water and the groundwater.

Increased industrialization and fast urbanization have led to a huge increase in garbage production in recent decades. Management of municipal solid waste (MSWM) presents a significant challenge in low-income nations. India currently generates 42.0 million tons of MSW annually. Overall, the amount of solid waste produced each year is estimated to rise by around 5%, with cities accounting for the production of nearly 75% of this total. It is becoming increasingly apparent, not only to members of the general public, but also to members of decision-making bodies, environmentalists, and medical researchers, that the interdependence of economic development, environmental management, and individual well-being is a crucial factor in determining the degree to which sustainability can be achieved (Goosen, 2012).

The term "solid waste" refers to any inert, non-fluid material that has no potential use to the waste producer. Trash, junk, and refuse are other names for it. Human activities generate trash, which must be collected, stored, and disposed of in ways that don't endanger local ecosystems or people's health. Solid waste management refers to the process of dealing with and disposing of solid waste in a way that is safe for humans and the environment (SWM). Municipal solid waste management (MSWM) difficulties and issues have a greater potential influence on public health in metropolitan regions of developing economies than other governance issues.

In India, an estimated 40-50 percent of rubbish created is not collected, and this uncollected waste ends up on highways and drainage systems. This, in turn, causes flooding, the proliferation of insects and disease-carrying pests, and so on. A significant amount of the waste is organic in nature and serves as food and shelter for rats and disease-carrying insects. The organic fraction of garbage causes bad odors and degrades the aesthetic appeal of the surroundings. The gathered garbage is sometimes disposed of in an improper manner, such as burying it in landfills or open burning it, resulting in pollution of land, water, and air. This lack of service and infrastructure typically impacts the lower strata of society due to their proximity to garbage storage places. This increases health risks and deepens social marginalization.

Disposal, however, is not a viable option for the sustainable management of solid waste. The goal of having zero emissions has become increasingly significant since the late 1990s. The concept is reflected by the phrase "no time for waste,"

because the concept envisions all industrial outputs from processing being used as input process materials or converted into value added inputs for other processes, thereby optimizing the consumption of resources and increasing eco-efficiency. This maximization of resource consumption and increase in eco-efficiency is what the phrase "no time for waste" refers to.

Review of Literature

If waste management activities are correctly managed, they can provide environmental benefits (Gentil et al, 2009). In the past, there has been little attempt to raise community knowledge, either about the potential dangers of inadequate waste management or the easy steps that every person may take. This might have aided in the reduction of trash generation and the promotion of effective waste management. This scenario, however, has changed. People are becoming more interested in environmental issues as they begin to see the negative repercussions of environmental difficulties.

According to Al-Khatib et al (2015) and Hilburn (2015), most developing-country communities often resort to waste disposal methods that have been shown to be harmful to human health and the environment, such as open dumping and burning (or unregulated landfills), because they believe they have no other options for managing their solid waste. This shows that most poor countries do not practice waste management in a sustainable manner.

Objectives of the Study

To study the impact of solid waste has on the environment in the study area and to study the environmental condition and what kind of pollution problem arises in the Gurugram city.

Study design

The study is descriptive in nature. Questionnaire was the main instrument used to solicit for information for discussion. In addition, informal interview was conducted to enable the researcher obtain more detailed information on waste management in the area.

Study Area

Gurgaon is a city in the northern Indian state of Haryana. Its official name is Gurugram. Gurugram is one of the Indian cities that is growing the fastest, and there are tasks to be done at different stages of managing solid waste. The municipal corporation of Gurugram (MCG) made a new wing to keep an eye on the environment and make sure things are sustainable. The new wing will be in charge of regulating and watching construction sites for dust pollution, enforcement of GRAP, micro STPs, reuse of treated waste water, pond rejuvenation, parks, green belts, and concrete forestry, among other things.

Study population

Includes households in Gurugram city.

Inclusion criteria

All households with permanent residents of Gurugram city for atleast a period of 6 months.

Study period

March 2022 to May 2022.

Sample size

400 respondents were randomly selected for the research study.

Tools and Techniques

The statistical measures such as number and percent distribution were used for describing the variables of the study. Data are coded, tabulated and analyze by using statistical method of SPSS (Statistical Package for Social Science) and Microsoft Excel.

Result and Discussion

A science that deals with the generation, storage, collection, transportation, segregation, processing, and disposal of solid waste using the best principles and practices of public health, economics, engineering, conservation, aesthetics, and other environmental conditions is referred to as solid waste management (SWM). In recent years, one of the most significant issues facing India is the accumulation of solid garbage. Waste has been growing both in volume and variety in tandem with the steady expansion of the industrial sector. The open spaces and nooks of every city in India are constantly covered with enormous amounts of garbage and other types of solid waste. This open disposal of rubbish, which is responsible for the spread of diseases, is interfered with by strays such as dogs, rodents, and cats. The problem of garbage disposal is particularly significant in slum regions, which are characterized by extreme poverty, inadequate housing, unsanitary conditions, and a lack of essential amenities. In our culture, only a small minority of people have the civic awareness to put trash away in the appropriate receptacles. SWM refers to the activities that are related with the production of solid wastes, as well as their storage and collection, transfer and transport, treatment, and disposal. However, the Municipal Solid Waste Management (MSWM) system in the majority of Indian cities consists of only four activities: the generation of waste, the collection of waste, the transportation of waste, and the separation of waste before disposal.

Household garbage, business waste, institutional waste, hospital waste, non-biodegradable waste, biodegradable waste, hazardous waste, compostable waste, combustible waste, and inert waste are the primary sources of solid waste. Typically, urban solid waste consists of home, commercial, and construction debris. The term municipal solid waste refers to all trash created from residential, institutional, commercial, industrial, construction, and street sources that is collected by the local government.

Waste reduction, reuse, and recycling are essential components of a comprehensive approach to solid waste management that also prioritizes effective collection and safe disposal. There is still widespread public concern about the

state of the environment, despite the government's many initiatives to improve it. Improving management and organizational capacity and increasing people's participation in useful ways should be prioritized. Grugram district now faces a significant challenge that calls for expert-level planning and administration. For waste management programs to be successful, they need to prioritize public health, reduce trash, maximize recycling, and safeguard the environment.

Thousands of tons of municipal solid waste (MSW) are produced everyday as a result of the rapid industrialization and population boom in India, which has caused people to migrate from rural to cities. As the country works to become fully industrialized by 2020, it is producing more and more municipal solid waste (MSW) [Sharma and Shah, (2005), CPCB, (2004); Shekdar et al., (1992)]. The widespread presence of MSW is the result of insufficient collection and transportation efforts. Due to a lack of adequate facilities to treat and dispose of the increased amounts of MSW produced everyday in major cities, waste management is currently experiencing a critical juncture. When waste is disposed of without proper scientific methodology, it has a negative effect on the environment and human health [Rathi, (2006), Sharholy et al., (2005), Ray et al. (2005), Jha et al. (2003), Kansal, (2002), Kansal et.al.(1998), Singh and Singh (1998), Gupta et al. (1998)].

A classification system such as very polluted, polluted, and neutral was developed for the purpose of examining the impact that solid waste has on the environment in the area that was chosen. The fact that the respondent believes the environmental conditions to be unclean is evidence that the city is not very clean. Around sixty percent of respondents stated their opinion that Gurugram city is very polluted, and forty percent of respondents expressed their opinion that Gurugram city is polluted. Only one of the respondents held an opinion that was unaligned with the others on the environment. Many of those who participated in the survey recommended that the government take the required actions to cut down on pollution. According to the findings of the area-by-area investigation, the existing environmental condition of the city is extremely contaminated.

The accumulation of solid waste has quickly become one of the most pressing environmental issues on a global scale. Because it is exposed to many different types of pollutants, the environment in the area under study is rather poor. Table 1.1 contains a list of the environmental issues that are the root of the pollution problem.

Table 1.1
Environmental problems

Problems	Average Score	Ranks
Air pollution	50	1
Noise pollution	37	6
Loss of biodiversity	35	7
Green house effect	20	10
Solid waste problem	47	2
Desertification	31	9
Deforestation	33	8

Land pollution	41	4
Water pollution	45	3
Sewage problem	40	5

Source: Field survey, 2022

Significant environmental problems in the research region include air pollution, water pollution, noise pollution, deforestation, desertification, land pollution, sewage problem, etc. The following is a ranking of environmental issues as reported by respondents. Pollution of the air is the most pressing issue, followed by garbage in the water supply. Other major environmental issues include: land pollution (ranked fourth), sewage problems (ranked fifth), noise pollution (ranked sixth), biodiversity loss (ranked seventh), deforestation (ranked eighth), desertification (ranked ninth), and the greenhouse effect (ranked tenth). The solid waste issue is the second most pressing issue in the research area, after air pollution. Thus, the government must give solid waste management its full attention.

Damage to the environment from improperly managed municipal solid waste is a severe issue (Ejaz and Janjua, 2012). Waste, both in terms of volume and diversity, has been growing steadily as the industrial sector as a whole has expanded. Cities in India always have a lot of trash lying around in the streets, on the roads, and in the fields. Not everywhere has access to municipal waste collection services, and where it is available, it is often spotty and unreliable. Stray animals like dogs, rodents, and cats tamper with it, contaminating the water supply and the surrounding ecosystem as a whole and spreading disease. Water and pollutants are contaminated when solid waste is discharged directly or indirectly into water bodies without proper treatment to eliminate dangerous substances. Pollution and over use of natural resources are also major contributors to eco-system degradation. Solid waste contributes to habitat loss, decreased soil fertility, sewage problems, improper waste disposal, the after effects of poor recycling, offensive odors, and an increase in disease.

Damage caused by solid waste was analyzed using a factor analysis because it is the second most pressing issue in Gurugram city (Table 1.2). Bartlett's test for sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sample adequacy were used in the factor analysis. The calculated KMO score was 0.541, which is statistically significant. The use of component analysis to investigate the underlying structure of the many problems associated with solid waste was validated by passing Bartlett's test of sphericity. Variables having communalities above 0.5 were considered significant and included in the study.

Table 1.2
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.541
Bartlett's Test of Sphericity	Approx. Chi-Square	123.721
	Degrees of freedom	36
	Significance	.000

Source: Field survey, 2022

The communalities for each variable were analyzed to determine how much variance to include in the factor rotation. The results are displayed in the table below.

Table 1.3
Communalities

Factors	Initial	Extraction
Contamination of water	1.000	.587
Damage to eco system	1.000	.583
Degradation of flora and fauna	1.000	.503
Reduction of soil fertility	1.000	.851
Sewage problem	1.000	.553
Unclean waste dumping	1.000	.585
Effect of inefficient recycling	1.000	.504
Bad smell	1.000	.540
Increasing diseases	1.000	.557

Extraction Method: Principal Component Analysis

All of the variables had values more than 0.050, indicating that the factors accounted for a significant percentage of the variance. The Eigen values, relative explanatory powers, and factor loading for the 9 linear components detected in the data set are listed in Table 1.3.

Table 1.4
Rotated Component Matrix

Factors	Component			
	1	2	3	4
Contamination of water			.712	
Damage to eco system			.576	
Degradation of flora and fauna		.695		
Reduction of soil fertility				.915
Sewage problem	.726			
Unclean waste dumping		.566		
The effect of improper recycling			.701	
Bad smell	.726			
Increasing diseases		.725		
Eigen values	1.521	1.471	1.247	1.023
Percentage of variance	16.900	16.345	13.851	11.368
Cumulative percentage	16.900	33.245	47.097	58.464

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Factor 1 contains strong loadings for two dimensions: "sewage problem" and "poor odor." These dimensions accounted for almost 16% of the variance. Factor 2 had substantial loadings for three dimensions, namely "degradation of flora and fauna," "unclean waste dumping," and "growing diseases," with a variance of 16%.

Factor 3 explains 13% of the variance by having significant loadings on three dimensions: "water contamination," "environmental damage," and "the effect of incorrect recycling." Factor 4 has a substantial loading on soil fertility loss, which explains 11% of the variance. According to the present study, solid waste will cause foul odors, water contamination, sewage problems, increased disease, and soil fertility loss.

Conclusions

It is concluded that in the studied area, the rising amount and complexity of waste linked with the modern economy poses a major threat to ecosystems and human health. Every year, an estimated 11.2 billion tonnes of solid trash are collected around the world, with organic garbage decomposition accounting for around 5% of global greenhouse gas emissions. An estimated 11.2 billion tons of solid trash are collected each year around the world. Electrical and electronic equipment waste, which contains new and complicated hazardous compounds, is the fastest-growing waste stream in both industrialized and developing countries.

Poor waste management, which includes everything from a lack of collection infrastructure to ineffective disposal, pollutes the air, water, and land. Landfills that are open and unhygienic contribute to the contamination of drinking water and can cause infection and disease transmission. Debris dispersal pollutes ecosystems, and hazardous compounds from electronic trash or industrial junk place a strain on urban inhabitants' health and the environment.

For Sustainable solid waste management in Gurugram city, in the first place, waste minimization is the solution. Recovery of resources and energy from trash, as well as remanufacturing and recycling garbage into useable goods, should be the second alternative when waste cannot be avoided. Recycling saves a lot of money and resources.

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