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## EMPOWERING THE SOLID WASTE THROUGH HOLISTIC MANAGEMENT FOR SUSTAINABLE DEVELOPMENT

**Prof. ANAND PAWAR**

Dean, Faculty of Commerce &  
Head, Dept of Business Management

Dr. B. R. Ambedkar Open University, Hyderabad-500033 (TS) INDIA

Email: [dr.anandpawar@yahoo.com](mailto:dr.anandpawar@yahoo.com)

&

**Dr. V. VASUDHA**

Assistant Professor of Commerce

St. Ann's PG College for Women, Mehdiapatnam, Hyderabad (TS) INDIA

[Email-Id- v.vasudhasingh@gmail.com](mailto:v.vasudhasingh@gmail.com), Mob: 9573704990

**ABSTRACT:** *The human attitude of negligence and carefree has led to a situation of danger and threat to human life and environment at large. One of key negligence of human is towards municipal solid waste generation and its treatment which has led the whole world face the chaotic and menacing challenge and also led to ignorance of the notion of sustainable development. The generation of solid waste is a vital by-product of human activity. As a result, the per capita generation of million tons of solid waste is getting doubled every five years due to rapid urbanization, swift population growth, solid increase in industrialization, insufficient availability of resources and rise in earning capacity and living standards of the people. Further, the hasty increase in generation of solid waste and improper solid waste disposal and management has triggered a challenge to various economies of the world and human life at large. In view to tackle this challenge and threat, this article tries to present the current scenario of municipal solid waste generation, disposal and treatment from the global to national to state to local level perspective. This article also tries to exhibit a suitable flow of activities and pressurized source segregation in the best and holistic manner which can lead to efficient and wealthy solid waste management and might produce a numerous opportunity in multiple ways.*

**Keywords:** *Solid waste, improper disposal of solid waste, vital by-product, source segregation, holistic management, sustainable development.*

### INTRODUCTION

The generation of solid waste is a vital by-product of human activity. The daily routine of human life will lead to generation of solid waste. Speedy urbanization, rapid population growth, solid increase in industrialization has directed to momentous increase in generation of solid waste. The waste generated during the time of the early people or previous generations was relatively small and was mostly biodegradable in nature which was not a nuisance or a source of causing diseases. But in this modern world of present generation, due to high living standards and advancement in every sector has led to generation of waste in larger amounts which is mostly hazardous and non-biodegradable. The waste generated in this present generation is causing a lot of damage to the mother earth that is soil, water, air and wildlife habitat. The per capita generation of million tons of solid waste is getting doubled every five years.

The hasty increase in generation of solid waste has triggered a challenge to the human life i.e. the management of solid waste. Thus, it has become a chaotic concern of various economies. The management of solid waste is not the sole responsibility of the government but also the

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citizens of every country. Solid waste management must be the priority concern of every country to reduce the adverse effect on the environment and to protect the mother earth for the future generations. Solid waste management will be effective and operational only when there is a holistic participation of each and every member or citizen involved in generation, collection, transportation, disposal and treatment of solid waste. Holistic participation here implies that every person must actively engage themselves in proper solid waste management by attributing their concern and willingness to reduce, reuse and recycle the generated solid waste. Any person may use these recycled wastes as a join product or by-product to increase the worth of the waste product.

**CONCEPT AND SOURCES OF SOLID WASTE**

The term solid waste refers to unwanted and useless solid waste generated from human activities. In other words, solid waste is termed as any non-liquid waste, trash, leftover or garbage generated from the human activities. The solid waste is generated from various sources or numerous human activities. The following table shows the various components of solid waste on the basis of the source of the generation of the waste.

**Table- 1: Sources and Composition of waste**

Source of Waste Generated	Places	Composition of Waste
Residential	Independent houses, Apartments, and Gated communities	Kitchen waste, plant waste, paper and cardboard waste, clothes, metal, E-waste, plastics, pooja waste, hazardous waste and construction and demolition waste.
Industrial	All types of industries-micro, small, medium and large enterprise.	Hazardous waste, plastics, cardboards, metals, glass, textiles, E-waste etc.
Commercial	Malls, restaurants, hyper markets, grocery stores, hardware stores, hotels etc.	Food waste, paper and plastics, metals, e-waste, cardboards etc.
Institutions	Schools, colleges, training centers, government offices, hospitals.	Paper, cardboards, processing waste, hazardous waste, plastics etc.
Municipality	Parks, roads	Green and plant waste, construction and demolition waste.

Source: Google

**SOLID WASTE MANAGEMENT**

The term solid waste management refers to the various activities, actions and doings required to manage the generated solid waste from its source to the final disposal to reduce and eliminate the antagonistic effect on human life and the environment. The solid waste management practices are of heterogeneous in nature. The practices differ from one country to another country, one sector to another sector, one region to another region etc., as they may take different approaches which will be the best possible way in dealing with solid waste to condense and eradicate the destruction and threat to human life and environment. The most common method used by various countries in solid waste management is as follows:

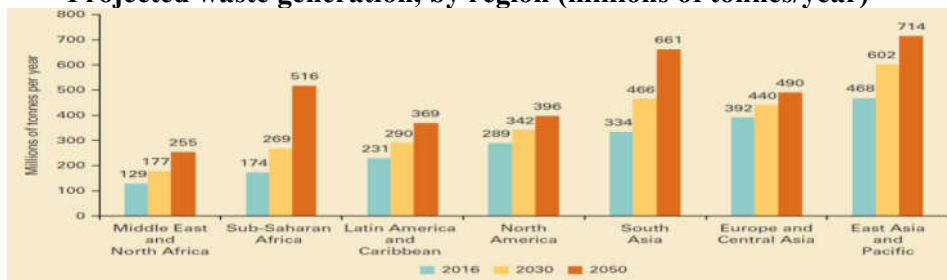


**SOLID WASTE MANAGEMENT AT GLOBAL LEVEL**

The world generates 2.01 billion tonnes of municipal solid waste annually, with at least 33 percent of that is extremely conventionally not managed in an environmentally safe manner. Worldwide, waste generated per person per day averages 0.74 kilogram but varies widely,

from 0.11 to 4.54 kilograms. However, they only account for 16 percent of the world’s population; high-income countries generate about 34 percent, or 683 million tonnes, of the world’s waste. In the forthcoming future, global waste is expected to rise to 3.40 billion tonnes by 2050, more than double population growth over the same period. The East Asia and Pacific region are generating most of the world’s waste, at 23 percent, and the Middle East and North Africa region is producing the least in absolute terms, at 6 percent. However, by 2050, the fastest growing regions like sub-Saharan Africa, south Asia, and the Middle East and North Africa, waste generation capacity expected to be more than triple, double, and double respectively.

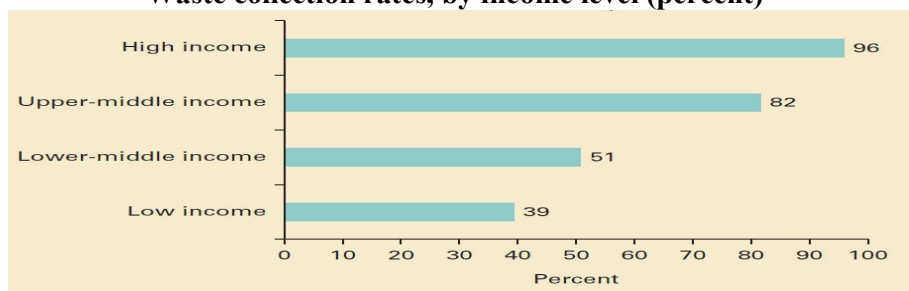
**Projected waste generation, by region (millions of tonnes/year)**



Source: What a Waste 2.0, World Bank Group.

Waste collection is a serious step in managing waste. Across regions, sub-Saharan Africa collects about 44 percent of waste while Europe and central Asia and north America collect at least 90 percent of waste.

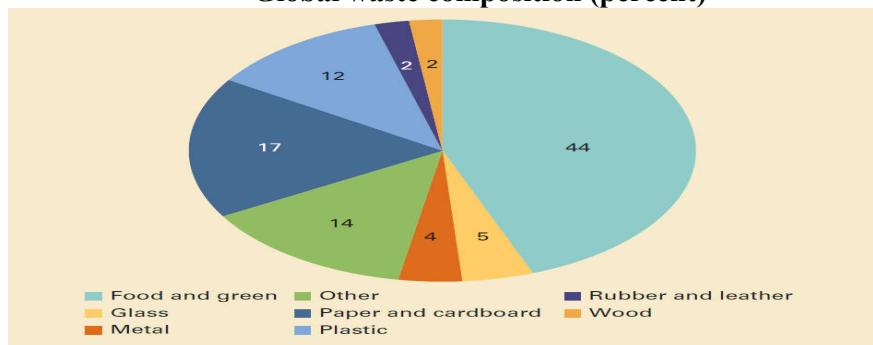
**Waste collection rates, by income level (percent)**



Source: What a Waste 2.0, World Bank Group.

Waste composition across the globe differs on the basis of the living standards, food habits, and income levels among the people. The higher the income and living standards of the people the more generation of non-biodegradable waste and vice-versa.

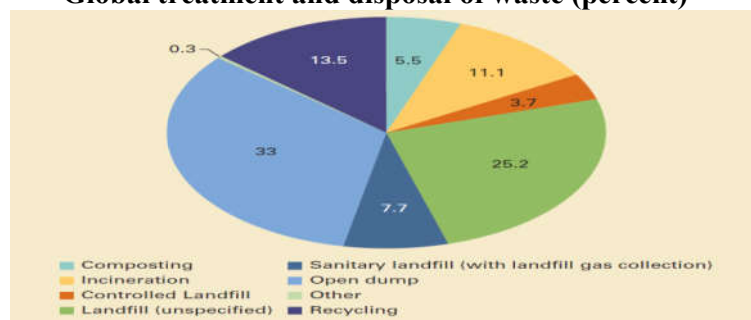
**Global waste composition (percent)**



Source: What a Waste 2.0, World Bank Group.

It is a misapprehension that technology is the solution to the problem of unmanaged and increasing waste. Globally, most waste is currently disposed of in some form of a landfill. Some 37 percent of waste is disposed of in some form of a landfill, 8 percent of which is disposed of in sanitary landfills with landfill gas collection systems. Open dumping accounts for about 31 percent of waste, 19 percent is recovered through recycling and composting, and 11 percent is incinerated for final disposal. Three regions openly dump more than half of their waste—the Middle East and North Africa, sub-Saharan Africa, and south Asia.

**Global treatment and disposal of waste (percent)**



Source: What a Waste 2.0, World Bank Group.

Based on the size of waste generated, its composition, and how it is managed, it is projected that 1.6 billion tonnes of carbon dioxide (CO<sub>2</sub>) equivalent greenhouse gas discharges were generated from solid waste treatment and disposal in 2016, or 5 percent of global emissions. This is determined primarily by disposing of waste in open dumps and landfills without landfill gas collection systems. Food waste accounts for nearly 50% of emissions. Solid waste-related emissions are anticipated to increase to 2.38 billion tonnes of CO<sub>2</sub>-equivalent per year by 2050 if no improvements are made in the sector. Financing solid waste management systems is a substantial challenge, even more so for ongoing operational costs than for capital investments, and operational costs need to be taken into account. Waste management is labour intensive and costs of transportation alone are in the range of \$20–\$50 per tonne. User fee models may be fixed or variable based on the type of user being billed. Typically, local governments cover about 50 percent of investment costs for waste systems, and the remainder comes mainly from national government subsidies and the private sector.

## A STEP TOWARDS CLEAN AND GREEN ENVIRONMENT

### a) Policies and Initiatives Taken By the Indian Government

Currently as per the information of municipal areas the country generates 1, 33,760 metric tonnes per day of municipal solid waste (MSW), of which only 91,152 TPD waste is collected and 25,884 TPD treated. The Ministry of Environment, Forest and climate change has notified the Municipal Solid Wastes (Management and Handling) Rules, 2000 for management of the municipal solid waste. The prominence is on management of the waste through a sustainable business model which includes segregation of municipal solid waste at source, door to door collection by involving waste collectors, processing of segregated waste in to useful products such as methane, compost, etc. The municipal authorities have been made responsible for setting up, operationalisation and coordination of the waste management system and for ensuring safe collection, storage, segregation, transportation, processing and disposal of plastic waste. The Ministry regularly provides financial assistance to create awareness on the various provisions of these Rules.

It has been observed that the waste processing and disposal facilities in majority of States are not working effectively. It is observed that after span of 2 years of notification of the Solid

Waste Management Rules, 2016; State policy and strategy for implementation of the Solid Waste Management Rules, 2016, has not been formulated by most of States/UTs. There is lack of coordination between UDDS, ULBs & State Pollution Control Boards and other concerned agencies, who are involved in Implementation of SWM Rules, 2016. It has been observed that most of the dumpsites are unscientific and operating without following SWM, Rules. The mixed MSW is dumped on dumpsites causing environmental & health hazards and often lead to open-fires. Besides, as per SWM Rules, 2016 Landfill sites should preferably be used for depositing inert waste and rejects. With an objective to develop clean and safe cities the government of India brought some initiatives under the Swachh Bharat Mission such as Liveability Index, Seven-star Rating and Swachh Survekshan. These three initiatives mainly focused on solid waste management and urban sanitation to improve the living standards of the people and make India a clean and safe place to live in.

**Municipal Solid Waste Management:** Status of the Solid Waste Management in the 16 States based on the information provided by the SPCBs & PCCs, is given below:

- Solid Waste Generation: 54417.385 TPD (tonnes per day)
- Solid Waste Collection: 45082.15TPD
- Treated I: 15386.81 TPD
- Land filled: 22904.70 TPD
- Total Landfill Sites operational: 21.

**b) Policies and Initiatives Taken By the Telangana Government**

As the State of Telangana moving toward its economic future, the amount of various types of solid waste, one of the most important by-products of urbanization & industrialization, is growing even faster than the rate we are anticipating. Generation of solid wastes is directly linked to economic development. As per the information provided by office of Commissioner & Director, Municipal Administration, Telangana State there are 73 Urban Local Bodies (ULBs) existing in Telangana State and among them, 12 Nos. are Class-I Municipalities. The total quantity of waste generated by Urban Local Bodies (ULBs) of Telangana has increased from 5455 MT/day in 2008 to 7871 MT/day in 2017. Whereas the quantity of waste processed has increased from 2481 MT/day in 2014 to 4895 MT/day in 2017.

Table -2: The process of solid waste management in Telangana

S.NO.	Parameters	Compliance Criteria
1	Collection of municipal solid wastes	House to House collection of MSW has been started in all the local bodies in the State. As per the information furnished by the Commissioner & Director of Municipal Administration 98% of households covered under door to door collection.
2	Segregation of municipal solid wastes	About 15% of households in the State are covered under source segregation.
4	Transportation of municipal solid wastes	In Hyderabad most of the MSW is transported in covered vehicles. In other municipalities the waste is transported in trucks covered with nets to avoid scattering.



5	Processing of municipal solid wastes	<ul style="list-style-type: none"> <li>• Compost plant established 20 municipalities</li> </ul> <p>The details of waste to energy plants set up in those states to produce energy</p> <ol style="list-style-type: none"> <li>19.8 MW Capacity at Jawahar nagar — Earth work for plant has started. It is expected to complete by March 2019.</li> <li>11 MW Capacity Chennaravulapally, Bibi Nagar— undergoing pre-commissioning activities.</li> <li>12 MW Capacity Permission for granting extension of time to agency (M/s. SVGPPL) for entering into PPA. with TSSPDCL is under examination of GHMC/</li> <li>The Government of Telangana have also entered MOU with Government of Japan through Clean/ Authority of Tokyo (CAT23) for establishment of Advance incineration plant at Warangal and for surrounding areas of GHMC and the studies are under process.</li> </ol>
6	Disposal of municipal solid wastes	<p>The Greater Hyderabad Municipal Corporation (GHMC) has constructed the sanitary landfill facility and operating the same.</p> <p>The rest of the ULBs are dumping the MSW in the existing dump sites.</p>

Source: TSPCB (Telangana State Pollution Control Board)

Initiatives taken by the Government of Telangana to improve efficiency in solid waste management are:

- **Swachh Auto Tippers:** 2000 Swachh Auto Tippers were launched across Hyderabad city for increasing the efficiency of House-to-House Collection of Wet & Dry Garbage. The introduction of these autos has seen an increase of 1200MT extra garbage being collected daily. The autos have aided removal of 1116 open garbage points across the city contributing to a cleaner Hyderabad.
- **Dry resource centers:** Dry waste collected by Swachh autos has a huge potential as recyclable waste. GHMC has 24 transfer stations wherein segregated waste is brought by Swachh auto tippers, dry resource centres can be facilitated at all these locations. We are partner with **ITC and Godrej** who are spending the 24 DRC’s centres and also involved in intensive segregating programme for dry resource and sanitation programme.
- **Organic composters:** Wet waste can convert to organic manure for use in our parks and road side greenery. Two thirds of the waste generated is wet waste. GHMC has installed about 3 small composting units in its parks so far. GHMC introduced 7 organic composter centres in many hotels and companies, current partners are Google and Ramkey.

**ROLE OF WASTE GENERATORS TOWARDS HOLISTIC SOLID WASTE MANAGEMENT**

Solid waste management must be the priority concern of every country to reduce the adverse effect on the environment and to protect the mother earth for the future generations. Solid waste management will be effective and operational only when there is a holistic participation of each and every member or citizen involved in generation, collection, transportation, disposal and treatment of solid waste. Holistic participation here implies that every person must actively engage themselves in proper solid waste management by attributing their concern and willingness to reduce, reuse and recycle the generated solid waste. Any person may use these recycled wastes as a join product or by-product to increase

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the worth of the waste product. Therefore, to understand and analyse the role of waste generators on holistic solid waste a management a primary research was conducted to find out their opinion on the same.

#### **REVIEW OF RESEARCH AND LITERATURE**

**Lilliana Abarca Guerrero, Ger Maas and William Hogland (2012)** in their study they made an attempt to evaluate the stakeholder's role in solid waste management and to scrutinize influential factors on the system in 30+ urban areas in 22 developing countries of 4 continents. The study concluded the list of wide-ranging lists of stakeholders that are linked with solid waste management and various factors causing the failure of solid waste management system.

**Rajendra Kumar, George and Mayuri Chabukdhara (2012)** The objective of the research was to study the shifting trend in municipal solid waste quantities and characteristics in major urban masses in India and assess the present practices and need for appropriate technology in municipal solid waste management-highlights and limitations. They concluded that there must be change in Municipality operations and pressure on source segregation. A scope for further study was suggested on heterogeneous nature of municipal solid waste.

**Vaibhav Srivastava, Ismail, Pooja Singh and Pratap Singh (2014)** The study engrossed on to supervise the challenges and opportunities tackled during urban solid waste management in developing countries like India and listed out various factors leading to rapid acceleration of solid waste generation. It concluded by articulating if MSW is managed in a proper way then it not only mitigates the undesirable effects but it could help in meeting the call of ecosystem and economy.

**Neha Gupta, Krishna Kumar Yadav and Vinit Kumar (2015)** In their study it was aim to present an outline of current status of solid waste management practices in India and the competent authorities responsible for efficient management of municipal solid waste. It concluded by emphasis on conception of management and storage facilities by municipal authorities in such a manner that they do not create unhygienic and unsanitary conditions in the environment.

**Sadef, Nizami, Batool, Chaudary, Ouda, Asam, Habib, Rehan, and Demirbas (2016)** This study was conducted in Lahore, the second largest city in Pakistan to determine the waste-to-energy (WTE) and reutilizing value of municipal solid waste (MSW) for developing an integrated solid waste management (ISWM) system. This study concluded that the WTE technologies and waste recycling practices can condense the momentous volumes of waste going into landfill by translating them into numerous forms of energy and valuable materials. The recovered materials and energy will not only produce revenue to fund waste management activities but also protect the River Ravi from waste pollution. But, the real selection of most practicable technology involves further in-depth environmental, socioeconomic, and technical assessments using the life cycle assessment (LCA) tool.

**Ashwani Kumar, Gaurav Dixit and Dolonchapa Prabhakar (2016)** The research was done to provide a deeper outline for factors, matters that relate to Municipal Solid Waste Management (MSWM) in Punjab region and to analyze the various key factors that play dynamic role in improving productivity of municipal waste management. The study recommended proper collection centers are required for waste collection and more focus must be on disposal of waste by evolving wide range of landfills and maintain the existing land filling methods. Further efforts of reducing municipal solid waste must be done through technological solution of disposal and collection and increases common public sensitivity through more education and awareness on municipal solid waste.

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**Brijesh Kumar Pandey, Savita Vyas, Mukesh Pandey and Anurag Gaur (2016)** The study was conducted to show municipal solid waste as a budding source of renewable energy. In this process of proving the above thought, an effort has been made to provide a limited way of power generation that derives power from municipal solid waste. This study proposed adoption of various technology which rest on many aspects such as geographical patterns, type of waste produced, demographical patterns of site and living standard of people. So, it is likewise not practicable to come up with a general capital investment of definite technology.

**Ramachandra, Bharath, Gouri Kulkarni and Sun Sheng Hand (2017)** The exploration was led in Greater Bangalore in 1967 households in direction to know the solid waste generation, composition, GHG emissions and its treatment by the competent authorities. Various demographic factors were considered for the study and relationship between the demographic and socioeconomic factors and waste generation was estimated. Finally, the study proposed setting up of decentralized waste treatment centers and enactment of purposeful elements in each stage of solid waste management process.

**Salma Sultan (2017)** The research was done to illustrate a synopsis of the prevailing municipal solid waste management practices from the universal to national and national to local level perceptions in locus to the Indian cities. Specific prominence has also been put on to assess the inclusive solid waste generation and management services practiced by the Indian municipalities. It concluded that in spite of various constructive initiatives taken by Indian government the state of solid waste management is far-off from acceptable level and there is an earnestness to discourse the issue or downsides of solid waste management by including every single solid waste generator.

**Prathibha Ganesan (2017)** This study was based on a sample survey of 175 households located in the landfill sites connected with two Municipal Corporations, viz. Thrissur and Kochi, Kerala. It observed some issues accompanying with the centralized waste management system and the ways in which urban local bodies tackled the struggle against centralized waste management. It clinched that strong substitute methods like decentralized waste management are preferred when the struggle is strong, and where the struggle is feeble there is a predisposition to maintain the centralized waste management system.

#### **NEED AND IMPORTANCE OF THE STUDY**

The present global world which is developing at rapid stage along with degradation of environment and natural resources. This has led to ignorance of the notion of sustainable development. Proper solid waste management will lead to economic and environment sustainability with no threat to human and wild life. The waste generated during the time of the early people or previous generations was relatively small and was mostly biodegradable in nature which was not a nuisance or a source of causing diseases. But in this modern world of present generation, due to high living standards and advancement in every sector has led to generation of waste in larger amounts which is mostly hazardous and non-biodegradable. The waste generated in this present generation is causing a lot of damage to the mother earth that is soil, water, air and wildlife habitat. Thus, to address the issue of environmental problems and threat to human life, it is necessary to take an initiative to manage the solid waste in the best possible way to reduce the negative effect on earth and earth life. Lastly proper solid waste management, reusing, recycling, reducing the generated solid waste into some wealth will conserve our planet earth and give the legacy of the natural beauty to the future generation which is a duty and responsibility of present generation.

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## OBJECTIVES OF THE STUDY

The objectives of this study are:

1. To present the overview of solid waste management and the policies of the Central and State Government on solid waste management; and
2. To analyze the opinion of waste generators on holistic solid waste management for sustainable development.

## HYPOTHESES

1. Level of education influences the perception and attitude of public towards holistic solid waste management.
2. Gender plays a significant role in managing the waste in the most efficient and effective way to reduce the effect of improper solid waste management.

## SCOPE AND PERIOD OF THE STUDY

The study explores, exclusively the legal and institutional framework of solid waste management of Central and Telangana Government. It concentrates on the composition of solid waste. It includes the study of current practices of solid waste management among the households. Time factor is limited to 3 months (data collected during) and is confined to one locality in Hyderabad.

## RESEARCH METHODOLOGY

This study is based on both primary data and secondary data. For the present study the sample was selected on the basis of purposive sampling technique and the sample was confined to household solid waste management. For the purpose of collecting primary data, a structured questionnaire was designed to gather information about solid waste management. It has 5 classes of questions covering demographic factor, collection of waste, segregation of waste, disposal of solid waste and awareness about solid waste management. A total number of 23 questions were designed to examine and conclude on the aforesaid factors. The questionnaire included Likert scale technique, multiple responses and dichotomous questions. The questionnaire was sent through an online survey link through Google forms to 150 households. Among 150 households only 110 responded to the survey. Valid responses which can be taken for the analysis were found to be 100 and 10 were found invalid. Finally, the sample size considered for the present study is 100 households as respondents. The secondary data was gathered from various authenticated sources such as research journals, newspapers, news applications, websites, etc.

## DATA ANALYSIS AND INTERPRETATION

**Hypothesis - 1:** Level of education influences the perception and attitude of public towards holistic solid waste management, for this hypothesis ANOVA test is used to establish the relationship between the education level and the awareness of solid waste management. ANOVA measures the mean variance among more than two independent samples.

*H<sub>0</sub>* = Level of education doesn't influence the perception and attitude of public towards holistic solid waste management.

*H<sub>1</sub>* = Level of education influence the perception and attitude of public towards holistic solid waste management.

Table -3: Relationship between education level and awareness and perception of respondents

ANOVA					
		Sum of Squares	df	Mean Square	F
Perception towards improper solid waste management and environment disasters	Between Groups	1.390	4	.348	.537
	Within Groups	61.520	95	.648	
	Total	62.910	99		
Willingness to participate in holistic solid waste management	Between Groups	1.775	4	.444	2.645
	Within Groups	15.935	95	.168	
	Total	17.710	99		
Willingness to take incentives for solid waste management	Between Groups	1.171	4	.293	1.179
	Within Groups	23.579	95	.248	
	Total	24.750	99		
Viewpoint in "Proper solid waste management will lead to various opportunities like employment "	Between Groups	3.194	4	.798	.887
	Within Groups	85.556	95	.901	
	Total	88.750	99		
Willingness to generate best out of waste	Between Groups	.716	4	.179	.250
	Within Groups	68.034	95	.716	
	Total	68.750	99		
				Sig.(p value)	
Respondents perception towards improper solid waste management and environment disasters	Between Groups			.709	
	Within Groups				
	Total				
Respondents willingness to participate in holistic solid waste management	Between Groups			.038	
	Within Groups				
	Total				
Respondents willingness to take incentives for solid waste management	Between Groups			.325	
	Within Groups				
	Total				
Respondents' viewpoint in "Proper solid waste management will lead to various opportunities like employment "	Between Groups			.475	
	Within Groups				
	Total				
Respondents willingness to generate best out of waste	Between Groups			.909	
	Within Groups				
	Total				

Source: Primary data

$H_0$ : There is no difference between the perception towards improper solid waste management and environment disasters among respondents of different education levels.

$H_1$ : There is a difference between the perception towards improper solid waste management and environment disasters among respondents of different education levels.

The above table shows the analysis of the perception towards improper solid waste management and environment disasters among respondents of different education levels. The statistic shows that mean square between the groups is 0.348, within the group is 0.648. The F-value is 0.537 & the asymmetric significance value (P-value) is 0.709. According to the statistic table, the P-value is insignificant because it is greater than the level of significance at

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5% ( $P > 0.05$ ). Hence the alternative hypothesis can be rejected. And null hypothesis can be accepted.

$H_0$  = *There is no difference between the perceptions towards Willingness to participate in holistic solid waste management and education level of the respondents.*

$H_1$  = *There is a difference between the perceptions towards Willingness to participate in holistic solid waste management and education level of the respondents.*

The above table shows the analysis of perception towards Willingness to participate in holistic solid waste management and education level of the respondents. The statistic shows that mean square between the groups is 0.444, within the group is 0.168. The F-value is 2.645 & the asymmetric significance value (P-value) is 0.038. According to the statistic table, the P-value is significant because it is lesser than the level of significance at 5% ( $P > 0.05$ ). Hence the alternative hypothesis can be accepted and null hypothesis can be rejected.

$H_0$  = *There is no difference between the perceptions towards Willingness to take incentives for solid waste management and education level of the respondents.*

$H_1$  = *There is a difference between the perceptions towards Willingness to take incentives for solid waste management and education level of the respondents.*

The above table shows the analysis of perception towards Willingness to take incentives for solid waste management and education level of the respondents. The statistic shows that mean square between the groups is 0.293, within the group is 0.248. The F-value is 1.179 & the asymmetric significance value (P-value) is 0.325. According to the statistic table, the P-value is insignificant because it is greater than the level of significance at 5% ( $P > 0.05$ ). Hence the alternative hypothesis can be rejected and null hypothesis can be accepted.

$H_0$  = *There is no difference between the perceptions towards a Viewpoint on "Proper solid waste management will lead to various opportunities like employment" among gender group of the respondents.*

$H_1$  = *There is a difference between the perceptions towards a Viewpoint on "Proper solid waste management will lead to various opportunities like employment" among gender group of the respondents.*

The above table shows the analysis of perception towards a Viewpoint on "Proper solid waste management will lead to various opportunities like employment" among education level of the respondents. The statistic shows that mean square between the groups is 0.798, within the group is 0.901. The F-value is 0.887 & the asymmetric significance value (P-value) is 0.475. According to the statistic table, the P-value is in significant because it is greater than the level of insignificance at 5% ( $P > 0.05$ ). Hence the alternative hypothesis can be rejected and null hypothesis can be accepted.

$H_0$  = *There is no difference between the perceptions towards Willingness to generate best out of waste and education level of the respondents.*

$H_1$  = *There is a difference between the perceptions towards Willingness to generate best out of waste and education level of the respondents.*

The above table shows the analysis of perception towards Willingness to generate best out of waste and education level of the respondents. The statistic shows that mean square between the groups is 0.179, within the group is 0.716. The F-value is 0.250 & the asymmetric

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significance value (P-value) is 0.909. According to the statistic table, the P-value is insignificant because it is greater than the level of insignificance at 5% ( $P > 0.05$ ). Hence the alternative hypothesis can be rejected and null hypothesis can be accepted.

**Hypothesis -2:** Gender plays a significant role in managing the waste in the most efficient and effective way to reduce the effect of improper solid waste management, for this hypothesis ANOVA test is used to establish the relationship between the gender and the contribution of individuals to solid waste management. ANOVA measures the mean variance among more than two independent samples.

$H_0$  = Gender doesn't play a significant role in managing the solid waste in the most efficient and effective way.

$H_1$  = Gender plays a significant role in managing the solid waste in the most efficient and effective way.

Table -4: Relationship between gender and contribution to solid waste management

ANOVA					
		Sum of Squares	df	Mean Square	F
Respondents willingness to participate in holistic solid waste management	Between Groups	.019	1	.019	.104
	Within Groups	17.691	98	.181	
	Total	17.710	99		
Respondents willingness to participate in generating best out of waste	Between Groups	.066	1	.066	.094
	Within Groups	68.684	98	.701	
	Total	68.750	99		
					Sig.
Respondents willingness to participate in holistic solid waste management		Between Groups			.747
		Within Groups			
		Total			
Respondents willingness to participate in generating best out of waste		Between Groups			.759
		Within Groups			
		Total			

Source: Primary data

$H_0$  = There is no difference between the willingness to participate in holistic solid waste management among the gender of the respondents.

$H_1$  = There is no difference between the willingness to participate in holistic solid waste management among the gender of the respondents.

The above table shows the analysis of perception towards a **willingness to participate in holistic solid waste management** among gender group of the respondents. The statistic shows that mean square between the groups is 0.19, within the group is 0.181. The F-value is 0.104 & the asymmetric significance value (P-value) is 0.747. According to the statistic table, the P-value is in significant because it is greater than the level of insignificance at 5%

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( $P > 0.05$ ). Hence the alternative hypothesis can be rejected and null hypothesis can be accepted.

$H_0$  = *There is no difference between the willingness to participate in generating best out of waste among the gender of the respondents.*

$H_1$  = *There is no difference between the willingness to participate in generating best out of waste the gender of the respondents.*

The above table shows the analysis of perception towards **willingness to participate in generating best out of waste** among gender group of the respondents. The statistic shows that mean square between the groups is 0.066, within the group is 0.701. The F-value is 0.094 & the asymmetric significance value (P-value) is 0.759. According to the statistic table, the P-value is in significant because it is greater than the level of insignificance at 5% ( $P > 0.05$ ). Hence the alternative hypothesis can be rejected and null hypothesis can be accepted.

### RESEARCH FINDINGS

Following are the major finding emerged from this study:

1. This study disclosed that at the moment, several countries across the globe and exclusively developed and developing countries has awoken and recognized the novel and threatening issue of solid waste management as a serious problem to be tackled and are scheduling out for proper solid waste management to endorse and achieve sustainable development. The study also revealed that the current practices of solid waste management has few drawbacks like lack of sophisticated technology, financial and other resources and cooperation between general public and authorities.
2. As various economies of the world the Indian government too recognized the issue of solid waste management and its threat in the last decade and took various initiatives to improve the efficiency of solid waste management but didn't reach to the efficient target due to lack of coordination between various levels of authorities. Under the policy of Indian government, the state government of Telangana published solid waste management policy in October 2018 for the effective implementation of "Solid Waste Management Rules," 2016 and outspreading necessary support to urban local bodies due to high density of population in urban cities. By taking various initiatives in solid waste management the Telangana state is still in drive to reach 100% effective solid waste management.
3. The main objective of the study was to enquire and analyse the opinion of the waste generators (households) on holistic solid waste management and to assess and exhibit the current status of solid waste management. From the study findings, education level has no significant relationship on awareness and perception about solid waste management. Thus, it would be better or safe to conclude that there is a negative relationship on the above set factors.
4. Putting into the perspective of gender on contribution to solid waste management, the study established that gender has an insignificant relationship with contribution to solid waste management. The study also found out that gender has a positive relationship with the willingness to take incentives to participate in solid waste management. Thus, it is safe to conclude that gender does not influence solid waste management, but, if incentives are given, gender might have a positive relationship in solid waste management.



**SUGGESTIONS**

From the research findings it has been found that considering that, it is recommended that the government should devise policies to implement or encourage the varied measures to achieve efficient and competent holistic solid waste management. The various economies of the world should derive towards an initiate which will make every bit of waste a raw material for a finished product. The government must integrate the Annapurna scheme with SWM RULE through a barter system of food for plastic by installing a coupon system-AI like weight weighing machine. The government, local authorities and waste generators must pressurize on segregation of domestic waste at source to facilitate effective and efficient treatment and disposal of waste. Thus, source segregation will facilitate collection of waste on different days via different collectors on different days on the basis of segregation. For prohibiting improper disposal of waste, local authorities must identify open dumping area and its owners and insist them in construction of boundary walls and the municipality must remove public municipal or dustbins to avoid littering of waste. The above practices might lead to scope of student volunteers and employment generation of rural and urban women which will lead to empowerment of women along with nation empowerment through empowering the solid waste.

**Opportunities Out of Waste**

Solid waste is an important by product of human life and activity which needs to be treated as a prospect in order to gain in terms of environmental protection, employment generation and monetary benefits. Management of solid waste through a proper flow of activities in the best and holistic manner may lead to efficient and prosperous solid waste management which might create a numerous opportunity in multiple ways. The below flow chart shows one of the models which leads to holistic management of solid waste.



Lastly proper solid waste management, reusing, recycling, reducing the generated solid waste into some wealth will conserve our planet earth and give the legacy of the natural beauty to the future generation which is a duty and responsibility of present generation.

**Scope for Further Research**

Research is never ending interrogation; hence future research can be focused on the collector’s perspective. A comparative study also can be taken up to inquire about the difference among the states and their initiative in the national interest. A probe can also be focused on industrial and commercial solid waste management.

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