

## A Study on Waste Management Practices in North Bengaluru

\* Priya Sharma  
 \*\* Pramod Kubsad  
 \*\*\* Kalakamma  
 \*\*\* Kumari Shimpi  
 \*\*\*\* Mohamad Irfan Wani  
 \*\*\*\*\* Savitha Kulkarni

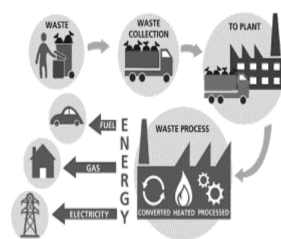
### Abstract

Solid Waste Management has become one of the major issues in India. Bengaluru city of India is facing serious problems related to environmental degradation and public health risk due inefficient ways of managing the Municipal Solid Waste (MSW) and also the uncollected disposal of waste from garbage bins, streets and other public areas. In order to prevent the damage on earth's ecosystem and to set a quality life for all living beings, humans must manage their waste and recycle the waste effectively and efficiently. This study aims to know the regular practice and waste disposal behaviour among the people living in Urban North Bengaluru. The descriptive study has been conducted using various tools and we have also developed a model of Smart Bin using Raspberry Pi 3 Model B, Ultra-Sonic Sensor (HC-504) and Jumper wires for Municipal Solid Waste Management. The availability of resources for waste collection and reusing is having more impact on the success of Waste Management and thus there is need for better resources for managing waste and smart bin can be one of the effective resource and an effective way to manage the collection of waste and overflow of garbage bins.

**Keywords:** Municipal Solid Waste management, availability of waste collection resources, segregation, Initiatives, waste reduction, SMTP (Simple Mail Transform Protocol), Raspberry Pi 3 Model B, Ultra-Sonic Sensor (HC-SR04), Jumper Wires

### Introduction

Bengaluru is located in the southeast of India. The term waste refers to all kinds of waste, whether it is generated during extraction of raw materials, processing of raw materials, consumption of final products or other human activities, including municipal, agricultural and social. Waste management and waste disposal includes all the activities such as collection, transportation, treatment and disposal of waste from its inception to the final disposal. Presently, Bengaluru does not have any scientific treatment method facilities for solid waste generated by municipal and industries and this has led to the development of several illegal and unauthorized dump sites in Bengaluru. The Bruhat Bengaluru Maha Paalike (BBMP) is not able to collect the waste on daily basis due to insufficient vehicles and working labors, in addition to it there are no sufficient dustbins on the road side in north Bengaluru. It has been observed by the localities that the BBMP is collecting domestic solid waste from the house weekly once. In few places, dustbin is available, but very far from the houses. Though used most of time the BBMP workers are not working effectively i.e. emptying the bin due to various constraints. This has led to overflowing of garbage containers in north Bengaluru.



- \* Student, Faculty of Management and Commerce, M.S. Ramaiah University of Applied Sciences, Bengaluru  
 \*\* Student, Faculty of Management and Commerce, M.S. Ramaiah University of Applied Sciences, Bengaluru  
 \*\*\* Student, Faculty of Management and Commerce, M.S. Ramaiah University of Applied Sciences, Bengaluru  
 \*\*\*\* Student, Faculty of Management and Commerce, M.S. Ramaiah University of Applied Sciences, Bengaluru  
 \*\*\*\*\* Student, Faculty of Management and Commerce, M.S. Ramaiah University of Applied Sciences, Bengaluru  
 \*\*\*\*\* Assistant Professor, KLS Institute of Management Education and Research, Belagavi

Overflowing waste bins are an epitome breeding ground for bacteria, insects and vermin. The flies that visit the garbage are also the same flies that roam around your lunch buffet and drop their off springs on your plate. This increases the risk which causes typhoid fever, food poisoning, enteric fever, gastroenteritis, and other major illnesses. These overflowing of bins also leads to air pollution which in turn causes various respiratory disorders.

This is a high risk for the waste collection staff. The risks of picking up and handling overflowing garbage include infections, chronic diseases and accidents. The direct contact with waste can result in skin and blood infections through infected wounds, various illnesses resulting from the bites of animals feeding on the waste.

Besides causing all sorts of health and environmental issues, overflowing garbage is a public nuisance and eyesore BBMP annually spending around 250 crores on solid waste management towards salaries for 3197 Pourakarmikas.

### 1.3 World Scenario (Solid Waste Management)

Municipal solid waste management it's becoming a global challenges increasing population especially in developing countries due to unprecedented and irreversible urbanization and Industrialization. In 2016, the waste generated amounted to 2.01 billion tonnes due to rapidly increasing the population and urbanization, annual waste generation is expected to increase by 70% from 2016 levels to 30.40 billion tonnes in 2050.

### 1.4 Solid Waste Management in India

Municipal solid waste management is a major environmental issue in India. Over 377 million urban people live in 7,935 towns and cities and generate 62 million tonnes of municipal solid waste per annum. Urban India is world's third largest garbage generator and by 2050 waste is expected to rise to 436 million tons up.

### 1.5 Solid Waste Management in Karnataka

According to information accessed from Central Pollution Control Board (CPCB) it was reported that as on January 2019, Karnataka generated 10,000 tonnes waste every day, of which only 3,200 tonne (32%) was processed. In fact, Karnataka has the worst track record with respect to solid waste processing as compared to any other state in southern part of India. In 2015, the Union Minister for Urban Development, M Venkaiah Naidu urged the mayors of municipality to curb "improper and unscientific handling of waste".

### 1.6 Solid Waste Management in Bengaluru

Bengaluru is located in the southeast of India state. It is situated in 12.97N 77.56E and covers an area of 2.190 square kilometres at an average elevation of 920 meters. Currently, Bengaluru city generates around 5000MT/ day of MSW at an average of 5.0 kg/day/per capita with a population of 10.18 million. Presently the Bruhut Bengaluru Mahanagara Palike (BBMP), the agency vested with responsibility of collection and disposal of solid waste in Bengaluru, at presently only 10% of the waste is recycled. Going by the present trend of increase in the quantity of waste the waste quantity projected to increase to in the next 20 years. The climate of Bengaluru being very modest, the rates of decomposition of organic waste is slow. Annually about 250 crore is spent on solid waste management towards salaries for 3197 Pourakarmikas by BBMP directly and for 18562 Pourakarmikas through contractors who performs door-to-door collection. There are no clear plans to enhance their efficiency. Presently, Bengaluru does not have any scientific treatment method facilities for solid waste generated by municipal and industries and this has led to the development of several illegal and unauthorized dump sites in Bengaluru.

**Table 1.1 A Composition of municipal solid waste at different stages**

Components (%)	Street bin, before rag picking	Street bin, after rag picking	Dump site	Bengaluru overall
Fermentable	65	78	70	72
Paper	8	4	11.4	11
Miscellaneous	12	15	8.7	1.9
Glass	6	1	0.5	1.4
Polythene/Plastics	6	1.9	9.1	6.2
Metals	3	0.1	0.3	1
Dust and sweepings	NA	NA	NA	6.5



Table 2.1 Wards and Information of Wards

Ward Name	BBMP Zone Name	BBMP Division
Ganga Nagar	East	Hebbal
Nagavara	East	Sarvajna Nagar
Mattikere	West	Malleshwaram
HAL Airport	Mahadevapura	K.R Puram
Kodigehalli	Yelahanka	Byatarayampura
Jalhalli	Rajrajeshwarinagar	Yeshwantpura
Malleshwaram	West	Malleshwaram
Mathikere	West	Malleshwaram
Vidyaranyapura	Yelahanka	Byatarayanapura
Sanjay Nagar	East	Hebbal

### 2.2.2 Data Analysis and Interpretation Respondents Profile

It consists of demographic profile of the respondents, mainly here only Gender has taken into consideration for the study purpose.

Table 2.2 Frequency of Gender

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	98	51.9	52.1	52.1
	Female	90	47.6	47.9	100.0
	Total	188	99.5	100.0	
Missing	System	1	.5		
Total		189	100.0		

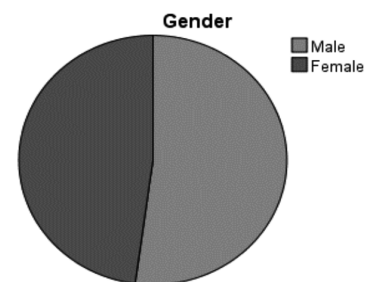


Fig.1

The figure of gender of the respondents that are requested for the research. There were 52.1% male and 47.9% female. The participation of both the gender is almost equal in the research, so it is vital information as we are able to assess the views and opinions of both of them and analyses their views.

## 3 Discussion

### 3.1 Statistical Tools

Using Statistical Package for Social Sciences (SPSS) for analysis of data is discussed. Further using tools like Reliability test, Frequency Distribution, Descriptive Statistics, Factor analysis, Correlation and Regression analysis were performed to finalize the results.

### 3.2 Reliability Analysis

The cronbach alpha value greater than 0.80 means that the information is credible for further study.

### R Square

In this case the R shows that the independent variables are 69.8% predicting the Success of Waste Management

TABLE 3.1 ANOVA

ANOVA					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	42.271	3	14.090	55.078	.000b
Residual	44.514	174	.256		
Total	86.785	177			
Dependent Variable: Success of waste management					
Predictors: (Constant), Availability of resources, Initiatives, Segregation					

The ANOVA table is explaining the variance that is brought in success of waste management with the help of independent variables considered in the study. The 42.271 out of 86.785 is explained by the 3 variables (Availability of resources, Initiatives & Segregation). Some portion is explained by other variables which we have not included in the research project. The significance (p-value) value is below 5% that is showing that the model is significant and a good fit for exploring the relationship that is present amongst the variables.

TABLE 3.2 Coefficients

Coefficients					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.250	.173		1.440	.152
Segregation	.161	.064	.167	2.532	.012
Initiatives	.096	.045	.119	2.140	.034
Availability of resources	.566	.068	.557	8.351	.000
Dependent Variable: Success of waste management					

The coefficient table shows the regression line that will be formed based on the data that has been analyzed. The significance value for Segregation, Initiatives and availability of resources are below 0.05 and when the p value is less than 0.05 that means we reject the null hypothesis and accept the alternative hypothesis. The beta values are the one that show the rate of change so it is evident that a change of 1 in segregation will bring out about 0.161 change in success of waste management and for other two variables the change of 1 in Initiatives and availability of resources will bring out about 0.96 and .566 respectively.

### Smart resource to manage the collection of waste (Smart Dustbin)

To give the alert signal to concerned authorities when the garbage container is full. It helps in controlling the overflow of garbage.

### Conclusion

This study is contributing towards identifying the problem in waste management system in Urban North Bengaluru. The study includes various research papers to identify the current scenario and methods used for waste management.

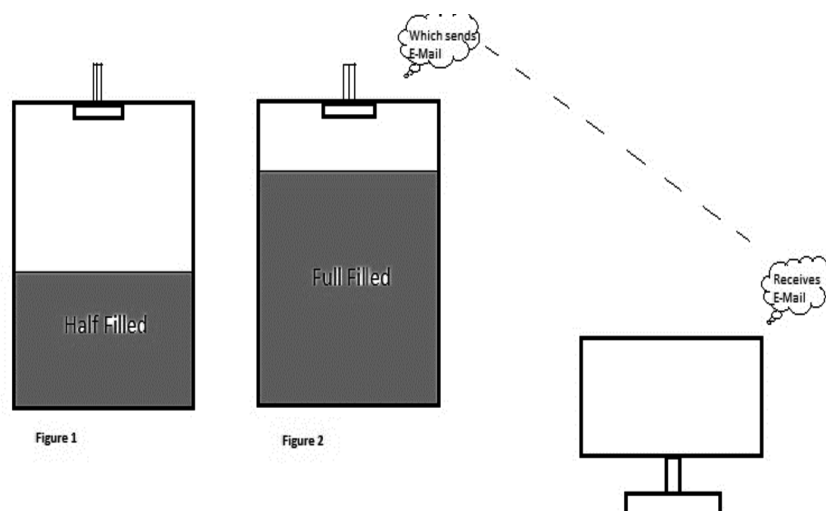
There is a significant impact of segregation, initiatives take by formal and informal sectors and availability of resources on success of waste management. The final conclusion can be made from coefficient table is that there is a significant impact of segregation, Initiatives take by formal and informal

Sectors and availability of resources on success of waste management. The factor that is having highest impact is availability of resources for waste collection and disposal having the higher value that is .566 than other variables Segregation and Initiative that is .161 and .096 respectively which shows that Availability of resources for waste collection and disposal is having the higher impact on success of waste management and thus smart resources for waste collection and disposal should be developed which will not only solve the problem but will result in increased efficiency and effectiveness of managing the waste.

The suitable model has been developed to manage overflow of the garbage container. Here we have used Raspberry Pi 3 Model B, Ultra-Sonic Sensor (HC-504) and Jumper wires.

The Raspberry Pi 3 Model B is used for the purpose of connecting to the Ultra-Sonic Sensor (HC-504) with the use of Jumper wires and is used for the coding platform, Python 3 has been used for the coding purpose and also the usage of SMTP (Simple Mail Transform Protocol) which is used for sending the E-Mail to the authorised people when the dustbin is full.

The Ultra-Sonic Sensor (HC-504) is used for the measuring the distance. Ultra-Sonic sensor is placed at the top of the dustbin which will measure the stature of the dustbin. Ultra-Sonic sensor is set at a threshold of 10cm. Once the threshold matches the given criteria Ultra-Sonic sensor will use SMTP to send E-Mail to the authorized people until they empty the Dustbin (Repeated time for sending the E-Mail to authorized person is set for 1 hour) and the usage of Jumper wires is for connecting the Raspberry Pi 3 Model B to the Ultra-Sonic Sensor (HC-504).



## References

- Annepu, R.K., 2012. Sustainable solid waste management in India. *Columbia University, New York*, 2(01).
- Balasubramanian, M. & Birundha, V.D. (2011) Municipal solid waste management in India, *Productivity*, Vol. 51(4) 308.
- CPCB (2015) The national action plan for municipal solid waste management. Central Pollution Control Board, New Delhi.
- Ganeshwaran, P. & Shri, S.D., 2015. A solid waste management in Coimbatore city. *Journal of Engineering and Applied Sciences* 14, 1819-6608.
- Joshi, R. and Ahmed, S., 2016. Status and challenges of municipal solid waste management in India: A review. *Cogent Environmental Science*, 2(1), p.1139434.
- Kumar, S., Smith, S.R., Fowler, G., Velis, C., Kumar, S.J., Arya, S., Rena, Kumar, R. and Cheeseman, C., 2017. Challenges and opportunities associated with waste management in India. *Royal society open science*, 4(3), p.160764.

- Medina, M. (2010) Solid Wastes, Poverty and the Environment in Developing Country Cities: Challenges and Opportunities, Working paper, World Institute for Development Economics Research, No. 2010, 23
- Sehker, M. and Beukering, P.V. (1998) Integrated Solid Waste Management: A Perspective on Bangalore (India), CREED Working Paper Series No. 24, pp.277–295.
- Sharholly, M., Ahmad, K., Mahmood, G. and Trivedi, R.C. (2005) 'Analysis of municipal solid waste management systems in Delhi – a review', in book of Proceedings for the Second International Congress of Chemistry and Environment, Indore, India, December, pp.773–777.
- Sharholly, M., Ahmad, K., Mahmood, G. and Trivedi, R.C. (2008) 'Municipal solid waste management in Indian cities – a review', Waste Management, Vol. 28, No. 2, pp.459–467.
- Tambe, E.B., Ayongwa, G.C., Ngwabie, N.M. and Forbid, G.T., 2016. Characterisation of Municipal Solid Waste for Planning Sustainable Waste Management in Kumba Municipality–South Western Cameroon. The Open Waste Management Journal, 9(1).
- Visvanathan, C., Trankler, J., Joseph, K., Chiemchaisri, C., Basnayake, B.F.A. and Gongming, Z. (2004) Municipal Solid Waste Management in Asia, Asian Regional Research Program on Environmental Technology (ARRPET), Asian Institute of Technology publications, ISBN: 974-417-258-1.