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# DETERMINANTS OF MUNICIPAL SOLID PLASTIC WASTES IN INDIA

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**ABSTRACT:**

*Municipal solid plastic wastes management is the need of the hour. Plastics are widely used in packaging almost all the manufactured goods. Plastic wastes have low rates of natural degradation and their half life is estimated to be around 1000 years. Factors such as population, GDP, education levels of people are known to affect the generation of wastes. This study quantified various factors that determine amount of municipal solid plastic wastes generated across various cities in India during 2015. Least Squares estimators with Whites Heteroscedasticity consistent estimates for variances were calculated. Results indicate a statistically significant positive relationship between GSDP and wastes generated. It is found that for every 1% increase in GSDP, waste generation increased by 0.09%. Also, a 1% increase in literacy rate decreases wastes generated by 0.25%. Results from this study also indicate that regions with higher population generate lesser wastes after controlling for other factors like education and state incomes.*

**KEYWORDS**: *Municipal Solid Wastes, Plastic waste determinants, Elasticity, Economics plastic waste recycling.*

## INTRODUCTION :

Municipal solid waste management (MSW) in India is of significance in light of *Swachh Bharat* Mission and Make in India Initiatives. Central Pollution Control Board reports that 133,760 tons of municipal solid wastes are produced per day in Urban India. 3501 tons of plastic wastes are generated per day. Plastics are used in packaging grocery, food & vegetable products, and cosmetics. Plastic wastes have low rates of natural degradation and their half life is estimated to be around 1000 years. Report of Central Pollution Control Board (2015), shows that the quantity of wastes generated varies across different cities of India. Factors such as population, GDP, education levels of people are known to affect the generation of wastes. However, in the Indian context, the impact of each of the factors on plastic waste generation is yet to be studied. The objective of the study is to analyze factors affecting the generation of municipal solid plastic wastes across different cities in India. This study analyzed various socio economic factors such as Gross State Domestic Product, education, that determine amount of municipal solid plastic wastes generated across various cities in India during 2015 using macroeconomic data. Results indicate a statistically significant positive relationship between GSDP and wastes generated. It is found that for every 1% increase in GSDP, waste generation increased by 0.09%. Literacy

rates and waste generation are also negatively related. A 1% increase in literacy rate decreases wastes generated by 0.25%. Results from this study also indicate that regions with higher population densities generated lesser wastes after controlling for other factors such as education, age, and state incomes.

Plastics constitute two major categories –Thermoplastics and Thermoset plastics. The plastics materials are categorized in seven types based on properties & applications (see Table 1).

**Table1: Types of plastics and their important applications**

| Source Code | Name of Plastic | Important Application |
|---|---|---|
| 1 PET | Polyethylene Terephthalate (PET) | Drinking water Bottles, Soft drink Bottles, Food jars, Jelly pickles, Plastics Films,Sheets |
| 2 & 4 HDPE and LDPE | High Density Polythelene and Lowdensity Polyethylene | Plastics bags ,Food containers, woven sacks,Bottles, Plastics Toys, Milk Pouches & Shopping Bags, Metalized Pouches |
| 3 PVC | Polyvinyl Chloride | Pipes, Hoses, Sheets, Wire,cable insulations, Multilayer Tubes |
| 5 PP | Polypropylene | Disposable Cups, Bottle caps,Straws |
| 6 PS | Polystyrene | Disposable Cups, glasses,Plates, spoons, trays, CD Covers, Cassette Boxes,Foams |
| 7 Other | Thermoset Poly Carbonate, Polyurethane | CD, Melamine Plates,Helmets, Shoe soles. |

***Source:*** *Report of the Central Pollution Control Board, 2015.*

Municipal solid waste includes commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes. Central Pollution Control Board (CPCB) reports that in 2012-13, out of the 1,33,760 metric tons per day of MSW generated daily 1,07,876 TPD is land filled without any treatment. In India, 43% of MSW is biodegradable and compostable. 8% is paper, 10% plastic and all other components such as metal, glass, rags, and other inert material accounts for 39% approximately. Report of Task force on Waste to Energy (2014) provides estimates on the composition of MSW over three annual time periods - 1996, 2005 and 2011. The estimates indicate that amount of plastics has steadily increased from 0.6% in 1996 to 10.11 % in 2011; similarly, paper waste increased from 3.63% in 1996 to 9.63 % in 2011. Inert materials showed a decrease from 45.13% in 1996 to 25.16% in 2011. These estimates might indicate a change in the consumption styles, which are correlated to changing personal incomes.

Current management practices for municipal solid plastic wastes include land filling, incineration, open burning, composting. Annepu (2012) reports that open burning of solid wastes and landfill fires emitted 22,000 tons of air pollutants in Mumbai city alone. Ponnaluru (2016), Gour et al (2016) estimated the determinants of municipal solid wastes in India. Halvorsen (2008) found that the opportunity cost of time has a significant negative effect on household recycling. Beede (1995) identified that MSW production is positively correlated to per capita income. Reschovsky et al (1994) found that waste collection from Municipal authorities encouraged recycling in New York. Under *Swachh Bharat* Mission, Government of India plans to build waste to energy plants with a capacity of 73.6MW. Sustainable strategies such as reduction, re-usage, and recycling are being implemented. These options require an understanding of the factors affecting the generation of wastes.

## DATA AND VARIABLES

Data used in this study is obtained from various sources and spans over one year 2015 and is across States and Union Territories of India. Municipal solid plastic wastes generated, collected and processed are measured in tons per day. Quantity of wastes generated is considered in this study.

Maximum amount of MSW is produced by the State of Maharashtra (26,820 tons), followed by Uttar Pradesh (19,180 tons), and Tamil Nadu (14,532 tons). State of Sikkim produced a Minimum 49 tons per day and Lakshadweep Islands (21 tons).

Gross State Domestic Product of 2012-13 year was reported in terms of 2004 prices, in millions of Rupees. State of Maharashtra showed highest GSDP with 82,583.2 million, followed by Tamil Nadu (Rs 44,794.4 million). Andaman and Nicobar Islands showed a minimum of Rs 401.5 million. An increase in GSDP would lead to a higher MSW generated.

Literacy rate is also an important factor. States of Kerala (93%), Goa (86.6%), and Tripura (84.9%) are among the top three states with high literacy rates. States of Jharkhand (61.1%), Andhra Pradesh (60.4%) and Arunachal Pradesh (59.9%) are among the lower literacy rates. Population density is found to be a maximum of 9252 persons per sq Km in the State of Chandigarh, followed by Puducherry (2598), Uttar Pradesh (828), Maharashtra (365), Tamil Nadu (555) and North Eastern States of Sikkim, Mizoram, Arunachal Pradesh (Minimum of 17) have lower population density. Proportion of population in the age group 10 to 59 is observed at minimum of 72.6 and a maximum of 78.1.

## ESTIMATION

$$\boldsymbol{Y = \beta_0 + \beta_i X_i + \varepsilon} \qquad (1)$$

The model in Equation 1 was estimated using least squares estimator. Dependent variable ($\boldsymbol{Y}$) in the above model is quantity of plastic waste generated and $\boldsymbol{X_i}$ are the independent variables such as GSDP, literacy rate, population density, proportion of people in the age group 10 to 59 years. Data is pooled across the States and select Cities of India and a regression model is estimated. Hetersoscedasticity consistent estimates were calculated as the data is cross sectional. Multicollinearity in the model was diagnosed by estimating Variance Inflation factors (VIFs). VIF value of greater than 10 would indicate multicollinearity. Elasticities of variables with respect to plastic waste generation are calculated and mean of elasticity is reported.

## RESULTS AND CONCLUSION

The results from the estimated model and mean elasticities are presented in Table .

**Table 2: Parameter estimates from regression and their Mean Elasticity**

| Variable | Parameter Estimate | Pr > \|t\| | VIF |
|---|---|---|---|
| Intercept | -1.21042 | 0.2758 | 0 |
| **lngsdp** | **0.09881** | **0.0035** | **2.47945** |
| **lnmsw** | **1.14544** | **<.0001** | **3.68731** |
| lnlit | -0.25283 | 0.1881 | 1.08107 |
| **lnpop** | **-0.17526** | **0.0001** | **5.13164** |
| | | | |
| Dependent Variable: | lnPlastic | | |
| Adjusted R Square | 0.9631 | | |

Parameter estimate on the GSDP variable is positive and statistically significant. Calculated elasticity based on this estimate indicates that a 1% increase in GSDP results in a 0.098% increase in

plastic MSW generated. Elasticity for literacy rate, indicates that a 1% increase in literacy rate reduces the wastes generated by 0.25%. Results indicate a statistically significant positive relationship between GSDP and wastes generated. Literacy rates and waste generation are also negatively related. Results from this study also indicate that regions with higher population densities generate lesser plastic wastes after controlling for other factors like education, age, and state incomes. Results from this study can be used to predict the amount of wastes generated from changes in the variables considered and are of interest to the municipal authorities. Further research can analyze the relationships between waste generated and retail industry as restaurants, clothing stores etc.

## REFERENCES

1. Annepu, Ranjith Kharvel., *Sustainable Solid Waste Management in India.* Masters Thesis. Department of Earth and Environmental Engineering Fu Foundation School of Engineering and Applied Science. Columbia University in the City of New York , 2012.
2. David N. Beede and David E. Bloom. "The Economics of Municipal Solid Waste." *The World Bank Research Observer*, Vol. 10, No. 2 (Aug., 1995), pp. 113-150.
3. Gour.A.A,. SK Singh and A Mandal "Composition, trends and impacts of municipal solid waste in India". Waste Management. Vol 55, 2016.
4. Halvorsen., Bente "Effects of Norms and Opportunity Cost of Time on Household Recycling" *Land Economics*, Vol. 84, No. 3 (Aug., 2008), pp. 501-516
5. James D. Reschovsky and Sarah E. Stone. "Market Incentives to Encourage Household Waste Recycling: Paying for What You ThrowAway." *Journal of Policy Analysis and Management*, Vol. 13, No. 1 (Winter, 1994), pp. 120-139.
6. Ponnaluru, Srinivasa S. "Determinants of municipal solid waste generation in India". *Waste Management*. Vol 55, 2016 pp I-III. *http://dx.doi.org/10.1016/S0956-053X(16)30399-3*.
7. Report of Task force on Waste to Energy, 2014 http://planningcommission.nic.in/reports/genrep/rep_wte1205.pdf.