Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 44 No. 4 (2023)

Study on Waste Management Using Regression Analysis in Karnataka, India

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Abstract
The waste-process and its intricacy management has obtained high attention in recent years all over the globe and also it causes chain-linked serious environmental and geographical problems. The potential of Multi Linear Regression (MLR)-model helps in prediction of waste-management, the data is differentiated into Waste Disposed in Tonnes (WDT), Waste Recycled Tonne (WRT), Waste Generated Tonne (WGT). These includes overall recycling rate every-year. The article mainly focuses on graphical representation of waste-management and future-prediction of waste-management. This model helps to state the difference between actual-values and predicted-values which gives us a best confirmation. This model can be applicable for each and every waste of state & predict the future-management of wastes. With the help of this model the total waste system can be easily segregated for-future-use.

Keywords: Disposal; recycling; waste management; discriptive analysis; visualization; multiple linear regression.

1. INTRODUCTION

Waste management is referred to used materials, which were produced from the activities of human and they are of different types. It can be solid, liquid and any other form and each of them have their different types of management way. So, by this way we need to do visualization to show the values of the waste management produced. The waste which generated on daily basis was increasing gradually and, in the year of 2014, Narendra Modi started Swatch Bharath Abhiyan and from there many wastes were started for recycling and nearly 190 plastic recycling plants were started in India and 2 plants are in our Karnataka and they are still active and now many private waste collecting plants are started and they are working on their own process which we are not getting any data regarding that. In this paper we showed many wastes collected type and one of the majors is plastic waste which takes thousands of years for dissolving in soil but if we recycle it, may be used for other purposes.

The general review of waste management shown in literature by Sepideh Jahandideh et al. they show the medical waste collected and predicted the future using ANN and LR for analysis [1]. The World

Health Organization (WHO) has advocated that hospital wastes should be treated as particular wastes [2,3,4,5]. More details about rate of hospital waste generation and hospital waste management in these hospitals were explained precisely by Askariana et al., [6,7].

M. Srinivasa Reddy et al., studied combustible of energy content ship scrapping solid type by using multiple regression analysis for better predictive model [8]. A.V. Shekdar et al., planned the solid waste operation for Indian city [9]. They show the existing resource level and method of estimation. Andrea Parisi Kern et al., proposed the statical method to show the WG with respect to raising of building and MR was used to show the of study of data [10]. Bilal Ahmed Khan et al., studied the WM training programs which were ignored from workers and handler's which was not safe and causing many health issues [11]. Sourav Kumar et al., studied the used algorithm namely YOLOv3 to show DNN frame work to create a new dataset [12]. Richa Kothari et al., studied the effective planning of treatment capacities and the behavioural and socio economic and demo-graphic terms helps the waste management and recycling behaviour of house-holds and other types of waste production [13]. Martin Rosecky et al., aim to show that the medical waste increased mainly due to helplessness of more people in the pandemic [14]. This was mainly focused to come out from the pandemic. Arunodaya R. Mishra et al., studied the different internet of thinking barriers for smart cities which studies the similar measure of weighting and compromising solution method [15]. It is clear that the prediction of waste management using multiple regression analysis for these, type is not done so far. So, this study mainly focuses on prediction of waste management for future generation.

2. METHOD USED

In this we are going to show how waste collected and disposed or recycling rate and by taking total waste generated and total waste disposed as graph then applied regression analysis for the data we have and to predict for feature we used multiple linear regression analysis. This shows the waste increasing or varying of waste in year wise. In this we have many types of waste collected in daily bases, so we used multiple linear regression analysis for predicting the future outcome.
MLR is a statistical method used to visualize the data in graphical representation and extents the line.

2.1 Regression Applied Data

```
data
```

	waste_type	waste_disposed_of_tonne	total_waste_recycled_tonne	total_waste_generated_tonne	recycling_rate	year
0	Food	679900	111100	791000	0.14	2016
1	Paper/Cardboard	576000	607100	1183100	0.51	2016
2	Plastics	762700	59500	822200	0.07	2016
3	C&D	9700	1585700	1595400	0.99	2016
4	Horticultural waste	111500	209000	320500	0.65	2016
...	...	...	...	...	...	...
220	Ash and sludge	214800	28600	243400	0.12	2017
221	Plastic	763400	51800	815200	0.06	2017
222	Textile/Leather	141200	9600	150800	0.06	2017
223	Others (stones, ceramic, rubber, etc.)	319300	7100	326400	0.02	2017
224	Total	2980000	4724300	7704300	0.61	2017

225 rows × 6 columns

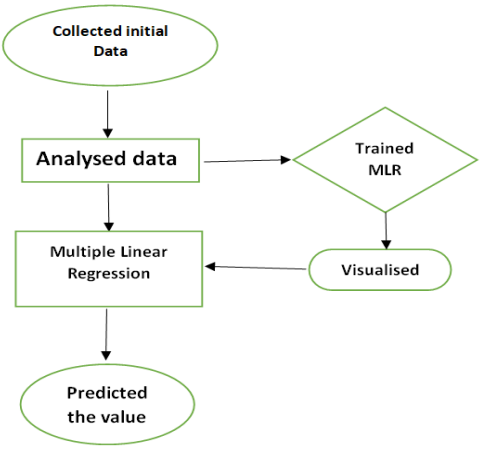


Fig. 1. Flowchart of regression analysis

3. RESULTS AND DISCUSSION

To study the waste recycling rate, we used Jupiter notebook to read the data, by using this we analysed the data. Then we got the predicted value as same as before, it shows increasing or decreasing of waste in every year. By seeing this we can conclude that some waste is collected more day by day but recycling percentage is less but some are not.

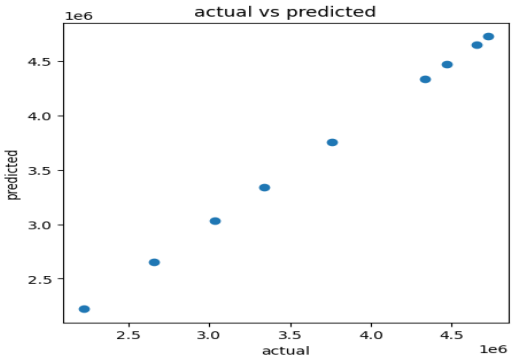
The codes used for prediction of waste recycling rate are as follows.

```
In [ ]: ml.predict([[3045200,          7814200,        0.61,   2016]])

Out[ ]: array([4769000.])

In [ ]: import matplotlib.pyplot as plt

In [ ]: from sklearn.metrics import r2_score
        r2_score(Y_test,y_pred)

Out[ ]: 1.0
```

Predicted values for the conformation of MLR working

Out[ ]:

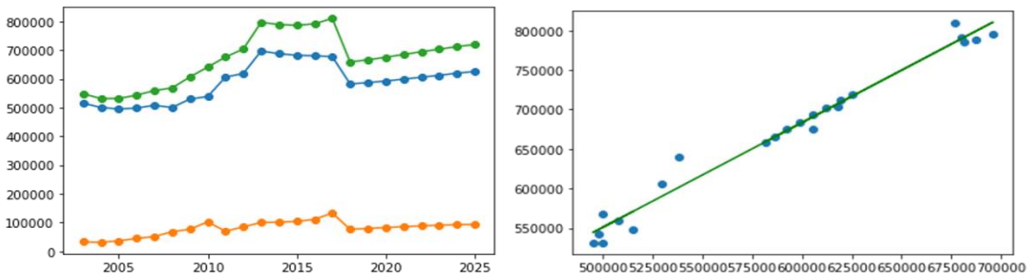
	actual value	predicted value	difference
0	4649700	4649700.0	0.000000e+00
1	3757500	3757500.0	-4.656613e-10
2	3342600	3342600.0	0.000000e+00
3	3034800	3034800.0	0.000000e+00
4	4724300	4724300.0	0.000000e+00
5	4335600	4335600.0	0.000000e+00
6	4471100	4471100.0	0.000000e+00
7	2223200	2223200.0	-4.656613e-10
8	2656900	2656900.0	0.000000e+00



In this we are going to show the TWDT, TWRT, TWGT in year wise how its growing and in another graph, we show how the waste is increasing day by day.

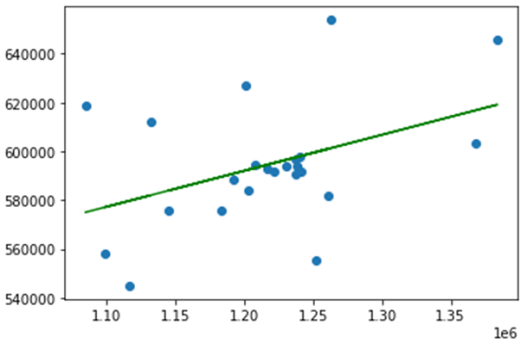
- GREEN LINE =WASTE GENERATED TONNE
- BLUE LINE=WASTE DISPOSED OF TONNE
- ORANGE LINE=WASTE RECYCLED TONNE

1. FOOD WASTE



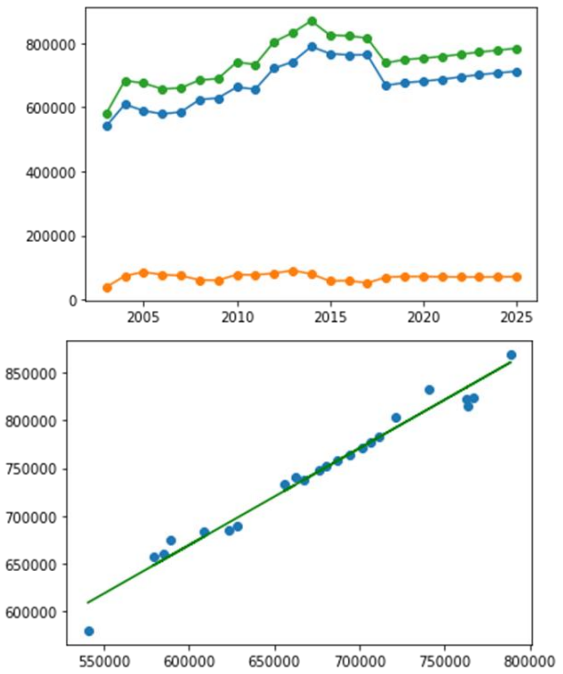
In this above two graph we can observe the increasing of in the beginning and after SBA the consistency is getting recycled in coming years. The other one is showing the statistical recognition of recycling rate where the lines are in same path shows the recycling percentage.

2. PAPER WASTE



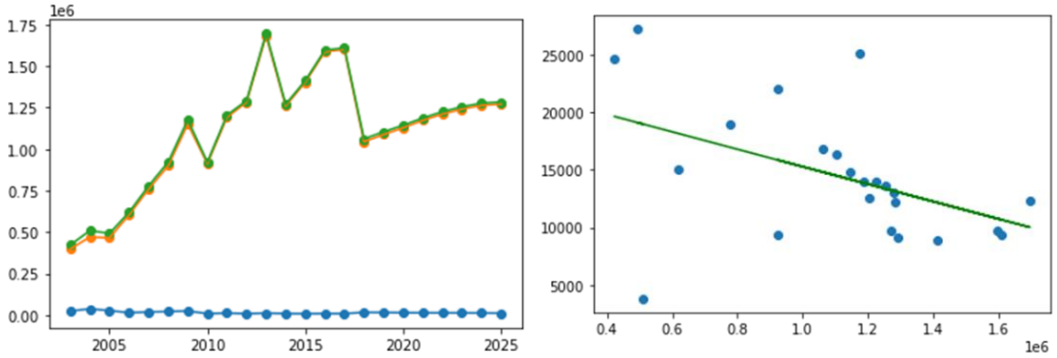
This waste was collected more compared to now because before more trees were there and many manufacuting componies came in exists of manufacturing but not they avoid to use because of technology. The second graph shows the waste is not recycling and they are dumped.

3. PLASTIC WASTE



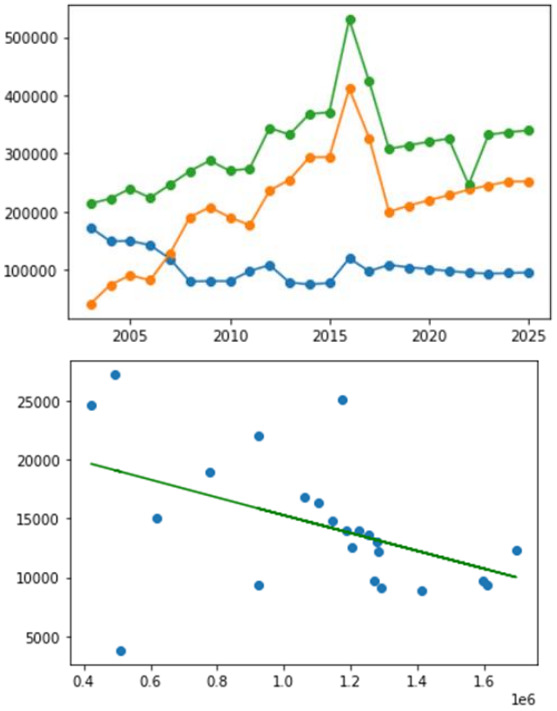
This waste is the major waste collected but recycling rate of this is very less so if we continue the same it will harm full for the living beings.

4. CONSTRUCTION WASTE



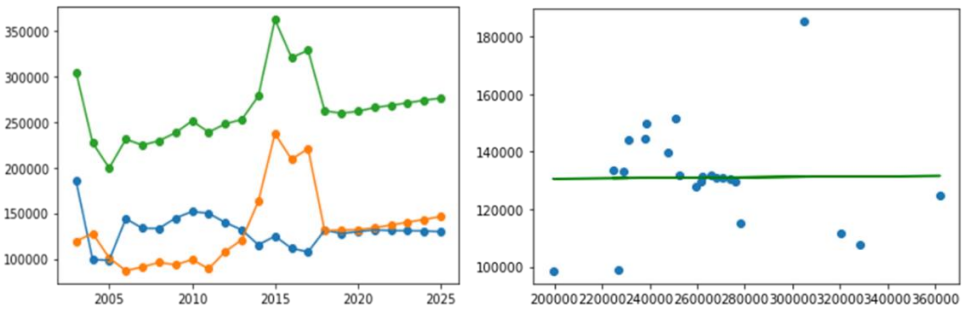
Construction waste is decreasing compared to before because now the percentage of demolishing is decreasing and construction of buildings and other things are becoming more.

5. WOOD WASTE



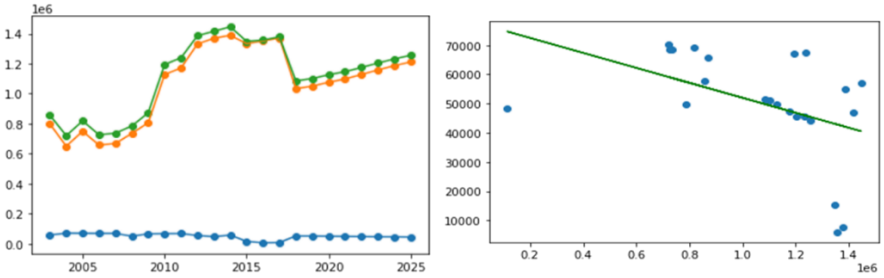
Wood waste is not more compared to before because from that many thinks are started to manufacture and now no trees to cut or use.

6. AGRICULTURE WASTE

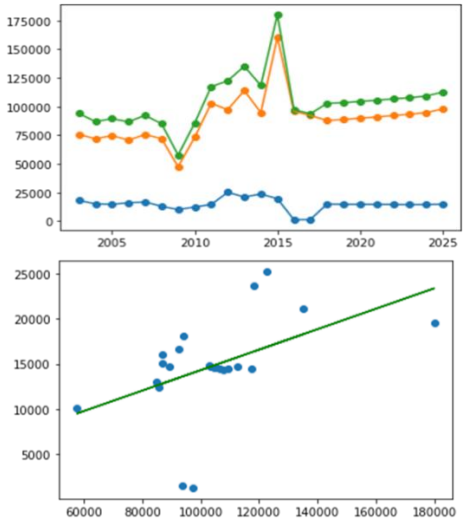


Now Agriculture or harticulture waste is not dumping because they are using for crop as a fertilizer.

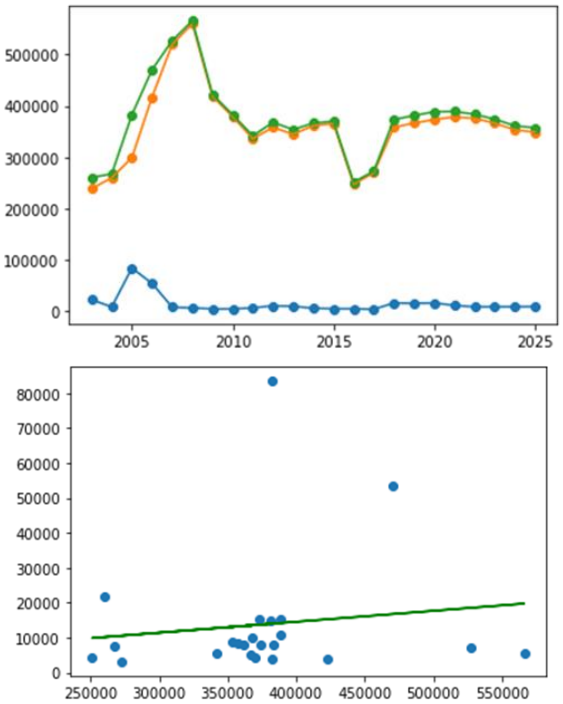
7. FERROUS-METALS WASTE



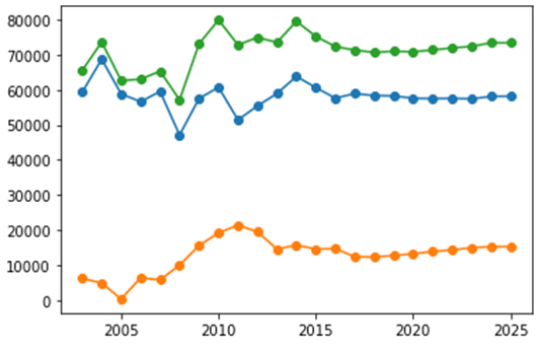
8. NONFERROUS -METALS WASTE

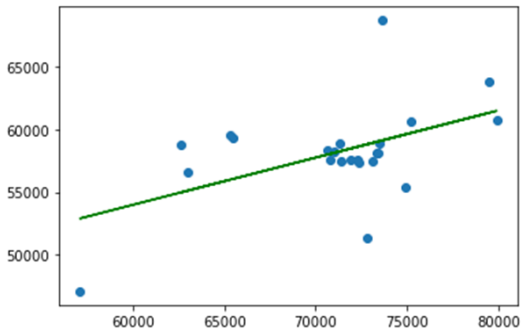


9. USED SLAG WASTE



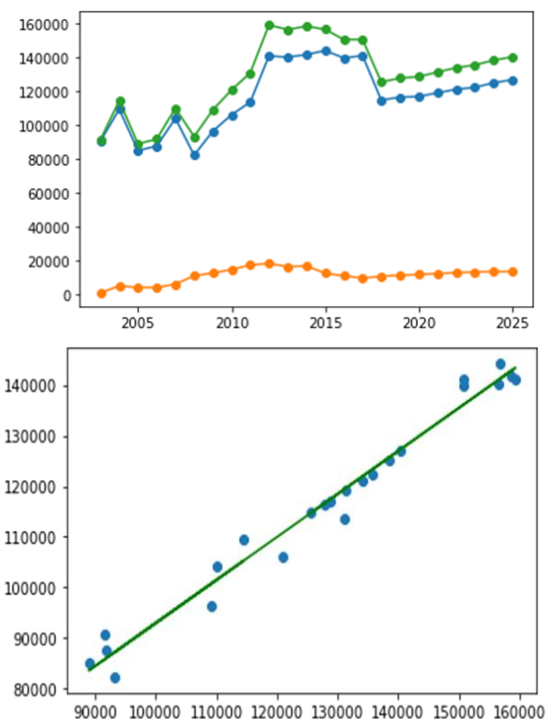
10. GLASS WASTE





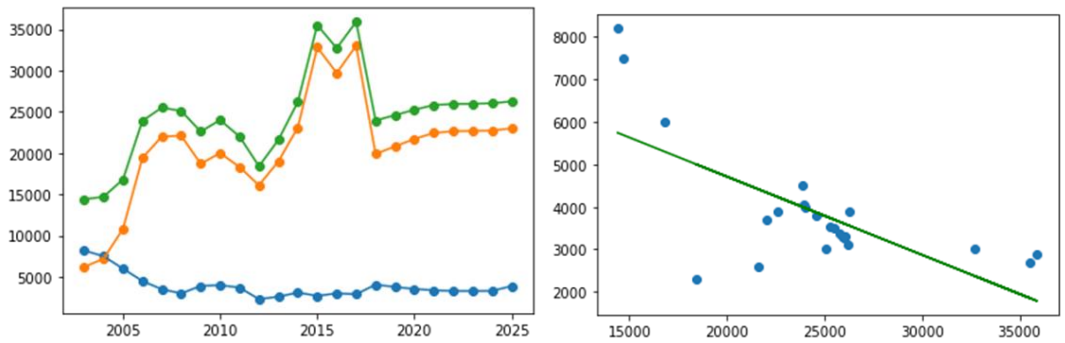
Glass waste is collected less or dumped less because they mix fibre and other chemical mixters for not breaking and more than glass now they are using fiber or Plastic.

11. TEXTILES WASTE



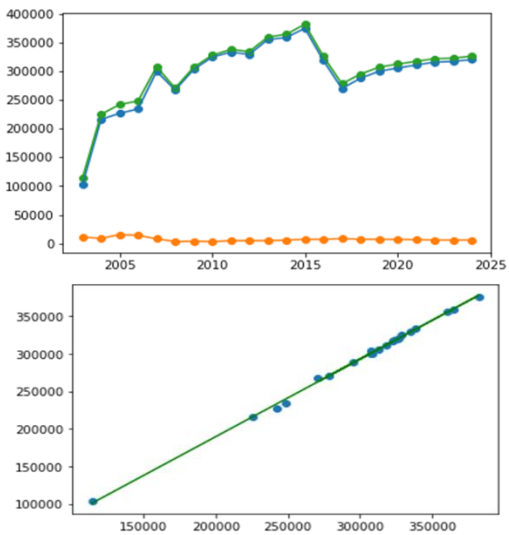
Textile or Fabric waste is increasing more and more but no one is ready to recyle these things. Rather than giving for recycling they are dumping this things.

12. SCRAP TYRES WASTE



These are decreased compared to cother because ther are re-taking the tyres from customers and using for recycling and manufacturing of new tyres.

13. OTHERS (STONES, CERAMICS & RUBBER etc)



This waste is disposed but not colledced and negleted so it is gradually increasing.

4. CONCLUSIONS

As per the above result is concerned, the waste data is collected and predicted using MLR-model and the increase of recycling rate of waste will be studied in the future. Our model helps to state the difference between actual-values and predicted-values which gives us a best confirmation. Our model provides 99% of prediction. This model can be applicable for each waste of state & predict the future-

management. With the help of this we easily segregate the total-waste system for-future-use. Through this result it helps various stakeholders including national authorities to improve prefect management strategies in view of building a bridge between wastes.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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