Hackthon- Data for Social Good

Project ID : SPS_PRO_2513

Project Title : SDG 6 Clean water and sanitation

TEAM MEMBERS:

1. *SANJANA N B*
2. *ISHWARYA M*
3. *VIVEK SIVARAMAKRISHNAN*

Analysis on Clean Water and Sanitation of Telegana

Abstract—. The urban growth is rapid as compared to other states and this will continue to pose pressure on the sanitation infrastructure in the urban centers. Need for policy formulation for the rapidly urbanizing areas in the state. The analysis of Telangana State Sanitation data shows recommendations to achieve an urban Telangana that is totally sanitized (safe), healthy, livable and climatically responsive, with cities/towns that are managed by ULBS, with citizen and stakeholder participation, in particular women and poor. The document provides an overview of the existing scenario of sanitation in the ULBS of state with integral solutions addressing the issues while showcasing linkages with cross cutting sectors.

Keywords— sanitation,waste management, data quality, data analysis.

INTRODUCTION

Sustainable development goal(SDG) is conducted every four years at the level of Heads of State and Government under the auspices of the General Assembly Economic and Social Council. Urbanization has to be viewed differently in case of the state of Telangana given its diverse topography including Eastern Ghats and plateau areas that have varying environmental conditions carrying capacity for the sanitation infrastructure and services.

Telangana at sixth place in which shows Niti Aayog's index for sustainable development goals.This study aims to provide an analysis of sanitation strategies in urban local bodies of Telangana. We look into the comprehensive range of services to be established inorder to achieve safe and hygiene living conditions. The state has 72 urban local bodies further divided into 1962 wards.We find spikes in compost yard location and extend (Acrs) as it varies from zero to fifty five. As the disposal rate relies on the area required to decompose .

The Government has ensured to set up community, public and she toilets for the public and are making efforts to keep the state open defecation free. All households that have space to construct toilets, have constructed one. Occupants who do not have space to construct toilets have access to a community toilet within a distance of 500 meter.The correlation between number of toilets in respective Ulbs and number of open defecation free declared wards, this analysis shows the reliability of urban localities. By acquiring data of the missing values in the records. We are able to enhance quality to make statistical analysis.The association of garbage generated per day against garbage lifted per day has high correlation .

A community toilet is built when there is no space available or when there are financial constraints for constructing an IHHL. It is used, owned and maintained by community members, located within the community where people reside. A public restroom is any structure or facility maintained for use by members of the general public for personal hygiene and comfort.A female urinal is designed for the female anatomy to allow for ease of use by women and girls.Dry resource collection is segregation which leads to a reduced amount of municipal solid waste being transported to the dump yard. Door to door collection system is where citizens place domestic waste close to the street in personal waste containers.16 ULBs use TRACTORS, AUTO, TRICYCLE AND PUSHCART TO ENSURE 100 % door to door collection. 54 ULBs have at least 1 government hospital.

DATA DESCRIPTION

Id	Feature	Description
01	ULB_Name	Urban Local Bodies names.
02	Public_Toilets	(PT) facility are provided for the floating population.
03	Community_Toilets	used by almost community members.
04	She_Toilets	toilets exclusively for women.
05	ODF_Declared_Wards	Open Defecation Free declared wards.
06	ODF_Non_Declared_Wards	Open Defecation Free non declared wards.
07	Compost_Yard_Location_&_Extent_Acrs	co-processing of dry fractions of municipal waste in cement.
08	Dry_Resourse_Collection_Center_(Yes/No)	collection points for segregated dry municipal waste.
09	%_of_Door_to_Door_Collection	Percentage of door to door collection of waste .
10	Tractors	Refuse collection vehicle (RCV).
11	Autos	Refuse collection vehicle (RCV).
12	Tricycles	Refuse collection vehicle (RCV).
13	Pushcarts	Garbage Pushcart,For Collecting Waste.
14	Regular_Workers	Employ on regular basis.
15	Out_Sourced_Workers	Engaging services of the petitioners as Sanitary Supervisors.
16	Government_Hospitals	Hospital which is owned and funded by the govt and operates solely off the money.
17	Private_Hospitals	hospitals managed and funded by an individual or a group of people.
18	Urban_Health_Centres	Providing universal access of quality health care to the needy.
19	Garbage_generation/day_(Mts)	Waste generation rate.
20	Garbage_lifted/day_(Mts)	Waste lifted rate.

Id	Feature	Description
01	toilets	No.of.toilets [Public_Toilets+Community_Toilets+She_Toilets]
02	no_of_wards	Total number of wards in ULB.
03	%gar_gen_lf	Disposal rate.
04	responsibility	less than 100% indicates requirement of toilets and awareness in respective ULBs.
05	workers	Total number of workers available .
06	disposal	1 equals to 100% disposal rate if not zero.

Model 1

There are some zeros in the garbage collected columns. Corresponding to these however the vehicles operating in the area is not 0. Secondly there is an obvious correlation between vehicle count and garbage collected (the more vehicles the more garbage collected). The 4 dimensional plane model ax1+bx2+cx3+dx4 = y (xi is vehicle counts and y is garbage lifted) is used to find a model that can predict garbage collected based on vehicle counts. We can see that the model has fared pretty well (obtaining a score of 86). The coefficients of the model provide useful information to compare how each vehicle contributes in collecting waste. There is scope for further analysis here where we can include vehicle size, fuel type, road size and mileage to determine which type of vehicle is optimum for a certain environment. We see that the ratio of

garbage generated to garbage collected is almost always one. So we shall proceed to fill zeros in generated and collected with the values from the linear model based on vehicle counts.

```
n = data.drop(zero_lifted, axis=0)
a = n[["Tractors", "Autos", "Tricycles", "Pushcarts"]]
b = n["Garbage lifted/day (Mts)"]
```

```
[ ] from sklearn.linear_model import LinearRegression

    model = LinearRegression()
    model.fit(a, b)
```

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

```
[ ] model.score(a,b)
```

```
0.8610930811911462
```

Model 2

First the total number of wards in an urban local body are calculated from the data given for the Open defecation free and Non-open defecation free declared wards. Based on the garbage generated per day and the availability of existing domestic wards, we try to understand the additional requirement for workers (either domestic or outsourced) in each place. This is done by taking 2 variables - x as (garbage gen , no of wards) and y as the number of outsourced workers and domestic workers

```
[ ] Y= data_new1[["Garbage_generation/day_(Mts)","no_of_wards"]]
    x= data_new1['workers']
    import sklearn
    from sklearn.model_selection import train_test_split
    xtrain_,xtest_,ytrain_,ytest_ = train_test_split(Y,x,test_size=1/3,random_state=5)
```

```
[ ] from sklearn.linear_model import LinearRegression
    model = LinearRegression()   # y=ax+b
    mymodel1=model.fit(xtrain_,ytrain_)
```

```
[ ] y_pred_=mymodel1.predict(xtest_)
```

```
[ ] y_pred_
```

```
array([233.8754, 142.5218, 156.685 , 215.8226, 780.555 , 174.5324,
        64.1134, 244.5456,  62.3751,  57.1602,  91.2915, 148.9944,
       156.4283, 303.8886,  43.2537, 209.7794,  15.4407,  74.9119,
        64.1134,  30.3085, 154.5057, 526.7613,  36.3004,  43.2537])
```

```
[ ] mymodel1.coef_
```

```
array([3.4766, 3.717 ])
```

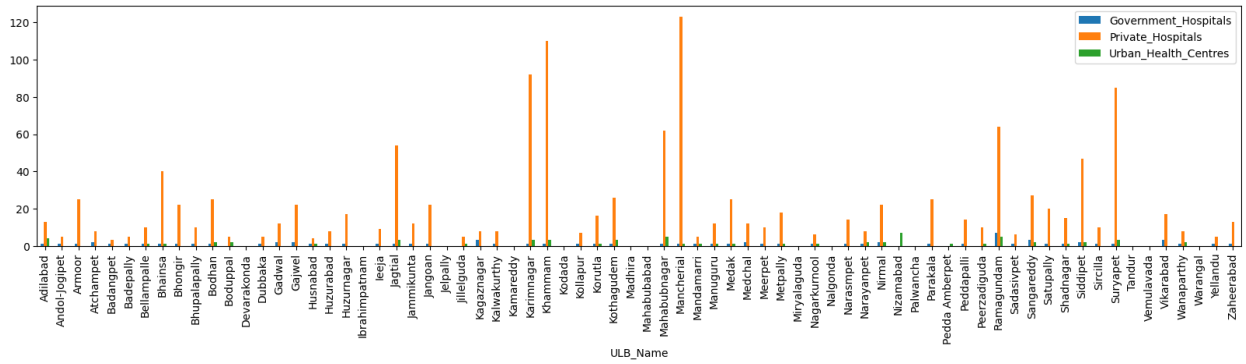
```
[ ] mymodel1.score(x,Y)
```

```
0.7705731409074034
```

ULB_Name	no_of_wards	%gar_gen_lf	workers
Andol-Jogipet	20	82.98	48
Armoor	23	93.75	84
Badepally	20	92.86	143
Bellampalle	34	87.5	98
Bhupalapally	20	83.33	68
Husnabad	20	91.67	55
Jammikunta	20	91.67	81
Jelpally	20	66.67	83
Kalwakurthy	20	87.5	75
Kamareddy	33	90.48	155
Khammam	50	88.52	656
Kollapur	20	75	40
Korutla	31	94.12	163
Kothagudem	33	92.31	36
Mancherial	32	92	341
Mandamarri	24	85.45	49
Medak	27	93.1	96
Metpally	24	95.83	106
Nagarkurnool	20	75	73
Narayanpet	23	inf	108

Model 3

Now hospital data is analysed. It is assumed that the ratio of garbage contributed by hospitals/health centres collectively is constant across all districts. Underlying this principle, there is a motivation to find how each type of hospital contributes to garbage generated. Again a linear 3d model is fit on the 3 hospital counts to predict garbage generated. This model also fares pretty well (a score around 70). The coefficients of this model are pretty interesting. Firstly the large value for UHCs is maybe because of the grand capacity they operate at as compared to hospitals. However we see that government hospitals contribute lower garbage than urban hospitals. There are numerous other advantages from financial to job generation aspects of government hospitals. From this analysis, promoting development of government hospitals over private hospitals has a positive impact on the sanitation of a district - over countless other benefits.




```
[ ]  v = data_df_working[["Government_Hospitals", "Private_Hospitals", "Urban_Health_Centres"]]
     w = data_df_working["Garbage_generation/day_(Mts)"]
     from sklearn.linear_model import LinearRegression

     hosp_line = LinearRegression()
     hosp_line.fit(v, w)
```

```
     LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

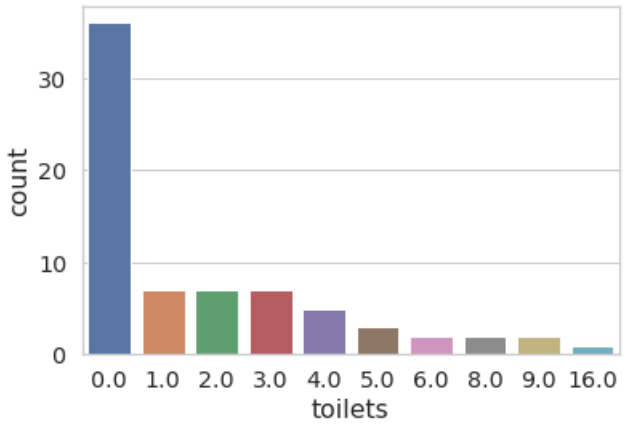
```
[ ]  hosp_line.score(v, w)
```

```
     0.7027731214664057
```

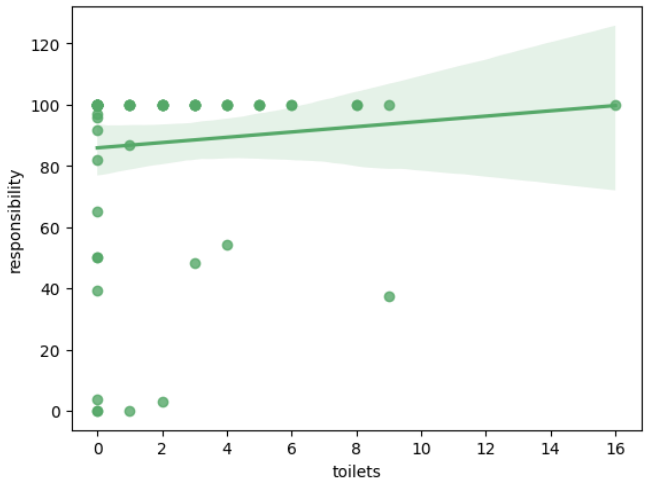
```
[ ]  hosp_line.coef_
```

```
     array([0.5174, 0.7167, 9.9063])
```

ANALYSIS

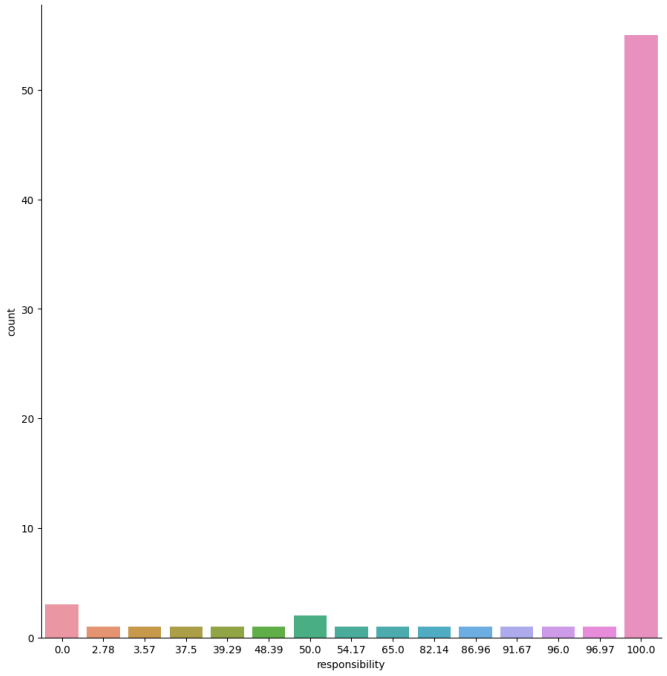


More than 30 Ulbs have no toilet facilities but are declared as open defecation free due to awareness.

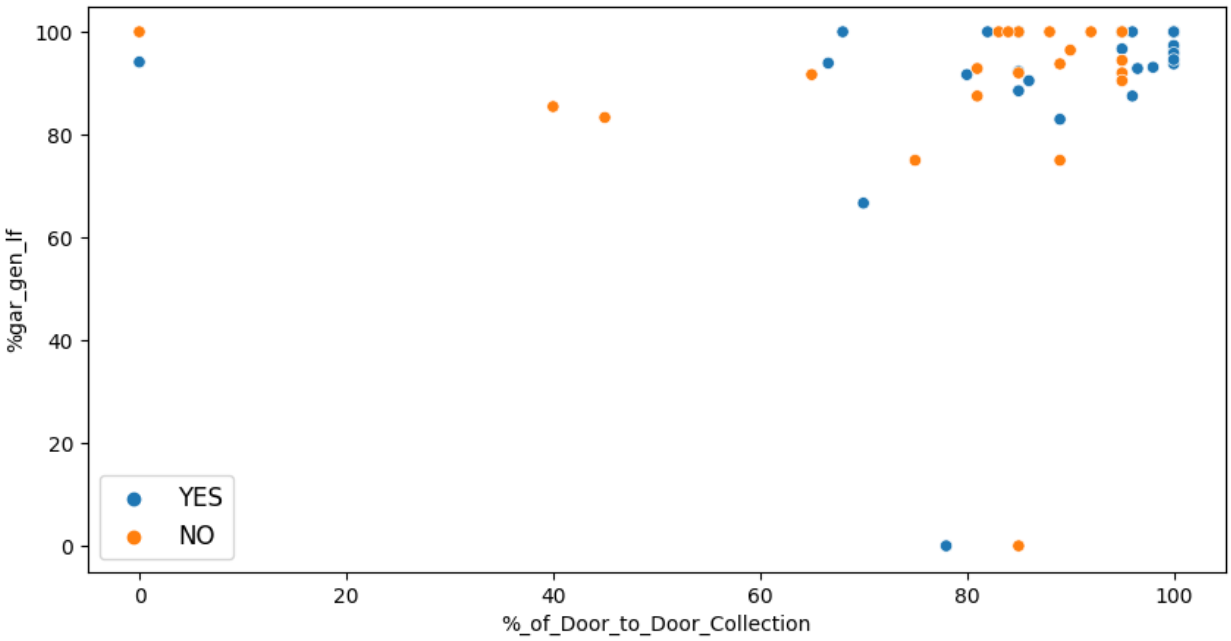


- Out of 72 ULBs, 55 have been declared as 100% ODF in spite of the lack of any kind of toilet facilities in 36 ULBs. Raising awareness among the masses or increasing the number of toilets in the remaining 17 ULBs can help.

ULB_Name	responsibility
Andol-Jogipet	50
Ieeja	0
Jammikunta	65
Jangoan	82.14
Kagaznagar	3.57
Kamareddy	0
Karimnagar	96
Kothagudem	96.97
Mahabubabad	39.29
Manuguru	86.96
Nalgonda	37.5
Nirmal	2.78
Palwancha	54.17
Tandur	48.39
Wanaparthy	50
Warangal	0
Yellandu	91.67



- % Door to door collection vs Garbage disposal - Places with no proper dry resource collection centers have low disposal rate as distinguished by a hue. Extra centers to be set up in order to improve the rate of disposal.

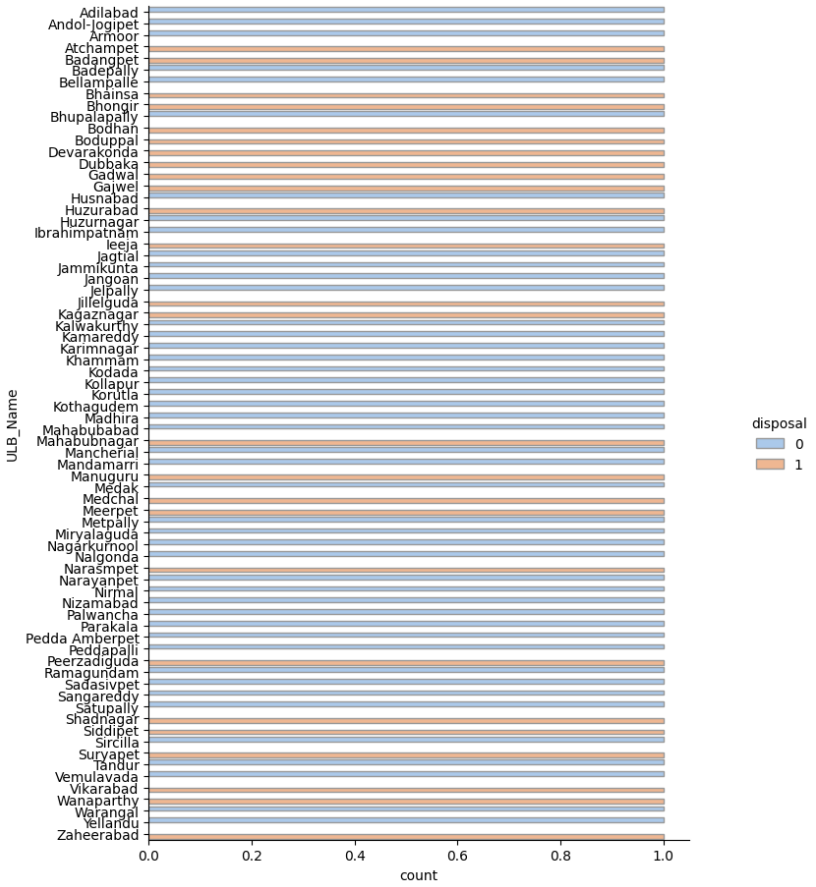


- More private hospitals are available as compared to government hospitals and urban health centers. We see that the state should work towards establishing government hospitals so as to provide health care facilities to the needy people as well.

- The rate of garbage disposal per day is 100% in 10 Urban Local Bodies even though they lack dry resource collection centers.
  % Disposal = (Garbage Lifted / Garbage Generated) * 100

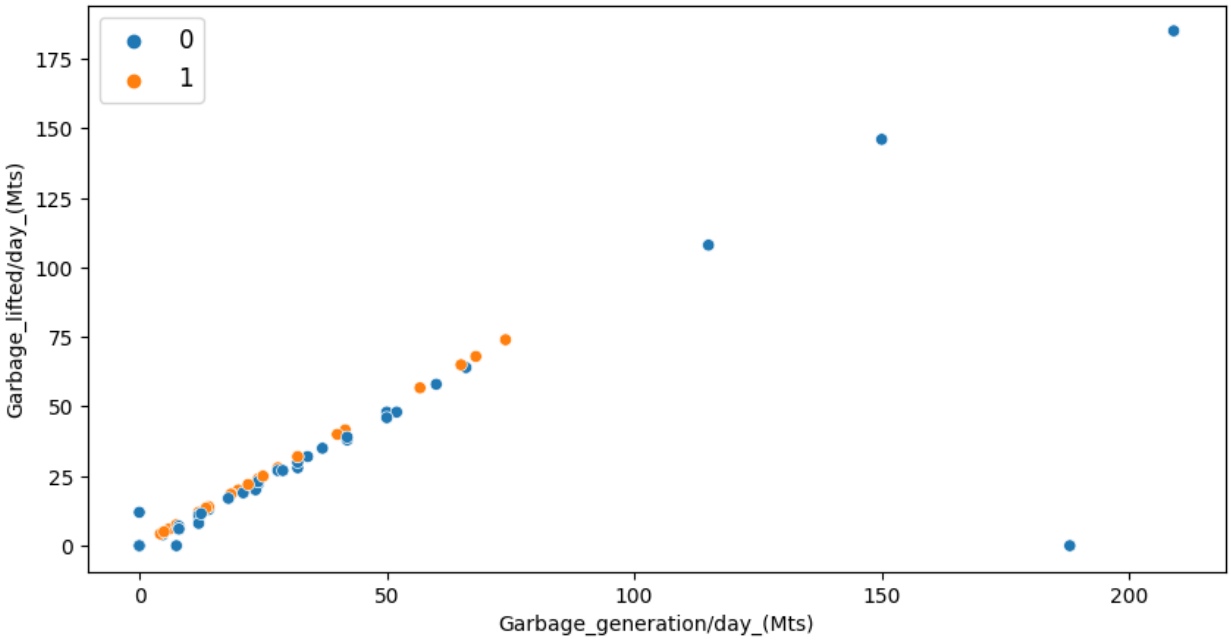
ULB_Name	Dry_Resourse_Collection_Center_(Yes/No)	disposal
Atchampet	NO	1
Bodhan	NO	1
Dubbaka	NO	1
Huzurabad	NO	1
Jillelguda	NO	1
Kagaznagar	NO	1
Medchal	NO	1
Narasmpet	NO	1
Wanaparthy	NO	1
Zaheerabad	NO	1

ULB_Name
Atchampet
Badangpet
Bhainsa
Bhongir
Bodhan
Boduppal
Devarakonda
Dubbaka
Gadwal
Gajwel
Huzurabad
Ieeja
Jillelguda
Kagaznagar
Mahabubnagar
Manuguru
Medchal
Meerpet
Narasmpet
Peerzadiguda



- Garbage generated vs Garbage lifted with hue based on 100% disposal gives a linear graph showing the dependence of one variable on the other.

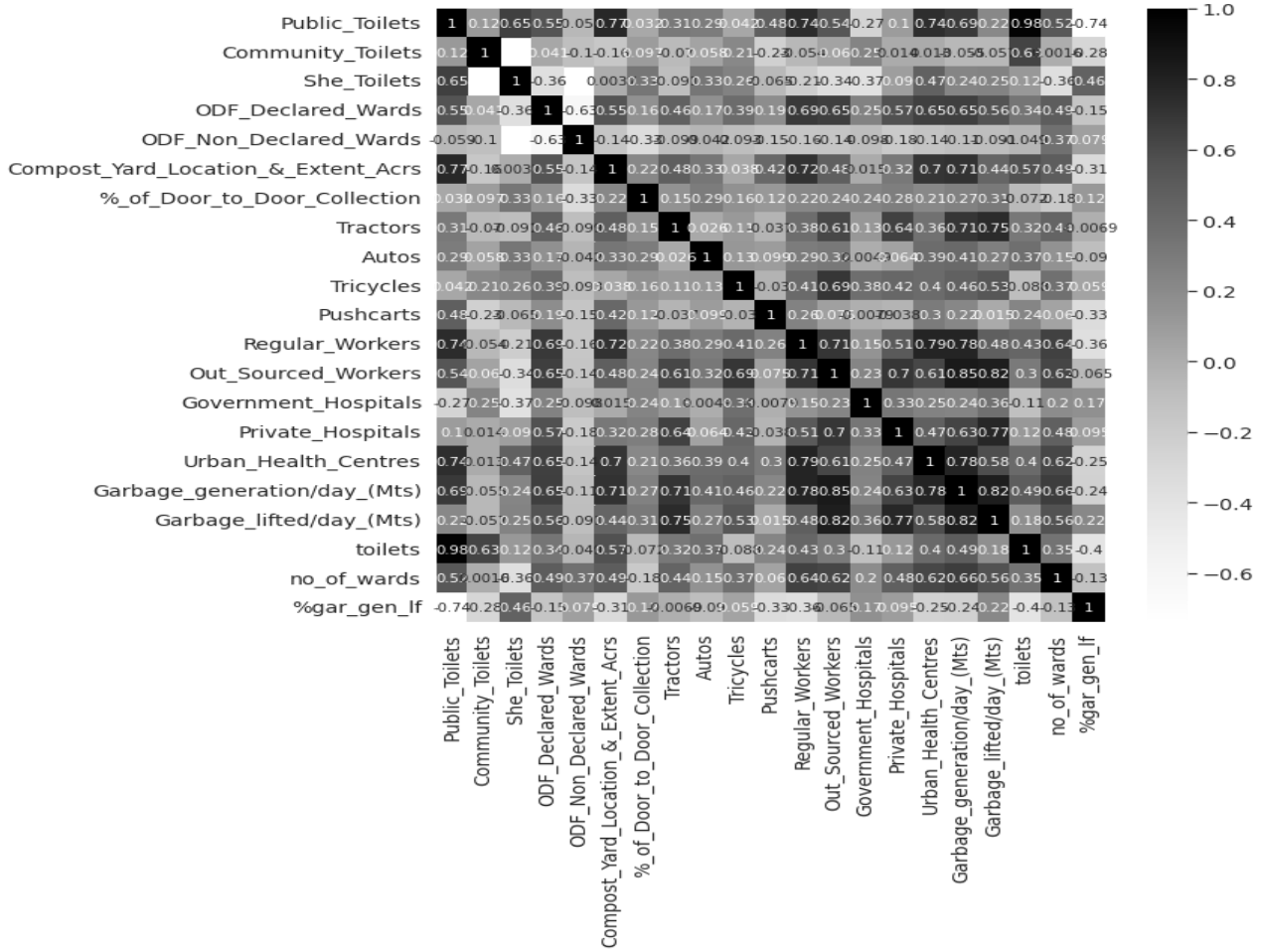
y = ax+b



- 26 ULBs lack dry resource collection centers but 10 of them maintain 100% garbage disposal per day.
- Among the 12 ULBs with no tractor, autos, tricycles, rickshaws, pushcarts only Kothagudem has high garbage generation. Other ULBs generate 0 mts of garbage.

ULB_Name	Tractors	Autos	Tricycles	Pushcarts	Garbage_generation/day_(Mts)
Badepally	0	0	0	0	14
Ibrahimpatnam	0	0	0	0	0
Kodada	0	0	0	0	0
Kothagudem	0	0	0	0	52
Madhira	0	0	0	0	0
Mahabubabad	0	0	0	0	0
Miryalaguda	0	0	0	0	0
Nalgonda	0	0	0	0	0
Palwancha	0	0	0	0	0
Tandur	0	0	0	0	0
Vemulavada	0	0	0	0	0
Warangal	0	0	0	0	0

<u>The correlation between given data points -</u>



CONCLUSION

The above recommendations, if prioritized and incorporated by the state in locations that lack facilities, based on resource availability and needs will enhance the sanitary environment of the urban areas. The planning, investment and promotion of these strategies must address the priorities of the public through a systematic approach.

REFERENCE

https://tspcb.cgg.gov.in/AnnualReports/PWM%20Annual%20Report%202020-21.pdf