

A
Project Report
(PS04CAST53)
On
**“Municipal finances: An Assessment of Municipal Council, Vallabh-
Vidyanagar”**

Project Guide
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CERTIFICATE

This is to certify that Mr. Bhavesh Nimba Patil, Exam No. 07 , "Master of Science in Applied Statistics", Semester-IV has successfully completed his project entitled “Municipal finances: An Assessment of Municipal Council, Vallabh-Vidyanagar” for PS04CAST53 in term 2022-2023

Date: 01/05/2023

Project Guide

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CERTIFICATE

This is to certify that Mr. Devendra Ravindra Patil, Exam No. 09 , "Master of Science in Applied Statistics", Semester-IV has successfully completed his project entitled “Municipal finances: An Assessment of Municipal Council, Vallabh-Vidyanagar” for PS04CAST53 in term 2022-2023

Date: 01 /05/2023

Project Guide
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Serial No.	Topic	Page No.
1	Abstract	8
2	Objective	9
3	Introduction	10
4	Literature Review	14
5	Methodology a)Data Collection b)Data Visualization	17
6	Statistical Theory i. Exponential Smoothing (Holt's Model) ii. Friedman's Rank Test iii. Kandell's tau Correlation iv. Socio Economic Profile	31 33 34 36 63
7	Conclusion	71
10	Bibliography	72
11	Appendix	73
12	Annexure A • Questionnaire	81

List of Table

Sr.No.	Table Name	Page No.
1	Structure of Municipal Revenues	12
2	Structure of Municipal Expenditures	13
3	Variable Information	18
4	1) Tax Revenue 2) Non-Tax Revenue	19
5	1) Capital Expenditure 2) Revenue Expenditure	20

Sr.No.	Fig.No	List of Figures	Page No.
1	1.1	1) Yearly Property tax	21
	1.2	2) Major taxes	21
	1.3	3) Revenue share of each tax	22
	1.4	4) Trend of tax (2012-2021)	22
2	2.1	1) Fixed Assets Purchase/ Acquisitions	24
	2.2	2) Loan, Advance, and Deposits	25
	2.3	3) Establishment Expenses	25
	2.4	4) Administrative Expenses	27
	2.5	5) Operations and Maintenance	28
	2.6	6) Grants and Contribution	29
3	3.1	Forecasting plot for Tax revenue	39
4	4.1	Forecasting plot for Non-Tax revenue	41
5	5.1	Forecasting plot for capital expenditure	43
6	6.1	Forecasting plot for revenue expenditure	45
7	7.1	Correlation matrix of Tax revenue	59
8	8.1	Correlation matrix of Non tax Revenue	60
9	9.1	Correlation matrix of capital expenditure	61
10	10.1	Correlation matrix of Revenue expenditure	62
11	11.1	Pie chart of Occupation of people	63
12	12.1	Pie chart of Family Size	64
13	13.1	Bar chart for Sanitation and Cleanliness	65
14	14.1	Bar chart for power supply	66
15	15.1	Bar chart for Roads	67
16	16.1	Bar chart for Health Facilities	68
17	17.1	Bar chart for Average Rating	69
18	18.1	Bar chart for PSAT Score	70

Abstract

Local Self-Government Institutions or Local Bodies directly influence the welfare of the people by providing civic, social and economic infrastructure services and facilities in both urban and rural areas. Given their strategic position in delivering services in the hierarchy of Government set up, following the Constitutional (73rd & 74th) Amendment Acts, more functions, powers and resources have been provided to them. Urbanisation is an important ingredient of economic development. The trend towards greater urbanisation is observed across the developing world. this paper critically examines the year on year changes in municipality revenue collection and spending of Municipality of Vallabh Vidyanagar, Anand using various statistical techniques. Also, to examine the trends in major revenue and expenditures of municipalities over the past 10 years and assess their fiscal position. Resulting analysis will provide better functioning of resources for the development of the people.

Objectives

Primary Objective

- To examine the trends in major revenue and expenditures of municipality
- Forecast the revenue and expenditure for next 3 years

Secondary Objective

- To critically examine the year on year changes in revenue and expenditure pattern of municipality.
- To understand the socio-economic profile of people in the territorial area of municipality.

Introduction

Local Self-Government Institutions (LSGIs) or Local Bodies in India, being at the cutting-edge level of administration, directly influence the well-being of the people by providing civic services and socio-economic infrastructure facilities. The Constitution (73rd and 74th) Amendment Acts, 1992 (for rural and urban local bodies, respectively) have accorded a constitutional status to these institutions as the third-tier of Government. The Constitution (74th Amendment) Act, 1992 has mandated grassroot level democracy in urban areas by assigning the task of preparation and implementation of plans for economic development and social justice to elected municipal councils and wards committees. It has incorporated the Twelfth Schedule into the Constitution of India containing a list of 18 functions as the legitimate functional domain of Urban Local Bodies (ULBs) in the country. In view of this position, the demands placed by the public on municipal authorities for the provision of various civic services have increased considerably.

While the Twelfth Schedule of the 74th Amendment Act, 1992 demarcates the functional domain of municipal authorities, the Amendment Act has not provided for a corresponding ‘municipal finance list’ in the Constitution of India. The assignment of finances has been completely left to the discretion of the State Governments, excepting in that such assignment shall be ‘by law’. This has resulted in patterns of municipal finances varying widely across States and in a gross mismatch between the functions assigned to the ULBs and the resources made available to them to discharge the mandated functions. The ULBs depend on the respective State Governments for assignment of revenue sources, provision of inter-governmental transfers and allocation for borrowing with or without State guarantees. Constitutionally built-in imbalances in the functions and finances eventually reflect in the high dependency of urban local bodies on State Governments and of the State Governments on the Central Government.

What is Municipal Finance?

Municipal finance is about the revenue and expenditure decisions of municipal governments. It covers the sources of revenue that are used by municipal governments.

What are the Roles and Responsibilities of ULBs?

The 74th Constitutional Amendment, carried out in 1992, made wide-ranging provisions about the responsibilities of the Urban Local Bodies. Article 243 of Constitution of India lists the authority and responsibility of the ULBs. They are

1. Urban planning, including town planning.
2. Regulation of land-use and construction of buildings.
3. Planning for economic and social development.
4. Roads and bridges.
5. Water supply for domestic, industrial and commercial purposes.
6. Public health, sanitation conservancy and solid waste management.
7. Fire services.
8. Urban forestry, protection of the environment and promotion of ecological aspects.
9. Safeguarding the interests of weaker sections of society, including the disabled and mentally retarded.
10. Slum improvement and upgradation.
11. Degradation Urban poverty alleviation.
12. Provision of urban amenities and facilities such as parks, gardens, playgrounds.
13. Promotion of cultural, educational and aesthetic aspects.
14. Burials and burial grounds; cremations, cremation grounds; and electric crematoriums.
15. Cattle pounds; prevention of cruelty to animals.
16. Vital statistics including registration of births and deaths.
17. Public amenities including street lighting, parking lots, bus stops and public conveniences.
18. Regulation of slaughter houses and tanneries.

All these functions are divided into two categories – obligatory and optional/discretionary, and it is up to the states to decide which function to be put in which category. Because of this, there is a wide variance across States in terms of the assignment of overall functions and within that, obligatory and discretionary functions to the ULBs. Similar to Union and State Governments, ULBs also carry out their responsibilities through various schemes or services. Given this wide variation of functions assigned to ULBs by

different states, across the country, it is difficult to generalise in terms of how these units of ULBs are spending their resources.

Municipal Revenues :

Structure of Municipal Revenues

The revenue base of ULBs can be broadly categorized into: (a) tax revenues, (b) non-tax revenues, (c) assigned (shared) revenue, (c) grants-in-aid, (d) loans and (e) other receipts.

Revenue Category	Sources of revenue
Tax Revenue	Property Tax, Octroi, Advertisement Tax, Tax on Animals, Vacant Land Tax, Taxes on Carriages and Carts
Non-Tax Revenue	User Charges, Municipal Fees, Sale & Hire Charges, Lease amounts
Grants-in-aid	i) Plan Grants made available through planned transfers from upper tier of Government under various projects, programs and schemes (ii) Non-Plan Grants made available to compensate against the loss of income and some specific transfers

Table 1. Structure of Municipal Revenues

Municipal Expenditure:

Structure of Municipal Expenditures

The expenditure incurred by the ULBs can be broadly categorized into: (a) revenue expenditure and (b) capital expenditure. Further, revenue expenditure broadly comprises (I) establishment expenditure, (ii) administrative expenditure, (iii) operations and maintenance expenditure, and (iv) interest payments on loans; the capital expenditure comprises (I) expenditure on capital formation and (ii) principal repayment. The component of these major expenditure.

Table 2. Structure of Municipal Expenditures

Expenditure Category	Expenditure Items
Establishment expenditure	Staff salaries, Allowances, wages, Pensions & Retirement benefits etc.
Administrative expenditure	Rents, rates & Taxes, Office maintenance, Communications, Books & periodicals, Printing & stationary, Travel expenditure, Law charges etc.
Operations & Maintenance	Power & fuel, Bulk purchases, Stores, Hire charges, Repairs & expenditure Maintenance and Interest payments made on loans
Capital expenditure	Buildings, Water supply & Sewerage, Energy/lighting, Solid waste management, Roads, Bridges, Culverts, Causeways, Health & sanitation, Parks and recreation spaces, Furniture & fittings, Tools & plant, Equipment etc., Principal repayments of loans
Other expenditure	Miscellaneous expenses not accounted for in the above

Literature Review

For our project work we referred two research paper, one is by RBI working paper named “Municipal Finances: An Assessment”- P. K. MOHANTY, B. M. MISRA, RAJAN GOYAL, and P. D. JEROMI in 2007 and other is “Revenue and Expenditure Structure of Vyas Municipality”-Devi Lal Sharma.

- “Revenue and Expenditure Structure of Vyas Municipality”

Objectives:

- This study has tried to analyze and examine Revenue and Expenditure of Vyas Municipality. Furthermore, the study has tried to answer what are the sources of revenues and its expenditure pattern of Vyas Municipality? To answer this question this study focuses on observing the sources of revenue and its expenditure pattern of Vyas Municipality.
- This study has intense relation with revenue and expenditure of Vyas Municipalities regarding the objectives to analyze, examine and interpret the Revenue and Expenditure.

Conclusion:

Based on the above analysis, it can be concluded that Vyas municipality largely depends upon the revenue raised from external sources to fulfill the financial requirements. The total revenue has been occupied by internal revenue and external revenue. The average growth rate of internal revenue has been greater than external revenue during the study period. The increment on both revenue increases the gap between them. It can be seen that municipality has no financial autonomy and will be suffered from financial crisis if strong improvement cannot be made on internal revenue mobilization. The contribution of fees and other tax sources imposed by the municipality have very nominal contribution to the tax revenue. It means neither municipality able to utilize the identified sources of tax properly nor can identify other new sources which represent the poor collection efficiency of tax revenue. It is due to the lack of effective strategies and mechanism to collect the tax. The contribution of revenue raised from property rental to non-tax revenue has been found very nominal, which indicates that municipality ignores the revenue from property rental, which might be another important source of internal revenue. The performance of municipality concerning to the current and

development expenditure has been found very strong. But current expenditure has been allocating for consumption purpose to provide unnecessary services and facilities to the municipal staffs and municipal board members which only increases the financial burden to the municipality. And higher percentage of development expenditure has been used for construction and maintenance of building and other purchase, which is completely unproductive in nature. And it also ignores the social programs and others. It means, to great extent, Municipality is found irresponsible or unknown about own responsibilities concerning to the local people.

- “Municipal Finances: An Assessment”

Objectives:

- I) To examine the trends in major revenue sources and expenditures of municipalities and assess their fiscal position.
- ii) Examine and identify major constraints that could influence the overall performance of ULBs in the provision of civic infrastructure.
- iii) To estimate and project the resource requirements of the municipal sector in the country during the 10-year period from 2004-05 to 2013-14, and suggest measures for improving municipal finances.

Conclusion:

I) The study highlights deficiencies in the conventional method for assessing municipal finances in terms of analysis of revenue and expenditures of municipalities. ULBs are required to generate revenue surplus due to statutory requirements. Overall resource gaps of ULBs, as seen from municipal budgets, are not very large. However, the spending by all the municipal bodies is lower than that required for providing a minimum level of civic amenities. A comparison of per capita spending on core services by 142 metropolitan municipal corporations in terms of the Zakaria Committee norms indicates that the level of under-spending on an average works out to be about 76 percent. Thus, the assessment of municipal finances in “normative terms”, besides the “standard approach” of revenue or fiscal balance is very essential.

ii) The projected investment requirement of funds for urban infrastructure in the country is estimated at about Rs. 63,000 crore per annum for the next ten-year period. This does not include the needs for redistributive functions like urban poverty alleviation. The figure constitutes about 2.2 per cent of the country's GDP and is at present nearly 3 times the revenue of all ULBs together. Assuming a status quo in the federal fiscal relationships in the country, municipal bodies can at best be able to raise upto about Rs.27, 285 crore per annum or about 1.0 per cent of the country's GDP in 2004-05. Within this, the resources available for asset creation after meeting current expenditure would at best be of the order of Rs 17,736 crore, implying an annual shortfall of at least Rs 10,000 crore (2004-05 prices) even for providing core urban services.

Methodology

Data Collection

The Data is collected through Primary and Secondary sources. The primary data has been collected by handing out questionnaire to people. This study focuses on municipal revenue and expenditure thus based on secondary data. The secondary sources include Annual budget/reports of Vallabh-Vidyanagar municipality office, Records of municipality office, internally generated research reports and Meeting executive of the board of Vallabh-Vidyanagar municipality. Got the data in Gujarati language of past 10 years for revenue generated and total spending. So, it requires lot of Data Preparation and translation for each year .

Sample data: Annexure 1

વલ્લભવિધાનગરનગરપાલિકા	
આવક સમરી રીપોર્ટ	
તારીખ :- 01/04/2012 થી :- 31/03/2013 સુધી	
વિગત	રકમ
ઘરવેરો	11561532.00
સફાઈ વેરો	2636529.00
દિવાબત્તી વેરો	2026250.00
ગટર વેરો	4678701.00
ખાસ ગટર વેરો	1800.00
શિક્ષણવેરો	1733427.00
પેનલ્ટી	278017.00
દવાખાના ફી	168365.00
દવાખાના લેબ.ફી	73285.00
સોનોગ્રાફી/ઈ.સી.જી.	4260.00
આ.ન.ફી, નકલ ફી, ર.દાખલા ફી	42691.00
મીલકત ટ્રાન્સફરફી	3431108.00
ગટરકનેક્શન ફી	18250.00
પાણી ટેન્કર ફી	182250.00
પરચુંરણ આવક(જનરેટર ફી)	22150.00
વેક્યુમ ટેન્કર ફી	43800.00
	10040.00

After the data preparation and translation, we had done some Data analysis, we get

Primary Data:

Variable Information

Sr.No	Variables
1	Occupation
2	Education
3	Annual household income
4	Family size
5	Sanitation and Cleanliness
6	Water Supply
7	Power Supply
8	Roads
9	Parks
10	Health Facilities
11	Street Lighting

Table:1 variable information

Primary data is collected by handing out questionnaire to the people from municipality wards.

Municipal Revenue:

1)Tax Revenue

Tax Revenue											
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Total
Property Tax	11561532	12264967	13193934	13361014	15732085	14248617	17193444	17193159	18603400	18675910	152028062
Water Tax	241245	266041	355102	362155	2938223	3179696	3498322	3524186	3494429	3911442	21770841
Sewerage Tax	4678701	8354197	8514306	7598627	8511846	8201221	9069720	10223712	10014369	10155806	85322505
Conservancy (Sanitation) Tax	2636529	5008479	5139279	4780671	5548247	5130954	5674300	6596868	6626674	6756975	53898976
Lighting Tax	2026250	3458659	3533316	3288773	3712557	3506359	3820285	17193159	3663189	3743549	47946096
Education Tax	1733427	1757511	1936583	1936817	2296305	2116567	2532077	2508642	3024747	2669339	22512015
Vehicle Tax	141141	266680	160346	160695	159906	199364	180722	178058	217080	239210	1903202
Tax on Animals	0	6701	0	0	0	29500	96750	9500	30500	30500	203451
Professional Tax	7069484	6965643	7006779	7833197	7778627	7728579	8533631	9040166	9430967	9586907	80973980
Advertisement Tax	159200	0	2000	73200	9000	876256	268800	403200	443520	739200	2974376
Octroi & Toll	9891732	10120706	10441186	12442404	11449987	12476944	12730057	13686635	12633780	11580965	117454396
Others Taxes	256852	377340	124196	264699	29363	154440	363576	441265	599743	774583	3386057

Table :3 Tax Revenue

2)Non-Tax Revenue

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Empanelment & Registration Charges	13634	14200	14065	40579	74500	242351	147988	239708	89167	25000
Licensing Fees	12625	259200	28450	75000	83842	96552	55070	69855	541950	207854
Fees for Grant of Permit	475000	80049	22625	59800	86075	15060	12000	13750	39975	407490
Fees for Certificate or Extract	6100	6775	2845	14789	11000	10500	6500	8756	22690	234340
Development Charges	235738	1215000	159000	243700	55515	1725980	5180360	1248810	107290	2148518
Regularization Fees	18250	83295	104800	77835	12600	15000	384811	72400	49600	39750
Penalties and Fines	278017	333861	348164	452862	620364	400245	648162	561180	495348	450057
Other Fees	822028	33100	3259750	200885	255475	132116	349554	943800	943800	416381
User Charges	42575	26000	4500	17807	87150	106676	858000	314850	19833	86750
Entry Fees	245910	130000	74309	24285	33971	10315	134150	38195	129075	718358
Service / Administrative Charges	285000	960344	937260	2536266	1860790	2050800	3283900	2887615	478471	70730
Other Charges	3431108	2556943	680431	180681	6986700	163250	993761	1559383	162500	30500
Fees Remission and Refund	630714	1327484	150712	1105640	1400220	1434200	1166500	1298100	2019747	3212300
Sale of stores & scrap	259149	175911	1274901	319896	219352	72200	328440	420399	359921	275858
Rent from Civic Amenities	65950	266680	32185	52000	5250	5975	3225	9950	830912	99550
Rent from Guest Houses	17912	24656	12865	25814	4538	8548	5983	7697	4195	8600
Other rents	4360	8196	3640	3520	53500	12693	3480	3612	10480	172006
Interest	3080380	2297591	2578572	3972881	4016361	4627760	4955216	1407057	1562182	2426409
Miscellaneous Income	2848656	1612633	1705219	3282871	3896642	2186808	2925542	2521255	8898264	6643326

Table :4 Non-Tax Revenue

Municipal Expenditure:

1) Capital Expenditure

CAPITAL EXPENDITURE	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Office Buildings and Quarters	0	0	0	0	320224	0	3360	4332	55720	111504
Civic amenities & Service Centers	1695883	698206	204360	24208691	16365788	1591357	357474	532728	0	5318902
Roads & Bridges	26732930	29062053	19831899	39812607	754331	13885054	28155660	27973888	28331051	7352852
Sewerage and Drainage	3611929	4028972	1377912	1156157	7198467	2362135	1784852	3508744	1344393	6789218
Waterways	2259345	561875	1342246	1321227	1414394	5126785	5606769	4121752	9269352	1926729
Public Lighting	64769	715824	113909	396117	593057	109717	167249	75671	105373	253819
Hospital	1117501	650063	443757	477994	505771	114269	84693	851480	942586	907596
Vehicles	313618	406057	550785	377677	232382	703476	898396	4916856	274308	3316206
Furniture, Fixtures, Fittings and Electrical Appliances	0	0	0	367080	1268246	6325	58587	61500	64301	0
Other Equipment :Computer & Machinery	14249	0	0	0	939100	0	122350	2219869	5684697	2200
Fire Services	49030	46531	8951	2650	69630	10350	77669	263206	435221	251755
Cemetery	1463404	544961	488021	434375	320595	704125	750454	3699797	4384225	7606861
Garden	163535	1022007	1947623	5549502	765800	5582304	11148327	3935789	1275643	840488
Deposits	6423136	5701567	5837076	8924180	3088803	2205247	7542151	4555826	5111895	6066580
Advances	41500	364000	135000	55000	666000	195000	127100	0	0	3078000
loans	2080739	5477007	0	1000001	1038836	0	1870171	0	1259000	1232000
Intrest	0	0	1630	228	0	0		0	0	1631174
Other(Bill deduction)	3530858	2991116	1692642	6330632	4740749	1812903	2893497	3542679	6252522	2298176

Table : 5 Capital Expenditure

2) Revenue Expenditure

REVENUE EXPENDITURE	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Salaries, Wages and Bonus	24269437	27995063	31445332	33828586	34632319	37770313	39245502.57	46550864	44784116	59576400
Benefits and Allowances	87168	1097095	1772281	1243985	525177	2017811	1443150	5822791	1705890	2863081
Employee Provident Fund	819589	821869	824490	878797	1511211	2735754	1969000	3841844	3555622	6895012
Election	339319	22565	39155	0.00	0.00	594887	0.00	6230	2690	80325
Rent, Rates and Taxes	177075	346704	132017	145343	928291	754459	802284	507044	425064	750905
Office Maintenance	1075548	948707	176593	362517	59953	344469	255211	708952	281495	640450
Communication Expenses	146719	139051	212050	200549	123614	184775	125066	93524	85309	86173
Books & Periodicals	36089	15582	8440	11819	1375	2220	1197	1720	710	811
Printing and Stationery	133226	407220	161928	163506	280327	172536	125797	331348	452018	452730
Travelling & Conveyance	48043	67760	41949	42382	78320	24830	31535	28700	1200	0
Insurance	284547	280308	355572	455780	406115	1254610	1003547	1306148	1273266	1115250
Fees	6600	8920	12000	477786	420360	146174	0	62900	0	0
Legal Expenses	85000	186270	158000	65000	462500	105000	25000	25000	27500	25500
Professional and other Fees	244797	264493	879980	1329799	475268	0	48084	0	243786	129435
Council meeting, Honorarium	179983	122569	283104	172962	735356	355749	176008	824159	268183	286699
Advertisement and Publicity	591340	454498	453446	616118	640029	624460	811820	527898	529341	508459
Private security guard	0	0	0	181970	710742	828352	579641	1146244	966067	105667
Bank charges	18125	620271	202657.7	763056.58	2778	1069	0	456	3071	76824.12
Power & Fuel	1437359	2025498	2323880	1848140	2295187	2351524	2735736	3206120	2848377	3396458
Bulk Purchases	400736	314753	821723	2151249	4109220	443415	757436	99894	455164	6107409
Hire Charges (e-tendering)	31186	25284	28024	16978	40000	31957	58862	121081	91950	65200
Repairs & maintenance Infrastructure Assets	461945	2495705	1516612	115533	1618546	53195	34474	418093	9000	0
Repairs & maintenance Civic Amenities	700000	0	0	1838825	6125218	206080	54000	793506	203507	145242
Repairs & maintenance Others	0	40651	71789	9500	7500	4120	511860	1073258	0	0
Other Machinery operating & maintenance expense	73199	373286	3308	186415	423023	49432	6500	128713	110800	61190
Electricity	7675447	9038739	9296904	9293043.1	12603960	11649897	10899028	11627225	9489317	10379828
Sanitation and Waste Management	3502409	1230158	486330	3044669	2407276	1158115	2375162	5761575	2644294	1133517
Grants	40985901	54469174	31562302	116168568	94956572	84125395	92875450.87	141698916	151213150	21879521
Contributions	151000	167001	840694	297288	1430378	443800	180235	5417587	814501	2150830
Subsidies	158040	58750	41200	0	0	0		0	0	0
Miscellaneous expenses (Violet)	0	0	26775	0	128711	11740	11763	144990	0	0

Table :6 Revenue Expenditure

Data Visualization

Municipal Revenue:

- Property Tax collection from 2012-13 to 2021-22



Fig1.1 Yearly Property tax

Interpretation: Property tax is the major revenue source in most of the ULBs the above graph shows that the property tax rises over the years.

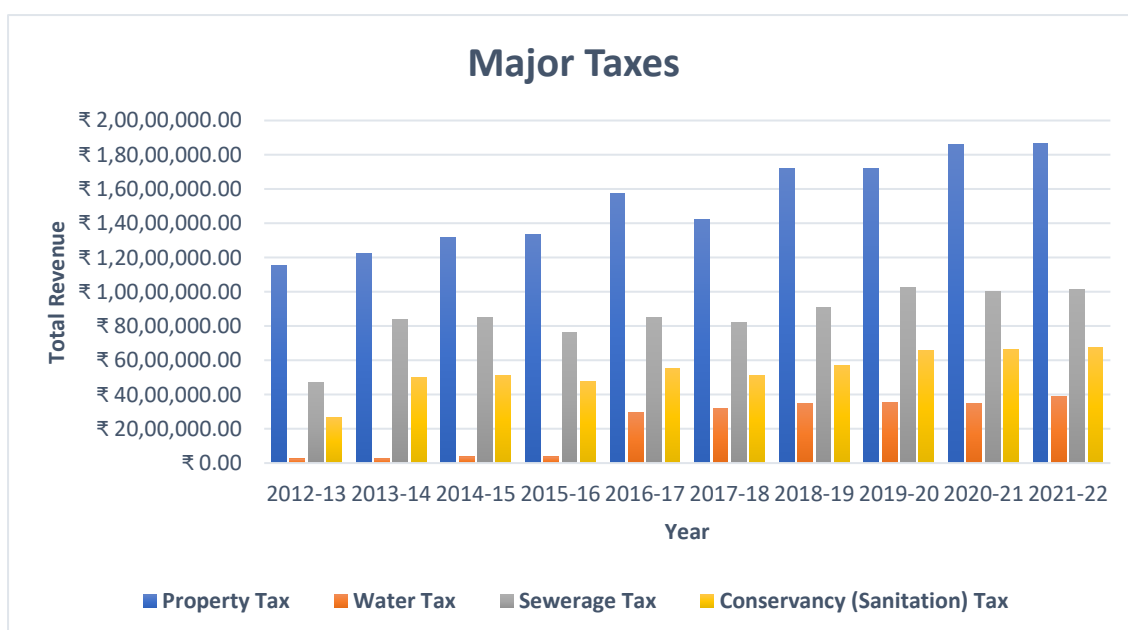


Fig 1.2 Major Taxes

- Revenue share of each tax

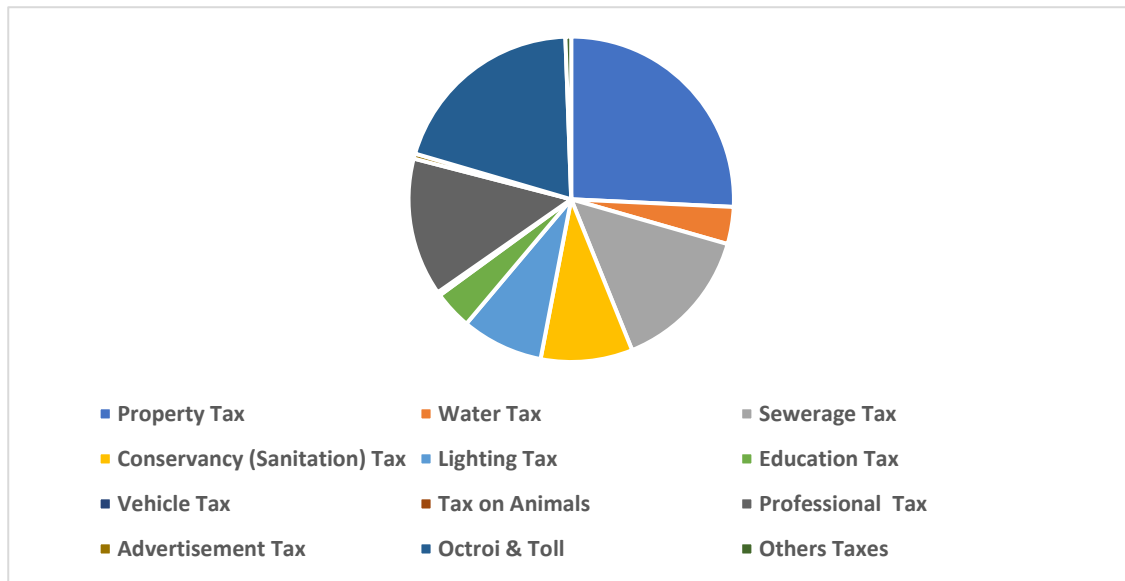


Fig. 1.3 Revenue share of each tax

Interpretation: Large share of revenue coming from property tax, octroi, sewerage tax and professional tax.

- Trend of Tax revenue from FY 2012-13 to FY 2021-22

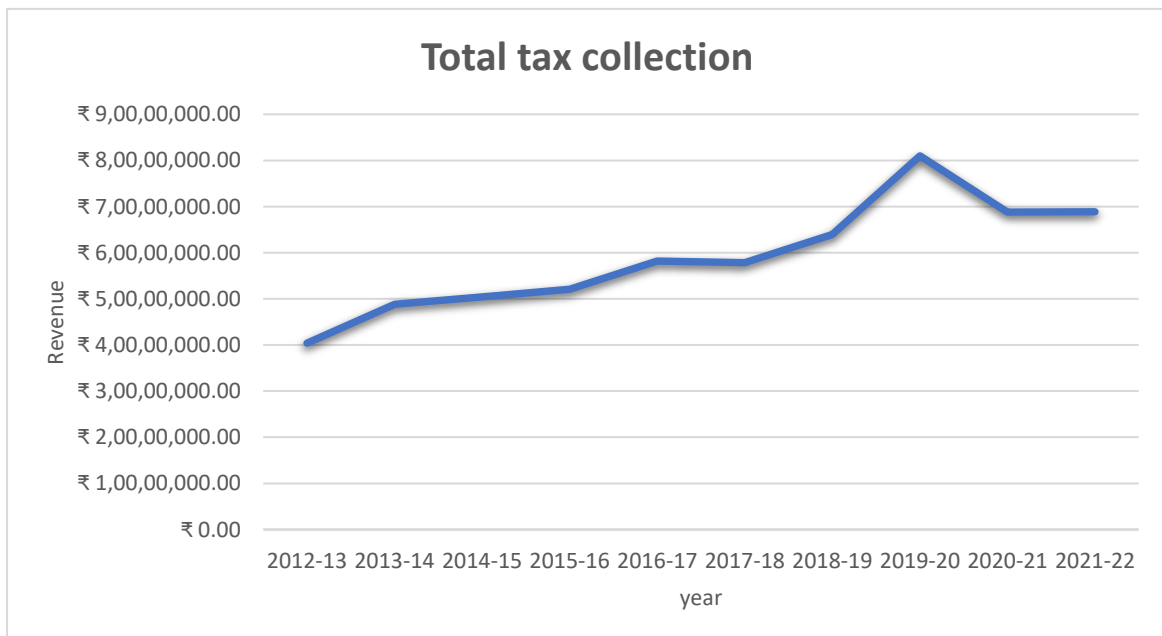


Fig.1.4 Trend of tax revenue (2012-12 to 2021-22)

Interpretation: Above graph is showing increasing trend in revenue collection up to 2019-20 and then fall.

Expenditures : Capital expenditure and Revenue expenditure

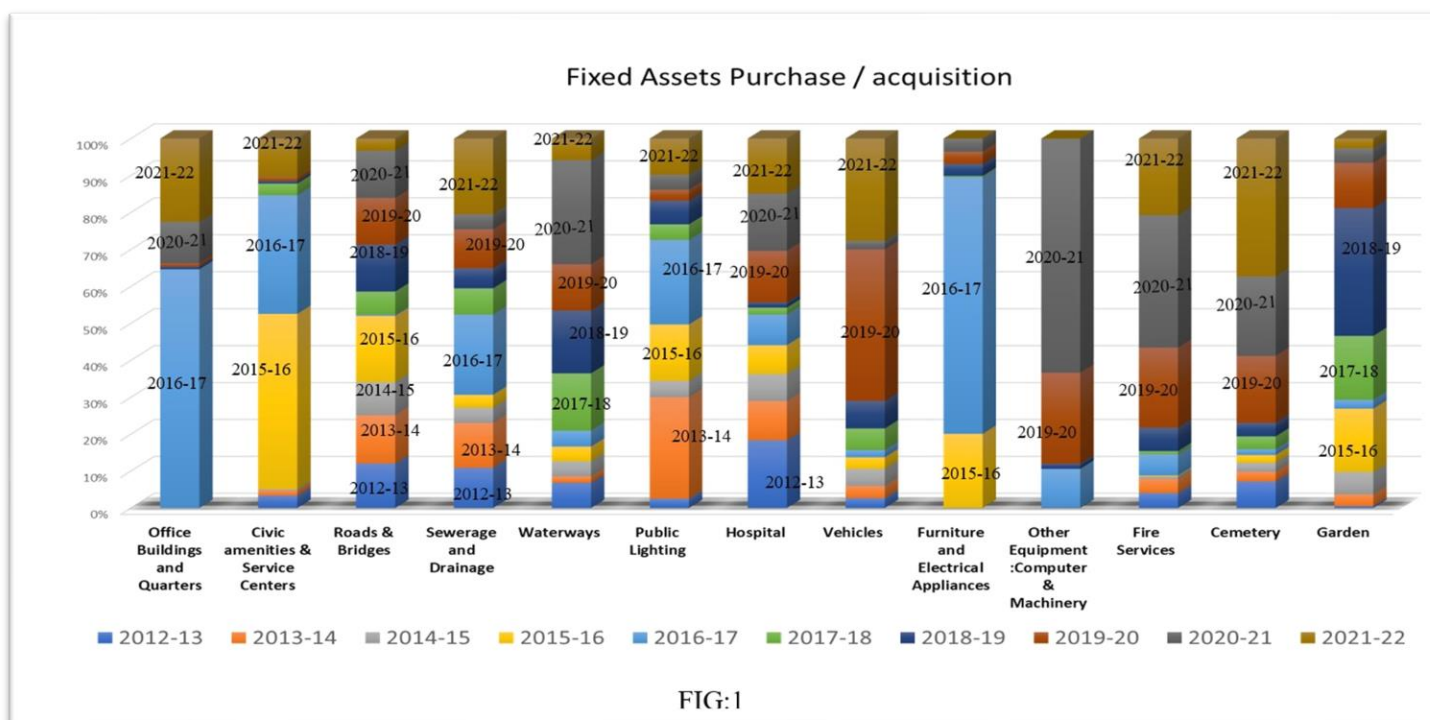


Fig:2.1

Interpretation: From the above Fig: Major Allocations in Year

Table:7

Year	fixed assets purchases/acquisition (measure allocations)
2012-13	Hospital, Waterways, Roads & Bridges, Sewerage and Drainage
2013-14	Roads & Bridges, Sewerage and Drainage, Public light, Hospital
2014-15	Hospital, Waterways, Roads & Bridges, Sewerage and Drainage, Garden, Vehicles
2015-16	Civic Amenities and Service centres, Roads & Bridges, Furniture and Electrical Appliances, Public light, Garden
2016-17	Office Buildings and Quarters, Civic Amenities and Service centres, Sewerage and Drainage, Furniture and Electrical Appliances, Public light
2017-18	Waterways, , Garden
2018-19	Waterways, , Garden
2019-20	Vehicles, Hospital, Computer & Machinery, Fire services, Cemetery
2020-21	Fire services, Cemetery, Hospital, Computer & Machinery, Waterways

2021-22	Office Buildings and Quarters, Fire services, Cemetery, Vehicles, Hospital, Sewerage and Drainage, Public light
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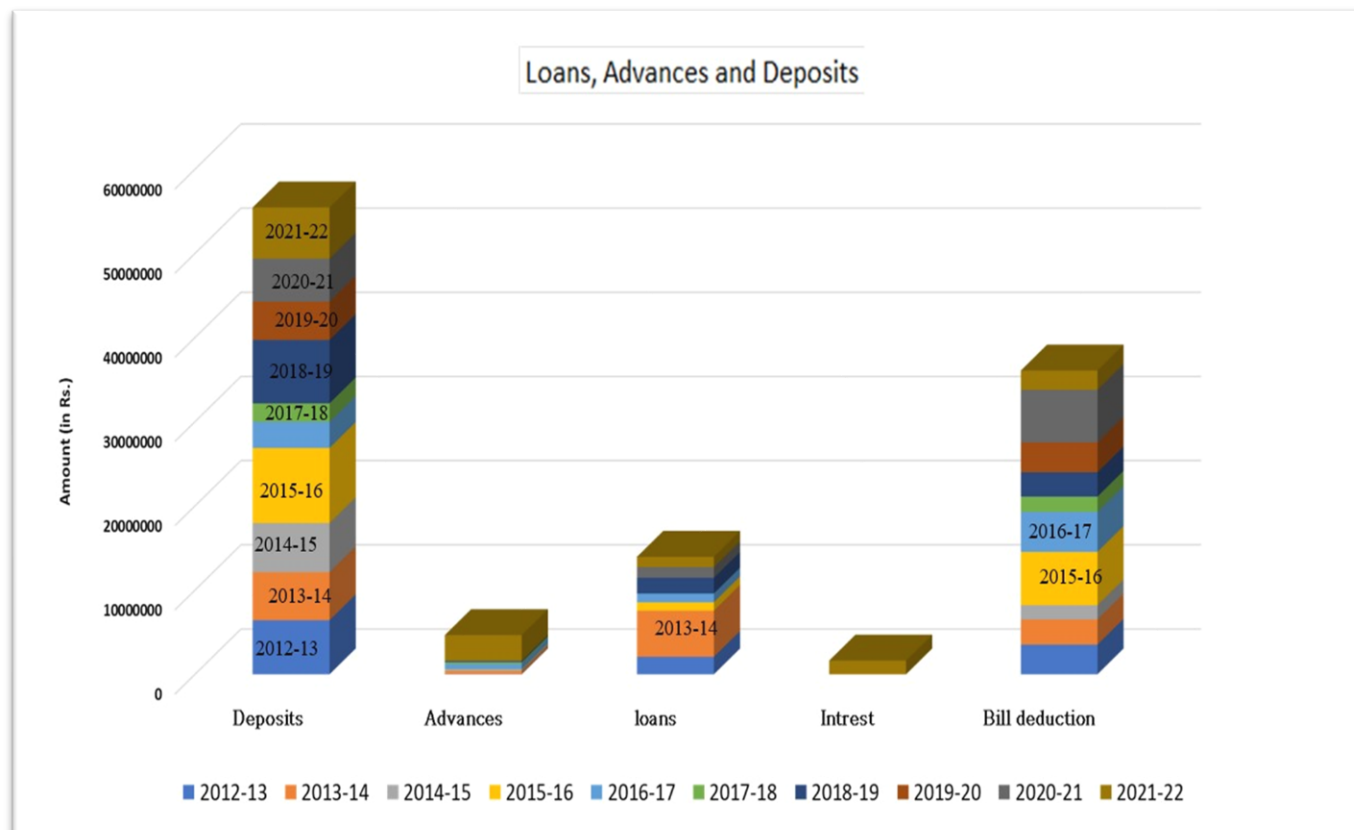


Fig:2.2

Interpretation: From the above Fig: we observed that the priorities of Loan, Advances and Deposits for years e.g. For Year 2015-16 the amount in deposits was more than other comparative years.

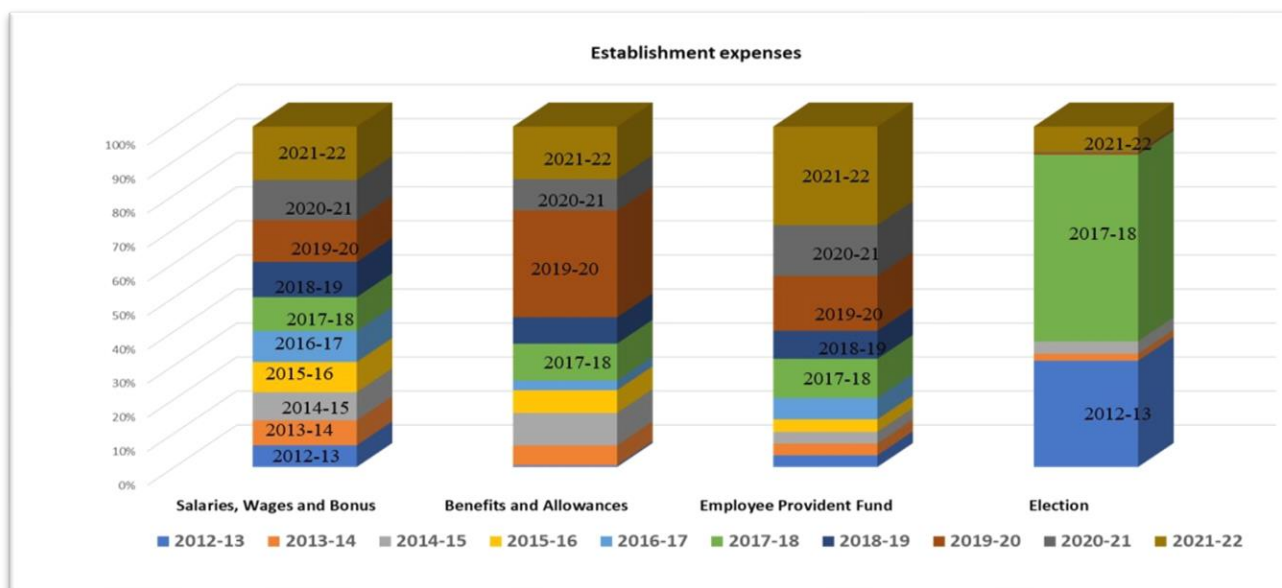


Fig:2.3

Interpretation: From the above Fig: we observed that the Salaries, Wages and Bonus having a gradual increase year by year. In 2019-20, salaries, wages, bonus, and allowances (collectively) are more than any other years

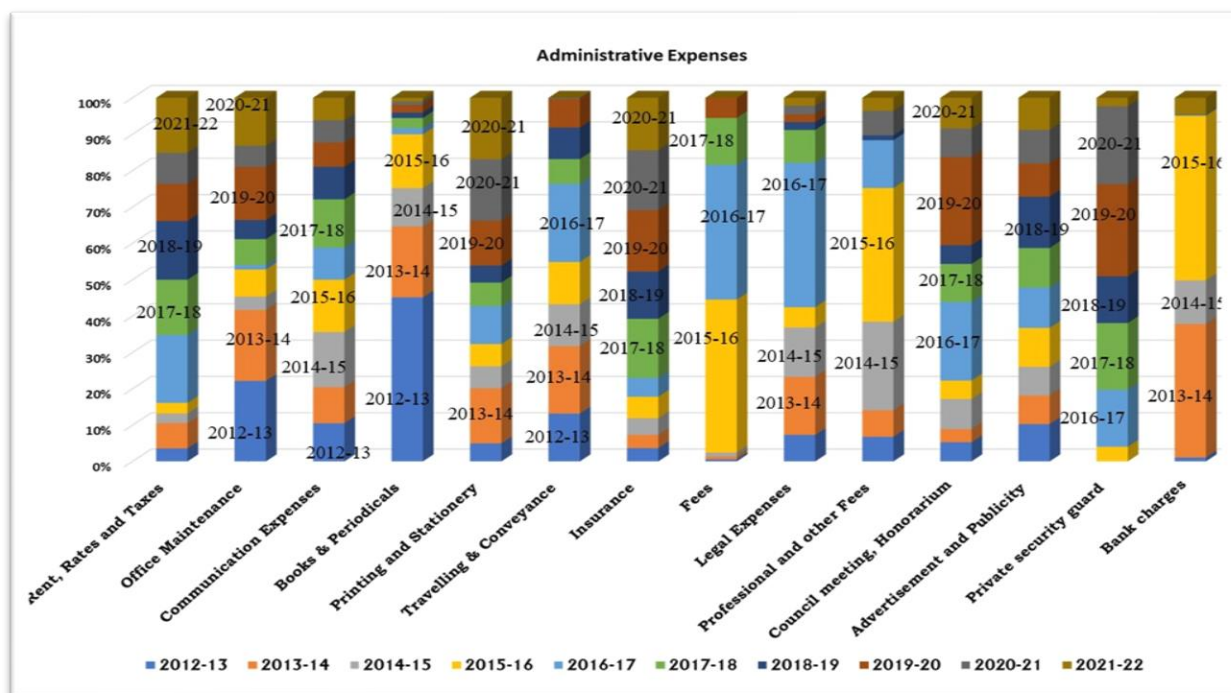


Fig:2.4

Interpretation: From the above Fig: Measure Allocations in Year

Table:8

Year	Administrative Expenses
2012-13	Office Maintenance, Books and Periodicals, Travelling & Conveyance
2013-14	Office Maintenance, Books and Periodicals, Travelling & Conveyance, Printing and Stationery, Bank Charges, Legal Expenses
2014-15	Professional and other fees, Books and Periodicals, Bank Charges, Legal Expenses
2015-16	Professional and other fees, Books and Periodicals, Bank Charges, Fees
2016-17	Rent, Rates and Taxes, Travelling & Conveyance, Fees, Legal Expenses, Council Meeting, Honorarium, Private Security-guard
2017-18	Rent, Rates and Taxes, Fees, Private Security-guard, Insurance
2018-19	Rent, Rates and Taxes, Insurance, Private Security-guard
2019-20	Council Meeting, Honorarium, Private Security-guard, Insurance, Office Maintenance, Printing and Stationery
2020-21	Private Security-guard, Insurance, Printing and Stationery
2021-22	Rent, Rates and Taxes, Office Maintenance, Insurance, Printing and Stationery, Bank Charges

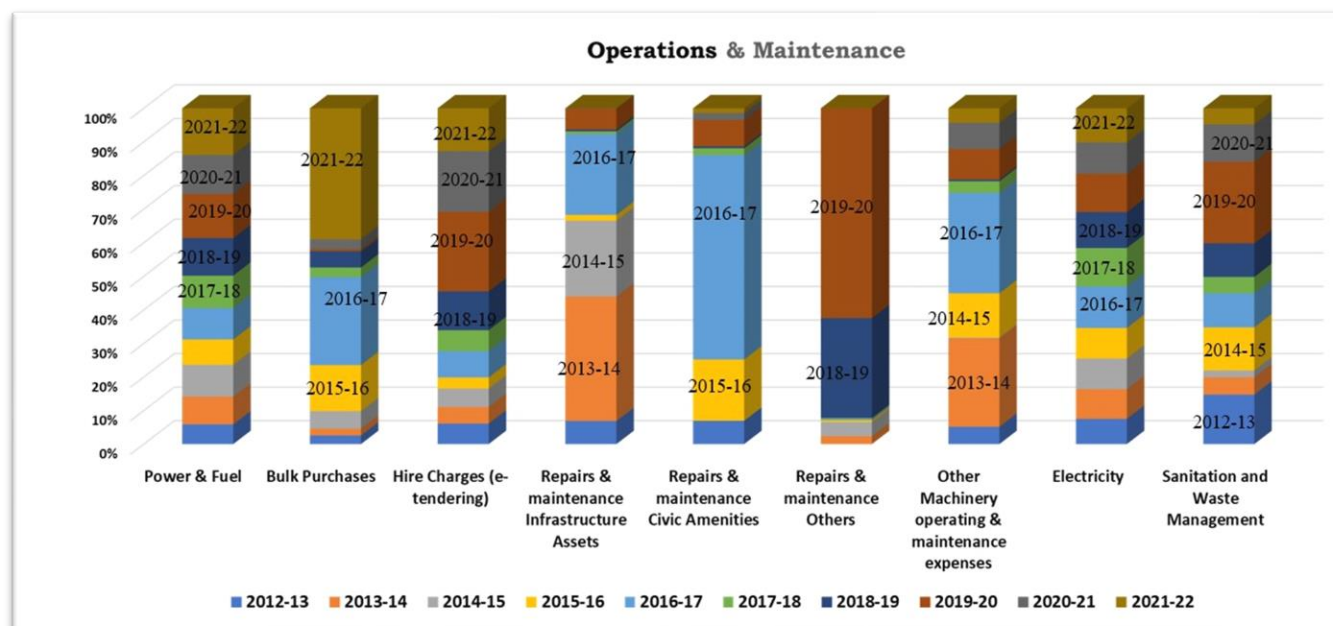


Fig:2.5

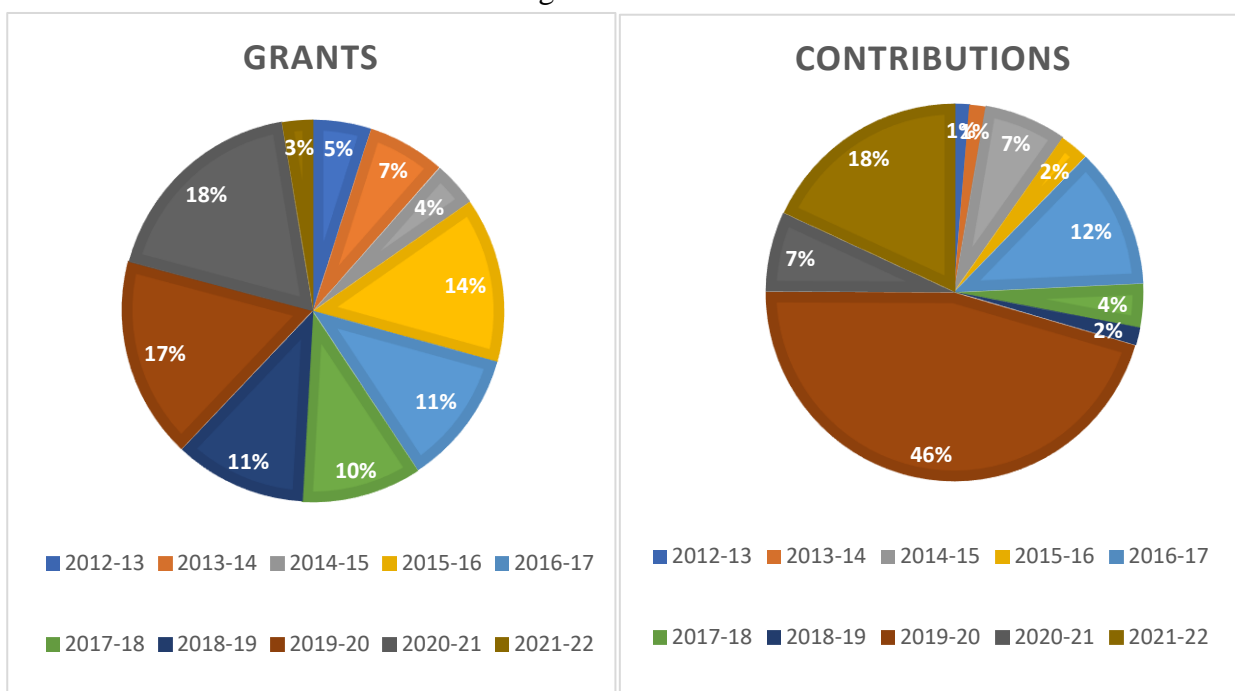
Interpretation: From the above Fig: Measure Allocations in Year

Table:9

Year	Operations and maintenance
2012-13	Sanitation and Waste Management
2013-14	Repairs & Maintenance Infrastructure Assets, Other Machinery & Operating maintenance expenses, Power & Fuel
2014-15	Repairs & Maintenance Infrastructure Assets, Electricity
2015-16	Sanitation and Waste Management, Other Machinery & Operating maintenance expenses, Repairs & Maintenance Civic Amenities, Bulk Purchases
2016-17	Sanitation and Waste Management, Other Machinery & Operating maintenance expenses, Repairs & Maintenance Civic Amenities, Bulk Purchases, Repairs & Maintenance Infrastructure Assets
2017-18	Electricity, Power & Fuel
2018-19	Repairs & Maintenance others, Sanitation and Waste Management, Hire charges(E-tendering)
2019-20	Repairs & Maintenance others, Sanitation and Waste Management, Hire charges(E-tendering), Power & Fuel
2020-21	Other Machinery & Operating maintenance expenses, Sanitation and Waste Management, Hire charges(E-tendering)

2021-22	Other Machinery & Operating maintenance expenses, Sanitation and Waste Management, Power & Fuel, Bulk Purchases, Electricity
---------	--

Fig:2.6



Interpretation: From the above Fig: 2.6

- **GRANTS:** Year by Year increase in allocation of amount.
- **CONTRIBUTION:** In 2019 “Contribution” is significantly more than any other years. Also, Year by Year increase we can observe in years 2014,2016,2019,2021.

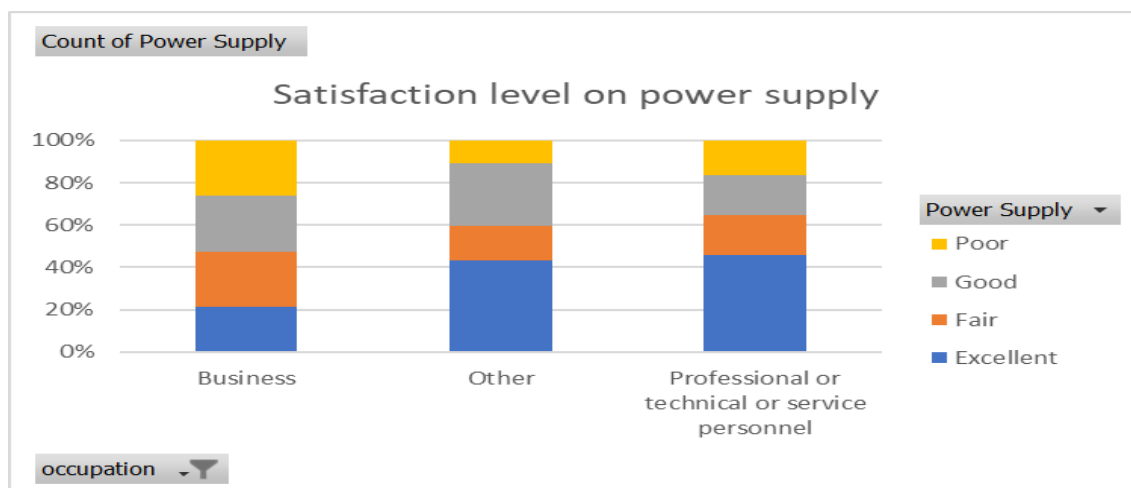


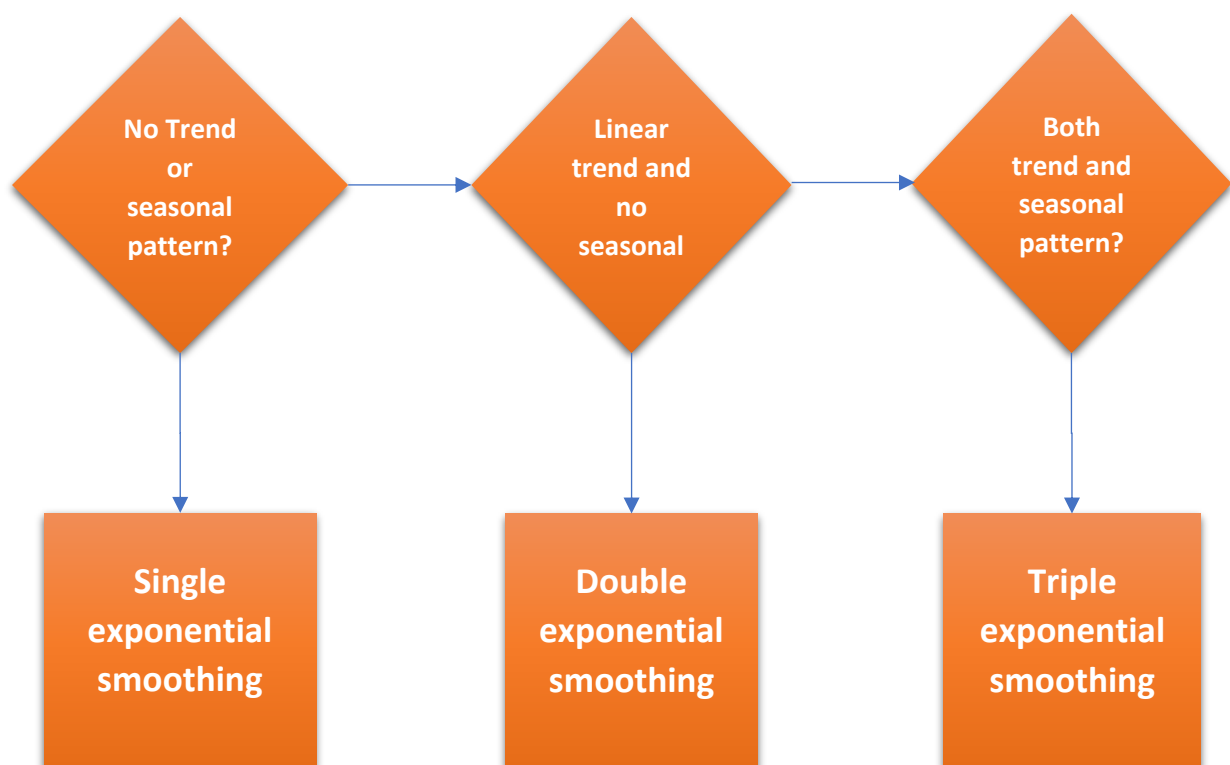
Fig:2.7

Interpretation: From the above Fig:2.7 Respondents from Business sector facing problems of Power supply related problems

Statistical Theory

1.Exponential Smoothing: -

Exponential smoothing is a time series forecasting method for univariate data. Time series methods like the Box-Jenkins ARIMA family of methods develop a model where the prediction is a weighted linear sum of recent past observations or lags. Exponential smoothing forecasting methods are similar in that a prediction is a weighted sum of past observations, but the model explicitly uses an exponentially decreasing weight for past observations. Specifically, past observations are weighted with a geometrically decreasing ratio. Forecasts produced using exponential smoothing methods are weighted averages of past observations, with the weights decaying exponentially as the observations get older. In other words, the more recent the observation the higher the associated weight.



How can we check which model is consider for forecast?

Residual Analysis: After fitting the different exponential smoothing models to your data, you can calculate the residuals (the differences between the actual values and the forecasted values) and plot them over time. If the residuals show any patterns or trends, it suggests that the model is not capturing all the relevant information in the data. The best model is the one that has the smallest residuals and the fewest patterns or trends.

Information Criteria: Information criteria such as the Akaike Information Criterion (AIC) or the Bayesian Information Criterion (BIC) can be used to compare the goodness-of-fit of different models. The model with the lowest AIC or BIC value is generally considered the best model.

Forecast Accuracy Metrics: You can evaluate the accuracy of the forecasts generated by the different models using metrics such as Mean Absolute Error (MAE), Mean Squared Error (MSE), or Root Mean Squared Error (RMSE). The model with the smallest error is considered the best model.

$$e_t = y_t - \hat{y}_t, \quad SSE = \sum_{t=1}^n (e_t)^2, \quad MAE = \frac{1}{n} \sum_{t=1}^n |e_t|$$
$$MSE = \frac{SSE}{n} = \frac{\sum_{t=1}^n (e_t)^2}{n}, \quad RMSE = \sqrt{\frac{\sum_{t=1}^n (e_t)^2}{n}}$$

Double Exponential Smoothing

Double exponential smoothing is sometimes called exponential smoothing with trend. If trend exists, single exponential smoothing may need adjustment. There is a need to add a second smoothing constant to account for trend. It is also called as Holt model.

$$\text{Model } C_t = \alpha y_t + (1 - \alpha)(C_{t-1} + T_{t-1})$$

$$T_t = \beta(C_t - C_{t-1}) + (1 - \beta)T_{t-1}$$

y_t = actual value in time t

α = constant-process smoothing constant

β = trend-smoothing constant

C_t = smoothed constant-process value for period t

T_t = smoothed trend value for period t

t = current time period

A smoothing approach for forecasting such a time series that employs two smoothing constants denoted by α and β . There are two estimates C_{t-1} and T_{t-1} is the estimate of the level of the time Series constructed in time period t-1 (This is usually called the permanent component).

T_{t-1} is the estimate of the growth rate of the Time series constructed in time period t-1 (This is usually called the trend component).

2.Friedman Rank Test

This test is a non-parametric statistical test used to compare three or more related groups. It is often used when the assumptions of the parametric tests, such as the one-way ANOVA, are not met.

The Friedman test is used to determine whether there is a significant difference in the median ranks of the groups being compared. It is useful when the data are measured on an ordinal or interval scale, and the samples are related (i.e., paired or matched). The test allows us to determine whether there are any differences between the groups and, if so, which group(s) differ significantly from the others.

The Friedman test assumes that the observations are independent within groups, the observations are measured on an ordinal or interval scale, and the distributions of the differences between the groups are symmetric.

The test statistic is calculated by summing the ranks for each group and then calculating a chi-squared statistic. The degrees of freedom for the test are equal to the number of groups minus one.

If the p-value is less than the significance level (α), we reject the null hypothesis and conclude that there is a significant difference between the groups. If the p-value is greater than the significance level, we fail to reject the null hypothesis and conclude that there is no significant difference between the groups.

Finally, you could conclude by discussing the strengths and limitations of the Friedman rank test. One strength of the test is that it does not assume normality, and it is robust to outliers. However, one limitation is that it requires at least three groups to be compared, and it can be less powerful than parametric tests when the data are normally distributed.

The Friedman rank test is a non-parametric test used to analyse the differences among three or more related samples. It is used when the data do not meet the assumptions required for a parametric test like ANOVA.

The Friedman test is a non-parametric statistical test used to determine whether there are significant differences between groups in a repeated measures design. Here are the hypothesis, mathematical expressions, and test statistic theory for the Friedman test:

Hypothesis:

- Null Hypothesis (H0): There is no significant difference between the groups.
- Alternative Hypothesis (Ha): There is a significant difference between the groups.

Mathematical expressions:

The Friedman test uses a rank-based approach to analyse the data. The ranks of each observation in each group are computed, and the ranks are summed across groups. The test statistic is given by:

$$F = \left[\frac{12}{b(k+1)} \sum_{j=1}^k T_j^2 \right] - 3b(k+1)$$

where:

k is number of columns(treatments)

b is number of rows (blocks)

T_j^2 is the squared sum of the ranks for sample treatment

Test statistic theory:

- The Friedman test is based on the rank sums of the observations in each group. The test statistic compares the observed rank sums to what would be expected if the null hypothesis were true.
- The test statistic has a chi-squared distribution with $(k-1)$ degrees of freedom, where k is the number of groups.
- If the test statistic is significant, it indicates that there are significant differences between the groups. The null hypothesis is rejected in favour of the alternative hypothesis.

3.Kendall's tau correlation

Kendall's tau is a non-parametric statistical test used to measure the strength of association between two variables. It is often used when the data are measured on an ordinal scale or when the assumptions of the parametric tests, such as the Pearson correlation coefficient, are not met.

The test is used to determine whether there is a significant relationship between two variables, and if so, the direction and strength of the relationship. It is particularly useful when the data do not meet the assumptions of the Pearson correlation coefficient, such as when the data are not normally distributed or when there are outliers.

The test assumes that the data are paired, and each pair is independent of the other pairs. It also assumes that the data are measured on an ordinal scale.

The test calculates a coefficient that ranges from -1 to 1, where a value of -1 indicates a perfect negative relationship, a value of 0 indicates no relationship, and a value of 1 indicates a perfect positive relationship. The test is based on the number of concordant and discordant pairs in the data.

If the p-value is less than the significance level (alpha), we reject the null hypothesis and conclude that there is a significant relationship between the two variables. If the p-value is greater than the significance level, we fail to reject the null hypothesis and conclude that there is no significant relationship between the two variables.

Finally, you could conclude by discussing the strengths and limitations of Kendall's tau. One strength of the test is that it does not assume normality and is robust to outliers. However, one limitation is that it can be less powerful than parametric tests when the data are normally distributed. Additionally, it only measures the strength of association between two variables and does not provide information about causality or the direction of the relationship.

Test statistics:

$$\text{Kendall's } \tau = \frac{C-D}{C+D}$$

Where C= numbers of concordant pairs

D= number of discordant pairs

- **Concordant:** Ordered in the same way (consistency) i.e. they are in the same order with respect to each variable. For example , a pair of observations X and Y are considered concordant if $(x_1 < x_2)$ and $(y_1 < x_2)$ or $(x_1 > x_2)$ and $(y_1 > x_2)$
- **Discordant:** Ordered differently (inconsistency) i.e., the values are arranged in opposite directions. For example , a pair of observations X and Y are considered discordant if $(x_1 < x_2)$ and $(y_1 > x_2)$ or $(x_1 > x_2)$ and $(y_1 < x_2)$

Data Analysis and Interpretation

1.Forecasting using Exponential Smoothing:

Variables: Tax-revenue, Non-tax revenue, Capital Expenditure, Revenue Expenditure.

Data Table:

Table:10

Year	Tax-Revenue	Non-Tax Revenue	Capital Expenditure	Revenue Expenditure
2012	40396093	12773106	49562426	84119827
2013	48846924	11411918	52270239	104037944
2014	50407027	11394293	33975811	84178535.68
2015	52102252	12687111	90414118	175910163.7
2016	58166146	19763845	40282173	168139326.3
2017	57848497	13317029	34409047	148446137.8
2018	63961684	21442642	61648759	157143349.4
2019	80998550	13626372	60264117	232276780
2020	68782398	16765400	64790287	222485388
2021	68864386	17673777	48984060	118912916.1

Source: Secondary data

A) Tax-Revenue Analysis:

Holt Model (Double Exponential Smoothing):

Model

Holt's method

Call:

holt(y = ts, h = 3, beta = 0.003)

Smoothing parameters:

alpha = 0.003

beta = 0.003

Initial states:

$$l = 39571355.0073$$

$$b = 3539279.7376$$

sigma: 6356639

AIC AICc BIC

339.2178 347.2178 340.4281

Forecasting for next 3 years

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
2022	78506440	70360079	86652801	66047656	90965224
2023	82046170	73899663	90192678	69587162	94505179
2024	85585901	77439063	93732738	73126388	98045413

Plot

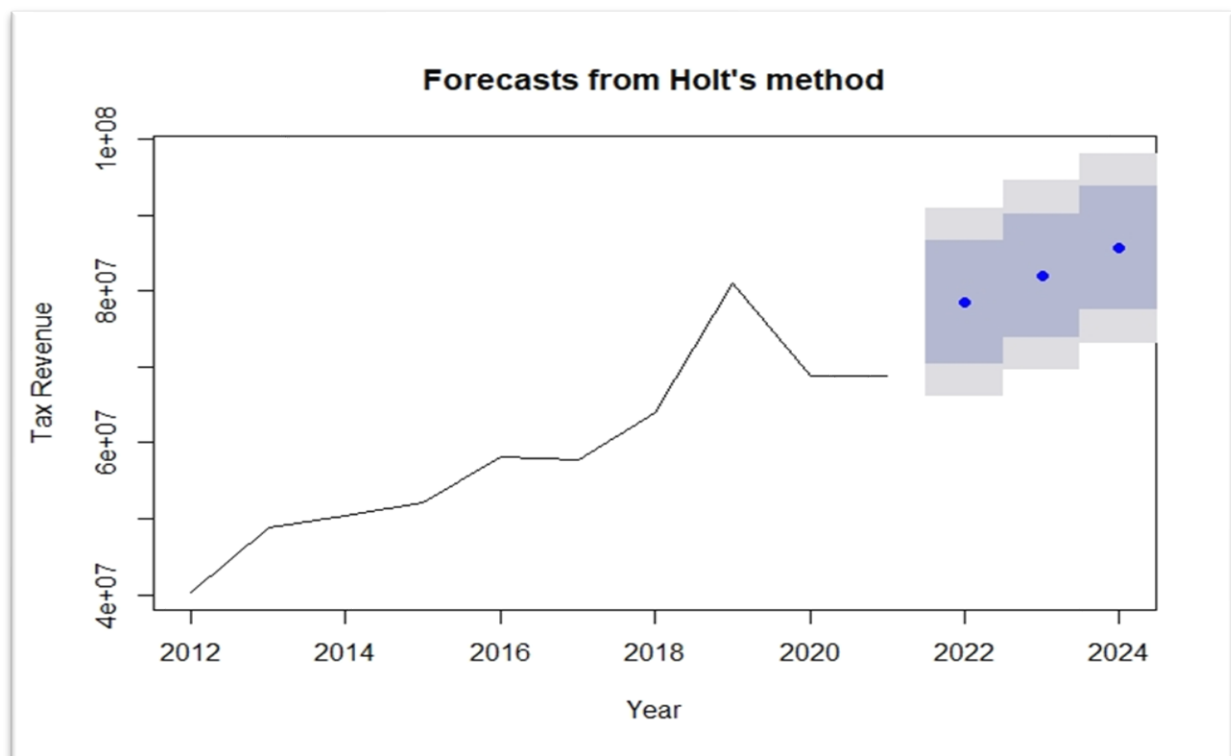


Fig:3.1

Model Accuracy

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	15013.22	4923832	3291313	-0.5349313	5.100105	0.5533076	-0.1336098

Interpretation: From the above analysis we forecasted the estimated Tax

Revenue collection for 2022, 2023 and 2024.

2022: The estimated tax for the 2022 is 78506440. There is a 95% probability that it will fall between 66047656 and 90965224.

2023: The estimated tax for the 2023 is 82046170. There is a 95% probability that it will fall between 69587162 and 94505179.

2024: The estimated tax for the 2024 is 85585901. There is a 95% probability that it will fall between 73126388 and 98045413.

B) Non-Tax Revenue Analysis:

Model

Holt's method

Call:

`holt(y = tsn, h = 3, beta = 0.002)`

Smoothing parameters:

`alpha = 0.002`

`beta = 0.002`

Initial states:

`l = 11333529.689`

`b = 682185.9312`

`sigma: 3587951`

AIC AICc BIC

327.7794 335.7794 328.9898

Forecasting for Next 3 years

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
2022	18838129	14239985	23436273	11805874	25870384
2023	19520395	14922214	24118576	12488084	26552706
2024	20202660	15604397	24800924	13170223	27235098

Plot

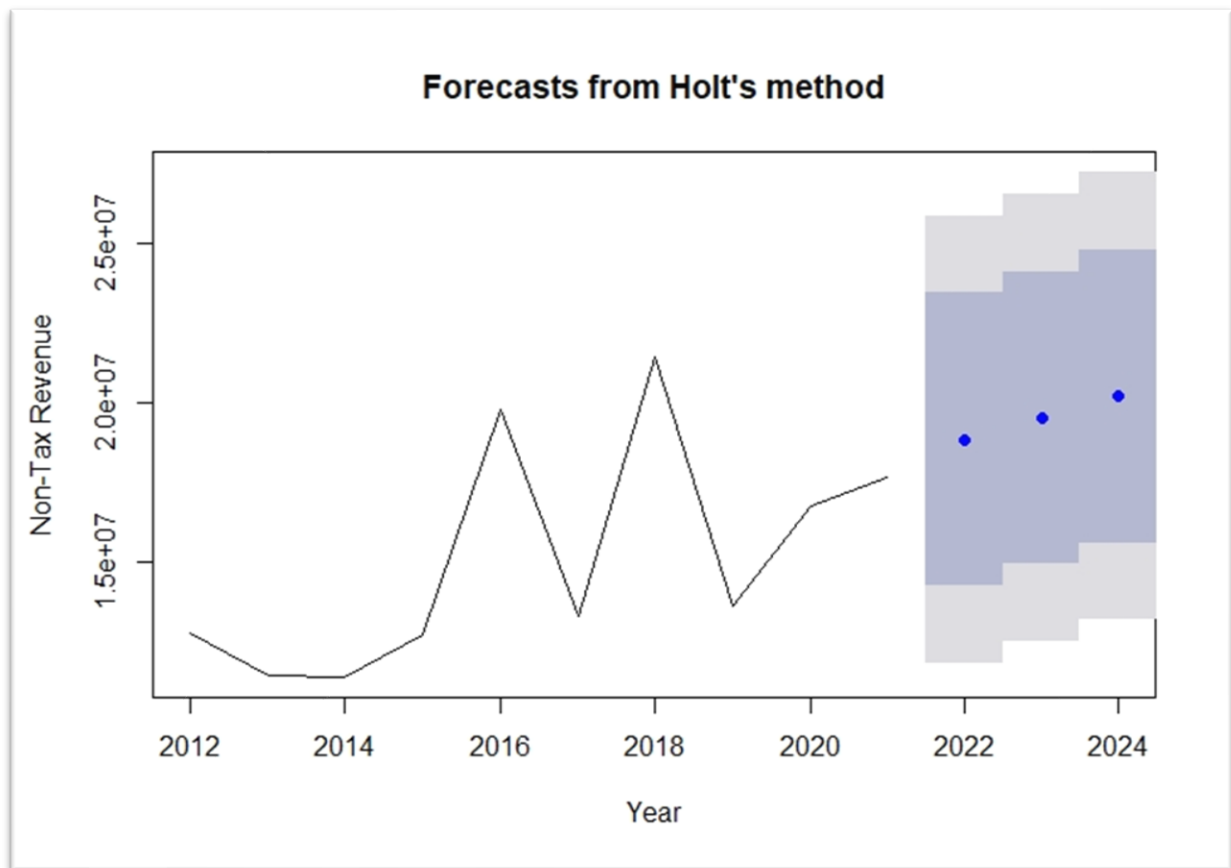


Fig:4.1

Model Accuracy

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	3986.507	2779215	2224915	-2.912935	14.1864	0.5533932	-0.5020853

Interpretation: Here the predicted non tax revenue collection for year 2022 is 18838129 and for 2023 and 2024 are 19520395 and 20202660 respectively.

C) Capital Expenditure:

Model

Holt's method

Call:

holt(y = tsc, h = 3, beta = 0.01)

Smoothing parameters:

alpha = 0.01

beta = 0.01

Initial states:

l = 49603190.6562

b = 737620.8749

sigma: 20660155

AIC AICc BIC
362.7919 370.7919 364.0023

Forecasting for next 3 years

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
2022	57731276	31254222	84208330	17238116	98224436
2023	58470791	31988441	84953140	17969533	98972049
2024	59210305	32716046	85704564	18690833	99729778

Plot

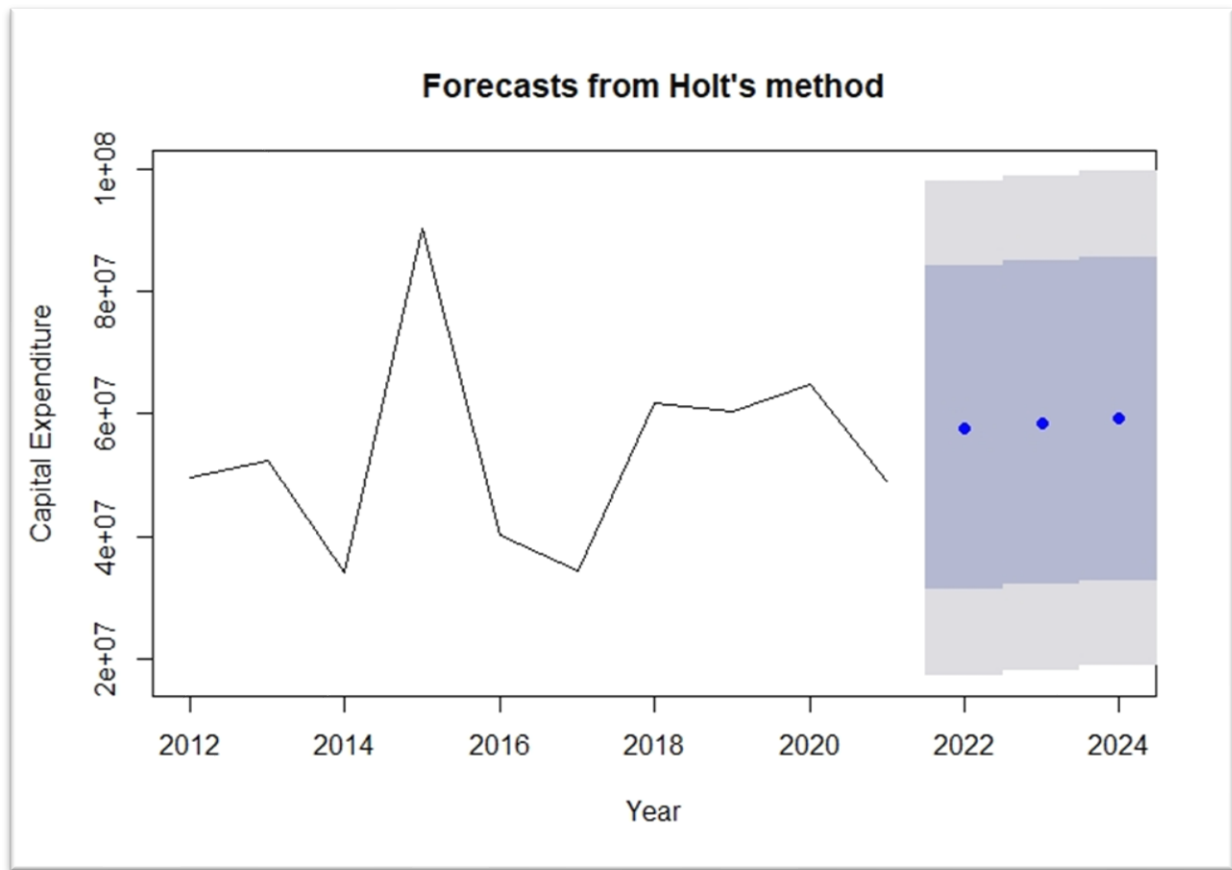


Fig:5.1

Model Accuracy

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	18937.09	16003287	11970303	-8.365469	23.84009	0.5906323	-0.4219823

Interpretation: here the Predicted value of the capital expenditure for the year 2022 is 57731276 and further the for 2023 and 2024 are somewhat same so capital expenditure of the municipality is not much changing over the years.

D) Revenue Expenditure:

Model

Holt's method

Call:

holt(y = tsr, h = 3) Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 89339453.5102

b = 11024156.685

sigma: 49901780

AIC	AICc	BIC
382.4289	397.4289	383.9419

Forecasting for next 3 years

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
2022	210603191	146651487	274554895	112797499	308408882
2023	221626948	157675242	285578653	123821255	319432641
2024	232650705	168698997	296602413	134845007	330456403

Plot

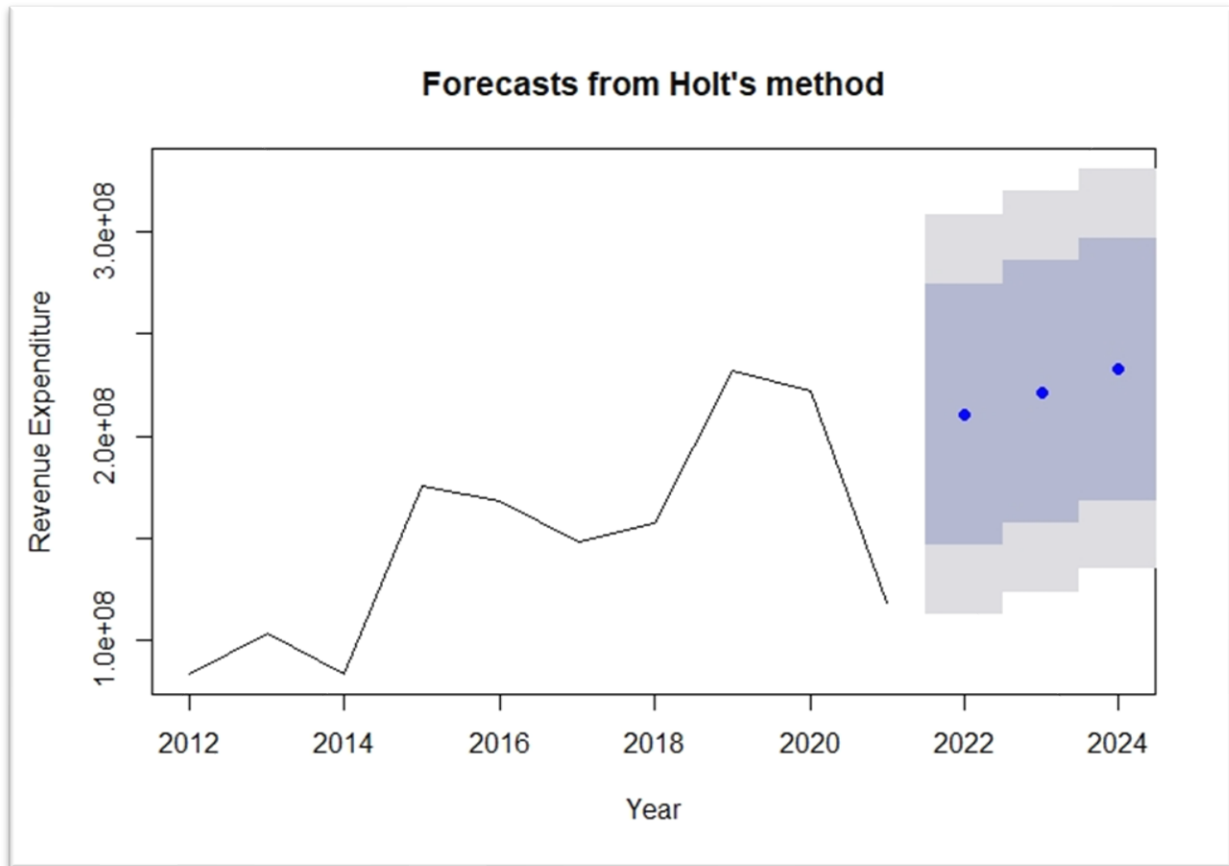


Fig:6.1

Interpretation: From the above graph though it is showing downward slope in revenue expenditure in recent year but predicted values are showing upward trend. So Predicted values of spending for 2022, 2023 and 2024 are 210603191, 221626948 and 232650705 respectively.

2. Friedman Rank Test : for Tax Revenue

Step 1: Enter the data

Enter the following data, which shows the yearly amount collected to the taxes for 10 years. Since each tax is having each of the ten years, we calculate proportion. We will calculate the proportion of each tax for that each year. Now we have proportion of allocated amount for tax to the total tax. For example, Property tax (0.286204) that of total tax for year 2012.

	A	B	C	D	E	F	G	H	I	J	K
1	TAX	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
2	Property Tax	0.286204213	0.251089854	0.261747911	0.256438321	0.270468066	0.2463092	0.268808495	0.212265022	0.270467453	0.271198381
3	Water Tax	0.005971988	0.005446423	0.007044692	0.006950851	0.050514315	0.054965922	0.054694026	0.043509248	0.050804117	0.0567992
4	Sewerage Tax	0.115820631	0.171028108	0.168911092	0.145840663	0.146336771	0.141770684	0.141799268	0.126220926	0.145594938	0.147475445
5	Conservancy (Sanitation) Tax	0.065266931	0.102534174	0.101955606	0.091755554	0.095386189	0.08869641	0.088714049	0.081444273	0.096342585	0.098120021
6	Lighting Tax	0.050159554	0.070806076	0.070095703	0.063121513	0.063826766	0.060612793	0.059727711	0.212265022	0.053257652	0.054361176
7	Education Tax	0.042910759	0.035979973	0.038418909	0.037173384	0.039478376	0.036588107	0.039587404	0.030971443	0.043975597	0.038762257
8	Vehicle Tax	0.003493927	0.005459504	0.003181025	0.003084224	0.002749125	0.003446313	0.002825473	0.002198286	0.00315604	0.003473639
9	Tax on Animals	0	0.000137184	0	0	0	0.000509953	0.001512624	0.000117286	0.000443427	0.000442899
10	Professional Tax	0.175004152	0.142601467	0.139004012	0.150342772	0.133731174	0.133600342	0.13341786	0.111608986	0.137113088	0.139214296
11	Advertisement Tax	0.003940975	0	3.97E-05	0.00140493	0.000154729	0.015147429	0.004202516	0.004977867	0.006448161	0.010734141
12	Octroi & Toll	0.244868532	0.207192289	0.207137509	0.238807413	0.196849676	0.215683114	0.199026295	0.168973827	0.183677516	0.168170598
13	Others Taxes	0.006358338	0.007724949	0.002463863	0.005080375	0.000504813	0.002669732	0.005684278	0.005447814	0.008719426	0.011247948
14											

Table:11

Step 2: Rank the data.

Next, rank the data values in each row in descending order using the =RANK.AVG() function. The following formula shows how to calculate the rank for the proportion of property tax on year 2012:

A	B	C	D	E	F	G	H	I	J	K	L	M
TAX	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		RANK_2012
Property Tax	0.286204213	0.251089854	0.261747911	0.256438321	0.270468066	0.2463092	0.268808495	0.212265022	0.270467453	0.271198381	=RANK.AVG(B2,K2,0)	9
Water Tax	0.005971988	0.005446423	0.007044692	0.006950851	0.050514315	0.054965922	0.054694026	0.043509248	0.050804117	0.0567992		10
Sewerage Tax	0.115820631	0.171028108	0.168911092	0.145840663	0.146336771	0.141770684	0.141799268	0.126220926	0.145594938	0.147475445		10
Conservancy (Sanitation) Tax	0.065266931	0.102534174	0.101955606	0.091755554	0.095386189	0.08869641	0.088714049	0.081444273	0.096342585	0.098120021		10
Lighting Tax	0.050159554	0.070806076	0.070095703	0.063121513	0.063826766	0.060612793	0.059727711	0.212265022	0.053257652	0.054361176		10
Education Tax	0.042910759	0.035979973	0.038418909	0.037173384	0.039478376	0.036588107	0.039587404	0.030971443	0.043975597	0.038762257		2
Vehicle Tax	0.003493927	0.005459504	0.003181025	0.003084224	0.002749125	0.003446313	0.002825473	0.002198286	0.00315604	0.003473639		2
Tax on Animals	0	0.000137184	0	0	0	0.000509953	0.001512624	0.000117286	0.000443427	0.000442899		8.5
Professional Tax	0.175004152	0.142601467	0.139004012	0.150342772	0.133731174	0.133600342	0.13341786	0.111608986	0.137113088	0.139214296		1
Advertisement Tax	0.003940975	0	3.97E-05	0.00140493	0.000154729	0.015147429	0.004202516	0.004977867	0.006448161	0.010734141		6
Octroi & Toll	0.244868532	0.207192289	0.207137509	0.238807413	0.196849676	0.215683114	0.199026295	0.168973827	0.183677516	0.168170598		1
Others Taxes	0.006358338	0.007724949	0.002463863	0.005080375	0.000504813	0.002669732	0.005684278	0.005447814	0.008719426	0.011247948		4
												64.5

Table:12

Copy this formula to the rest of the cells:

	L	M	N	O	P	Q	R	S	T	U	V
1	TAX	RANK_2012	RANK_2013	RANK_2014	RANK_2015	RANK_2016	RANK_2017	RANK_2018	RANK_2019	RANK_2020	RANK_2021
2	Property Tax	1	8	6	7	3	9	5	10	4	2
3	Water Tax	9	10	7	8	5	2	3	6	4	1
4	Sewerage Tax	10	1	2	5	4	8	7	9	6	3
5	Conservancy (Sanitation) Tax	10	1	2	6	5	8	7	9	4	3
6	Lighting Tax	10	2	3	5	4	6	7	1	9	8
7	Education Tax	2	9	6	7	4	8	3	10	1	5
8	Vehicle Tax	2	1	5	7	9	4	8	10	6	3
9	Tax on Animals	8.5	5	8.5	8.5	8.5	2	1	6	3	4
10	Professional Tax	1	3	5	2	7	8	9	10	6	4
11	Advertisement Tax	6	10	9	7	8	1	5	4	3	2
12	Octroi & Toll	1	4	5	2	7	3	6	9	8	10
13	Others Taxes	4	3	9	7	10	8	5	6	2	1

Table:13

Step 3: Calculate the Friedman Rank Test:

Calculate the sum of the ranks for each column. Also calculate squared sum of ranks;

The test statistics is defined as :

$$F = \left[\frac{12}{b(k)} \sum_{j=1}^k T_j^2 \right] - 3b(k+1)$$

where:

k is number of columns(treatments)

b is number of rows (blocks)

T_j^2 is the squared sum of the ranks for sample treatment

Hypothesis:

H_0 :=The mean rank of Tax Revenue is same over the years.

H_1 = The mean rank of Tax Revenue is not same over the years.

The test is $F(t)=11.5$ and the corresponding p-value is $p=0.24299$. Since the value is greater than 0.05, we failed to reject null hypothesis that the mean rank of Tax Revenue collection is same over the years.

[illegible]

Step 4:

We have significant evidence to conclude that the proportion of amount tax revenue collected over the ten years is statistically significantly same.

Friedman Rank Test : for Non-Tax Revenue

Step 1: Enter the data

Enter the following data, which shows the yearly collection of the non-taxes for 10 years.

Since each non-tax is having each of the ten years, we calculate proportion. We will calculate the proportion of each non-tax for that each year. Now we have proportion of collected amount for non-tax to the total non-tax revenue. For example, Miscellaneous Income (0.223019836) that of total non-tax for year 2012.

	A	B	C	D	E	F	G	H	I	J	K	L
1	NON-TAX	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
2	Empanelment_and_Registration_Charges	0.001067399	0.001244313	0.00123439	0.003198443	0.003769509	0.018198579	0.006901575	0.017591476	0.005318513	0.001414525	
3	Licensing_Fees	0.000988405	0.022713097	0.002496864	0.005911511	0.004242191	0.007250266	0.002568247	0.005126456	0.032325504	0.011760587	
4	Fees_for_Grant_of_Permit	0.037187509	0.007014509	0.001985643	0.004713445	0.004355175	0.001130883	0.000559633	0.001009073	0.002384375	0.023056192	
5	Fees_for_Certificate_or_Extract	0.000477566	0.000593678	0.000249686	0.001165671	0.000556572	0.000788464	0.000303134	0.000642577	0.001353383	0.013259192	
6	Development_Charges	0.018455809	0.106467642	0.013954354	0.019208471	0.002808917	0.129606987	0.241591498	0.091646551	0.006399489	0.1215653	
7	Regularization_Fees	0.001428783	0.007298948	0.009197587	0.006134966	0.000637528	0.001126377	0.017946063	0.005313226	0.002958474	0.002249095	
8	Penalties_and_Fines	0.02176581	0.029255468	0.030555999	0.035694651	0.031388831	0.030055127	0.030227712	0.041183376	0.02954585	0.025464676	
9	Other_Fees	0.064356156	0.002900477	0.286086201	0.015833786	0.012926381	0.009920831	0.016301816	0.06926275	0.056294511	0.023559254	
10	User_Charges	0.003333175	0.00227832	0.000394935	0.00140355	0.004409567	0.008010495	0.040013726	0.02310593	0.001182972	0.004908402	
11	Entry_Fees	0.019252169	0.0113916	0.006521598	0.001914147	0.001718846	0.000774572	0.006256225	0.00280302	0.007698892	0.040645415	
12	Service_Administrative_Charges	0.022312506	0.084152725	0.082256968	0.199908868	0.094151214	0.153998313	0.153148106	0.211913707	0.028539194	0.004001974	
13	Other_Charges	0.268619708	0.224059006	0.059716825	0.014241304	0.353509148	0.01225874	0.046345082	0.114438605	0.009692581	0.001725721	
14	Fees_Remission_and_Refund	0.04937828	0.116324355	0.013226972	0.087146711	0.07084755	0.107696694	0.054400946	0.095263802	0.120471149	0.181755151	
15	Sale_of_stores_&_scrap	0.020288644	0.015414674	0.111889434	0.025214251	0.01109865	0.00542163	0.015317142	0.030851866	0.021468083	0.015608322	
16	Rent_from_Civic_Amenities	0.005163192	0.023368552	0.00282466	0.004098648	0.000265637	0.000448674	0.000150401	0.000730202	0.04956112	0.005632639	
17	Rent_from_Guest_Houses	0.001402321	0.002160548	0.001129074	0.002034663	0.000229611	0.000641885	0.000279023	0.000564861	0.000250218	0.000486597	
18	Other_rents	0.000341342	0.000718197	0.000319458	0.000277447	0.002706963	0.000953141	0.000162293	0.000265074	0.000625097	0.009732272	
19	Interest	0.24116139	0.201332589	0.226303817	0.313143079	0.203217593	0.34750694	0.231091672	0.103259841	0.093178928	0.137288651	
20	Miscellaneous_Income	0.223019836	0.141311303	0.149655534	0.258756387	0.197160117	0.164211402	0.136435706	0.185027607	0.530751667	0.375886037	

Table:15

Step 2: Rank the data.

Next, rank the data values in each row in descending order using the =RANK.AVG() function. The following formula shows how to calculate the rank for the proportion of Empanelment and Registration Charges on year 2012:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	NON-TAX	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		RANK_2012	RANK_2013	RAI
2	Empanelment_and_Registration_Charges	0.001067399	0.001244313	0.00123439	0.003198443	0.003769509	0.018198579	0.006901575	0.017591476	0.005318513	0.001414525		=RANK.AVG(B2,\$B\$2:\$K\$2,0)		
3	Licensing_Fees	0.000988405	0.022713097	0.002496864	0.005911511	0.004242191	0.007250266	0.002568247	0.005126456	0.032325504	0.011760587		10	2	
4	Fees_for_Grant_of_Permit	0.037187509	0.007014509	0.001985643	0.004713445	0.004355175	0.001130883	0.000559633	0.001009073	0.002384375	0.023056192		1	3	
5	Fees_for_Certificate_or_Extract	0.000477566	0.000593678	0.000249686	0.001165671	0.000556572	0.000788464	0.000303134	0.000642577	0.001353383	0.013259192		8	6	
6	Development_Charges	0.018455809	0.106467642	0.013954354	0.019208471	0.002808917	0.129606987	0.241591498	0.091646551	0.006399489	0.1215653		7	4	
7	Regularization_Fees	0.001428783	0.007298948	0.009197587	0.006134966	0.000637528	0.001126377	0.017946063	0.005313226	0.002958474	0.002249095		8	3	
8	Penalties_and_Fines	0.02176581	0.029255468	0.030555999	0.035694651	0.031388831	0.030055127	0.030227712	0.041183376	0.02954585	0.025464676		10	8	
9	Other_Fees	0.064356156	0.002900477	0.286086201	0.015833786	0.012926381	0.009920831	0.016301816	0.06926275	0.056294511	0.023559254		3	10	
10	User_Charges	0.003333175	0.00227832	0.000394935	0.00140355	0.004409567	0.008010495	0.040013726	0.02310593	0.001182972	0.004908402		6	7	
11	Entry_Fees	0.019252169	0.0113916	0.006521598	0.001914147	0.001718846	0.000774572	0.006256225	0.00280302	0.007698892	0.040645415		2	3	
12	Service_Administrative_Charges	0.022312506	0.084152725	0.082256968	0.199908868	0.094151214	0.153998313	0.153148106	0.211913707	0.028539194	0.004001974		9	6	
13	Other_Charges	0.268619708	0.224059006	0.059716825	0.014241304	0.353509148	0.01225874	0.046345082	0.114438605	0.009692581	0.001725721		2	3	
14	Fees_Remission_and_Refund	0.04937828	0.116324355	0.013226972	0.087146711	0.07084755	0.107696694	0.054400946	0.095263802	0.120471149	0.181755151		9	3	
15	Sale_of_stores_&_scrap	0.020288644	0.015414674	0.111889434	0.025214251	0.01109865	0.00542163	0.015317142	0.030851866	0.021468083	0.015608322		5	7	
16	Rent_from_Civic_Amenities	0.005163192	0.023368552	0.00282466	0.004098648	0.000265637	0.000448674	0.000150401	0.000730202	0.04956112	0.005632639		4	2	
17	Rent_from_Guest_Houses	0.001402321	0.002160548	0.001129074	0.002034663	0.000229611	0.000641885	0.000279023	0.000564861	0.000250218	0.000486597		3	1	
18	Other_rents	0.000341342	0.000718197	0.000319458	0.000277447	0.002706963	0.000953141	0.000162293	0.000265074	0.000625097	0.009732272		6	4	
19	Interest	0.24116139	0.201332589	0.226303817	0.313143079	0.203217593	0.34750694	0.231091672	0.103259841	0.093178928	0.137288651		3	7	
20	Miscellaneous_Income	0.223019836	0.141311303	0.149655534	0.258756387	0.197160117	0.164211402	0.136435706	0.185027607	0.530751667	0.375886037		4	9	

Table:16

Copy this formula to the rest of the cells:

NON-TAX	RANK_2012	RANK_2013	RANK_2014	RANK_2015	RANK_2016	RANK_2017	RANK_2018	RANK_2019	RANK_2020	RANK_2021
Empanelment_and_Registration_Charges	10	8	9	6	5	1	3	2	4	7
Licensing_Fees	10	2	9	5	7	4	8	6	1	3
Fees_for_Grant_of_Permit	1	3	7	4	5	8	10	9	6	2
Fees_for_Certificate_or_Extract	8	6	10	3	7	4	9	5	2	1
Development_Charges	7	4	8	6	10	2	1	5	9	3
Regularization_Fees	8	3	2	4	10	9	1	5	6	7
Penalties_and_Fines	10	8	4	2	3	6	5	1	7	9
Other_Fees	3	10	1	7	8	9	6	2	4	5
User_Charges	6	7	10	8	5	3	1	2	9	4
Entry_Fees	2	3	5	8	9	10	6	7	4	1
Service_Administrative_Charges	9	6	7	2	5	3	4	1	8	10
Other_Charges	2	3	5	7	1	8	6	4	9	10
Fees_Remission_and_Refund	9	3	10	6	7	4	8	5	2	1
Sale_of_stores_&_scrap	5	7	1	3	9	10	8	2	4	6
Rent_from_Civic_Amenities	4	2	6	5	9	8	10	7	1	3
Rent_from_Guest_Houses	3	1	4	2	10	5	8	6	9	7
Other_rents	6	4	7	8	2	3	10	9	5	1
Interest	3	7	5	2	6	1	4	9	10	8
Miscellaneous_Income	4	9	8	3	5	7	10	6	1	2

Table:17

Step 3: Calculate the Friedman Rank Test:

Calculate the sum of the ranks for each column. Also calculate squared sum of ranks;

Hypothesis:

Ho:=The mean rank of Non-Tax Revenue is same over the years.

H_1 = The mean rank of Non-Tax Revenue is not same over the years.

The test is $F(t)=7.731$ and the corresponding p-value is $p=0.5614$. Since the value is greater than 0.05, we failed to reject null hypothesis that the mean rank of Tax Revenue collection is same over the years.

	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	NON-TAX	RANK_2012	RANK_2013	RANK_2014	RANK_2015	RANK_2016	RANK_2017	RANK_2018	RANK_2019	RANK_2020	RANK_2021			
2	Empanelment_and_Registration_Charges	10	8	9	6	5	1	3	2	4	7		Bloks(Type)b	19
3	Licensing_Fees	10	2	9	5	7	4	8	6	1	3		Treatments(years)k	10
4	Fees_for_Grant_of_Permit	1	3	7	4	5	8	10	9	6	2			
5	Fees_for_Certificate_or_Extract	8	6	10	3	7	4	9	5	2	1		SQUARED SUM OF RANKS	
6	Development_Charges	7	4	8	6	10	2	1	5	9	3		sum(rank12)^2	12100
7	Regularization_Fees	8	3	2	4	10	9	1	5	6	7		sum(rank13)^2	9216
8	Penalties_and_Fines	10	8	4	2	3	6	5	1	7	9		sum(rank14)^2	13924
9	Other_Fees	3	10	1	7	8	9	6	2	4	5		sum(rank15)^2	8281
10	User_Charges	6	7	10	8	5	3	1	2	9	4		sum(rank16)^2	15129
11	Entry_Fees	2	3	5	8	9	10	6	7	4	1		sum(rank17)^2	11025
12	Service_Administrative_Charges	9	6	7	2	5	3	4	1	8	10		sum(rank18)^2	13924
13	Other_Charges	2	3	5	7	1	8	6	4	9	10		sum(rank19)^2	8649
14	Fees_Remission_and_Refund	9	3	10	6	7	4	8	5	2	1		sum(rank20)^2	10201
15	Sale_of_stores_&_scrap	5	7	1	3	9	10	8	2	4	6		sum(rank21)^2	8100
16	Rent_from_Civic_Amenities	4	2	6	5	9	8	10	7	1	3		total	110549
17	Rent_from_Guest_Houses	3	1	4	2	10	5	8	6	9	7		alpha	0.05
18	Other_rents	6	4	7	8	2	3	10	9	5	1			
19	Interest	3	7	5	2	6	1	4	9	10	8		F(t)	7.7311
20	Miscellaneous_Income	4	9	8	3	5	7	10	6	1	2		critical value	16.91898
21		110	96	118	91	123	105	118	93	101	90		chi-square	
22														
23														
24														
25														
26														
27														
28														

Table:18

Step 4:

Conclusion:

We have significant evidence to conclude that the proportion of amount non-tax revenue collected over the ten years is statistically significantly same.

Friedman Rank Test : for Capital Expenditure

Step 1: Enter the data

Enter the following data, which shows the yearly amount allocated to the Capital expenditure for 10 years. Since each Capital expenditure is having each of the ten years, we calculate proportion. We will calculate the proportion of each Capital expenditure for that each year. Now we have proportion of allocated amount for Capital expenditure to the total Capital expenditure. For example, Roads & Bridges (0.539378964217773) that of total Capital expenditure for year 2012.

	B	C	D	E	F	G	H	I	J	K	L	
1	Capital Expenditures	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	
2	Office Buildings and Quarters	0	0	0	0.00000	0.007949521	0	5.45023E-05	7.18836E-05	0.000860005	0.002276332	
3	Civic amenities & Service Centers	0.03421711	0.01335762	0.006014867	0.26775	0.406278678	0.046248215	0.00579856	0.008839887	0	0.108584344	
4	Roads & Bridges	0.539378964	0.555996176	0.58370642	0.44034	0.018726174	0.403529165	0.456710897	0.464188134	0.437273121	0.150107035	
5	Sewerage and Drainage	0.072876356	0.077079655	0.040555677	0.01279	0.17870106	0.068648661	0.028951953	0.058222773	0.020749916	0.138600557	
6	Waterways	0.045585844	0.010749425	0.03950593	0.01461	0.035112157	0.148995263	0.090946989	0.068394796	0.143067	0.039333796	
7	Public Lighting	0.001306817	0.013694676	0.00335265	0.00438	0.014722567	0.003188609	0.002712934	0.001255656	0.00162637	0.005181665	
8	Hospital	0.022547343	0.01243658	0.013060969	0.00529	0.012555703	0.0033209	0.001373799	0.014129138	0.014548261	0.018528395	
9	Vehicles	0.006327737	0.007768417	0.016211092	0.00418	0.005768855	0.020444507	0.014572816	0.081588452	0.004233783	0.067699697	
10	Furniture, Fixtures, Fittings and Electrical Appliances	0	0	0	0.00406	0.031484051	0.000183818	0.000950335	0.001020508	0.000992448	0	
11	Other Equipment :Computer & Machinery	0.000287496	0	0	0.00000	0.023313042	0	0.00198463	0.036835668	0.087739957	4.49126E-05	
12	Fire Services	0.000989257	0.000890201	0.000263452	0.00003	0.001728556	0.000300793	0.001259863	0.004367541	0.00671738	0.005139529	
13	Cemetery	0.02952648	0.010425837	0.014363778	0.00480	0.007958732	0.020463368	0.012173059	0.061393034	0.067667936	0.155292579	
14	Garden	0.003299576	0.019552369	0.057323812	0.06138	0.019010891	0.162233613	0.180836195	0.065308996	0.0196888	0.017158398	
15	Deposits	0.129596885	0.109078648	0.171800932	0.09870	0.076679155	0.064089162	0.122340678	0.075597656	0.078899095	0.123848044	
16	Advances	0.000837328	0.00696381	0.003973415	0.00061	0.016533368	0.005667114	0.00206168	0	0	0.062836768	
17	loans	0.041982186	0.104782513	0	0.01106	0.025788976	0	0.030335907	0	0.019431925	0.025151039	
18	Intrest	0	0	4.79753E-05	0.00000	0	0	0	0	0	0.033300098	
19	Other(Bill deduction)	0.071240621	0.057224074	0.049819032	0.07002	0.117688512	0.052686812	0.046935203	0.058785878	0.096504002	0.046916813	
20												

Table:19

Step 2: Rank the data.

Next, rank the data values in each row in descending order using the =RANK.AVG() function. The following formula shows how to calculate the rank for the proportion of Office Buildings and Quarters on year 2012:

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Capital Expenditures	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22		RANK12	RANK13	RANK
2	Office Buildings and Quarters	0	0	0	0.00000	0.007949521	0	5.45023E-05	7.18836E-05	0.000860005	0.002276332		=RANK.AVG(C2:P2,\$C\$2:\$L\$2,0)		
3	Civic amenities & Service Centers	0.03421711	0.01335762	0.006014867	0.26775	0.406778678	0.046248215	0.00579856	0.008839887	0	0.108584344		RANK.AVG(number,ref,[ordi		
4	Roads & Bridges	0.539378964	0.555996176	0.58370642	0.44034	0.018726174	0.403529165	0.456710897	0.464188134	0.437273121	0.150107035		4	3	
5	Sewerage and Drainage	0.072876356	0.077079655	0.040555677	0.01279	0.17870106	0.068648661	0.028951953	0.058222773	0.020749916	0.138600557		5	10	
6	Waterways	0.045585844	0.010749425	0.03950593	0.01461	0.035112157	0.148995263	0.090946989	0.068394796	0.143067	0.039333796		9	2	
7	Public Lighting	0.001306817	0.013694676	0.00335265	0.00438	0.014722567	0.003188609	0.002712934	0.001255656	0.00162637	0.005181665		1	7	
8	Hospital	0.022547343	0.01243658	0.013060969	0.00529	0.012555703	0.0033209	0.001373799	0.014129138	0.014548261	0.018528395		7	6	
9	Vehicles	0.006327737	0.007768417	0.016211092	0.00418	0.0005768855	0.020444507	0.014572816	0.081588452	0.004233783	0.067699697		8.5	8.5	
10	Furniture, Fixtures, Fittings and Electrical Appliances	0	0	0	0.00406	0.031484051	0.000183818	0.000950335	0.001020508	0.000992448	0		5	8.5	
11	Other Equipment :Computer & Machinery	0.000287496	0	0	0.00000	0.023313042	0	0.00198463	0.036835668	0.087739957	4.49126E-05		6	7	
12	Fire Services	0.000989257	0.000890201	0.000263452	0.00003	0.001728556	0.000300793	0.001259863	0.004367541	0.00671738	0.005139529		4	8	
13	Cemetery	0.02952648	0.010425837	0.014363778	0.00480	0.007958732	0.020463368	0.012173059	0.061393034	0.067667936	0.155292579		10	7	
14	Garden	0.003299576	0.019552369	0.057323812	0.06138	0.019010891	0.162233613	0.180836195	0.065308996	0.0196888	0.017158398		2	5	
15	Deposits	0.129596885	0.109078648	0.171800932	0.09870	0.076679155	0.064089162	0.122340678	0.075597656	0.078899095	0.123848044		7	3	
16	Advances	0.000837328	0.00696381	0.003973415	0.00061	0.016533368	0.005667114	0.00206168	0	0	0.062836768		2	1	
17	loans	0.041982186	0.104782513	0	0.01106	0.025788976	0	0.030335907	0	0.019431925	0.025151039		7	7	
18	Intrest	0	0	4.79753E-05	0.00000	0	0	0	0	0	0.033300098		3	6	
19	Other(Bill deduction)	0.071240621	0.057224074	0.049819032	0.07002	0.117688512	0.052686812	0.046935203	0.058785878	0.096504002	0.046916813				

Table:20

Copy this formula to the rest of the cells:

	M	N	O	P	Q	R	S	T	U	V	W
1	Capital Expenditures	RANK_2012	RANK_2013	RANK_2014	RANK_2015	RANK_2016	RANK_2017	RANK_2018	RANK_2019	RANK_2020	RANK_2021
2	Office Buildings and Quarters	8	8	8	8	1	8	5	4	3	2
3	Civic amenities & Service Centers	5	6	8	2	1	4	9	7	10	3
4	Roads & Bridges	3	2	1	6	10	8	5	4	7	9
5	Sewerage and Drainage	4	3	7	10	1	5	8	6	9	2
6	Waterways	5	10	6	9	8	1	3	4	2	7
7	Public Lighting	9	2	5	4	1	6	7	10	8	3
8	Hospital	1	7	5	8	6	9	10	4	3	2
9	Vehicles	7	6	4	10	8	3	5	1	9	2
10	Furniture, Fixtures, Fittings and Electrical Appliances	8.5	8.5	8.5	2	1	6	5	3	4	8.5
11	Other Equipment :Computer & Machinery	5	8.5	8.5	8.5	3	8.5	4	2	1	6
12	Fire Services	6	7	9	10	4	8	5	3	1	2
13	Cemetery	4	8	6	10	9	5	7	3	2	1
14	Garden	10	7	5	4	8	2	1	3	6	9
15	Deposits	2	5	1	6	8	10	4	9	7	3
16	Advances	7	3	5	8	2	4	6	9.5	9.5	1
17	loans	2	1	9	7	4	9	3	9	6	5
18	Intrest	7	7	2	3	7	7	7	7	7	1
19	Other(Bill deduction)	3	6	8	4	1	7	9	5	2	10

Table:21

Step 3: Calculate the Friedman Rank Test:

Calculate the sum of the ranks for each column. Also calculate squared sum of ranks;

Hypothesis:

Ho:=The mean rank of Capital expenditure is same over the years.

H_1 = The mean rank Capital expenditure is not same over the years.

The test is F(t)=8.839 and the corresponding p-value is p=0.4522. Since the value is greater than 0.05, we failed to reject null hypothesis that the mean rank of Capital expenditure is same over the years.

	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	Capital Expenditures	RANK_2012	RANK_2013	RANK_2014	RANK_2015	RANK_2016	RANK_2017	RANK_2018	RANK_2019	RANK_2020	RANK_2021		Bloks(Type)b	18
2	Office Buildings and Quarters	8	8	8	8	1	8	5	4	3	2		Treatments(years)K	10
3	Civic amenities & Service Centers	5	6	8	2	1	4	9	7	10	3			
4	Roads & Bridges	3	2	1	6	10	8	5	4	7	9		Squared Sum of Ranks	
5	Sewerage and Drainage	4	3	7	10	1	5	8	6	9	2		sum(rank12)^2	9312.25
6	Waterways	5	10	6	9	8	1	3	4	2	7		sum(rank13)^2	11025
7	Public Lighting	9	2	5	4	1	6	7	10	8	3		sum(rank14)^2	11236
8	Hospital	1	7	5	8	6	9	10	4	3	2		sum(rank15)^2	14280.3
9	Vehicles	7	6	4	10	8	3	5	1	9	2		sum(rank16)^2	6889
10	Furniture, Fixtures, Fittings and Electrical Appliances	8.5	8.5	8.5	2	1	6	5	3	4	8.5		sum(rank17)^2	12210.3
11	Other Equipment :Computer & Machinery	5	8.5	8.5	8.5	3	8.5	4	2	1	6		sum(rank18)^2	10609
12	Fire Services	6	7	9	10	4	8	5	3	1	2		sum(rank19)^2	8742.25
13	Cemetery	4	8	6	10	9	5	7	3	2	1		sum(rank20)^2	9312.25
14	Garden	10	7	5	4	8	2	1	3	6	9		sum(rank21)^2	5852.25
15	Deposits	2	5	1	6	8	10	4	9	7	3		total	99468.5
16	Advances	7	3	5	8	2	4	6	9.5	9.5	1		alpha	0.05
17	loans	2	1	9	7	4	9	3	9	6	5			
18	Intrest	7	7	2	3	7	7	7	7	7	1		F(t)	8.83939
19	Other(Bill deduction)	3	6	8	4	1	7	9	5	2	10		critical value	16.919
20	SUM OF SQUARE OF RANK	96.5	105	106	119.5	83	110.5	103	93.5	96.5	76.5		chi-square	
21														
22		min.sum of ranks	18					Hypothesis					p-value	0.45223
23		max.sum of ranks	180					Ho=Capital Expenditure is same over the years					REJECT NULL?	NO
24		sum of all ranks	990					H1=Capital Expenditure is not same over the years						
25		Exp. Sum Ho	99											

Table:22

Step 4: Conclusion: We have significant evidence to conclude that the proportion of amount Capital spending over the ten years is statistically significantly same.

Friedman Rank Test : for revenue expenditure

Step 1: Enter the data

Enter the following data, which shows the yearly amount allocated to the Revenue Expenditure for 10 years. Since each Revenue Expenditure is having each of the ten years, we calculate proportion. We will calculate the proportion of each Revenue Expenditure for that each year. Now we have proportion of allocated amount for Revenue Expenditure to the total Revenue Expenditure. For example, Salaries, Wages and Bonus (0.288510305661946) that of total Revenue Expenditure for year 2012.

	B	C	D	E	F	G	H	I	J	K	L	M
1	Revenue Expenditure	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	
2	Salaries, Wages and Bonus	0.28851031	0.269085123	0.37355523	0.19230603	0.20597394	0.25443783	0.24974332	0.20041118	0.20129014	0.50100865	
3	Benefits and Allowances	0.00103624	0.010545143	0.02105383	0.00707171	0.00312346	0.01359288	0.00918365	0.02506833	0.00766742	0.02407712	
4	Employee Provident Fund	0.00974311	0.007899704	0.00979454	0.00499571	0.00898785	0.01842927	0.01252996	0.01653994	0.01598137	0.05798371	
5	Election	0.00403376	0.000216892	0.00046514	0	0	0.00400743	0	2.6821E-05	1.2091E-05	0.00067549	
6	Rent, Rates and Taxes	0.00210503	0.003332476	0.0015683	0.00082623	0.00552096	0.00508238	0.00510543	0.00218293	0.00191053	0.00631475	
7	Office Maintenance	0.0127859	0.009118856	0.00209784	0.00206081	0.00035657	0.0023205	0.00162406	0.00305219	0.00126523	0.00538587	
8	Communication Expenses	0.00174417	0.001336541	0.00251905	0.00114006	0.00073519	0.00124473	0.00079587	0.00040264	0.00038344	0.00072467	
9	Books & Periodicals	0.00042902	0.000149772	0.00010026	6.7188E-05	8.1777E-06	1.4955E-05	7.6172E-06	7.405E-06	3.1912E-06	6.8201E-06	
10	Printing and Stationery	0.00158376	0.003914149	0.00192363	0.00092949	0.00166723	0.00116228	0.00080052	0.00142652	0.00203167	0.00380724	
11	Travelling & Conveyance	0.00057113	0.000651301	0.00049833	0.00024093	0.0004658	0.00016727	0.00020068	0.00012356	5.3936E-06	0	
12	Insurance	0.00338264	0.002694286	0.00422402	0.00259098	0.00241535	0.00845162	0.00638619	0.00562324	0.00572292	0.00937871	
13	Fees	7.846E-05	8.57379E-05	0.00014255	0.00271608	0.00250007	0.00098469	0	0.0002708	0	0	
14	Legal Expenses	0.00101046	0.001790404	0.00187696	0.00036951	0.00275069	0.00070733	0.00015909	0.00010763	0.0001236	0.00021444	
15	Professional and other Fees	0.0029101	0.002542274	0.01045373	0.00755953	0.00282663	0	0.00030599	0	0.00109574	0.00108849	
16	Council meeting, Honorarium & sitting fees	0.0021396	0.001178118	0.00336314	0.00098324	0.00437349	0.00239649	0.00112005	0.00354818	0.0012054	0.002411	
17	Advertisement and Publicity	0.00702973	0.004368579	0.00538672	0.00350246	0.00380654	0.00420664	0.00516611	0.00227271	0.00237922	0.00427589	
18	Private security guard	0	0	0	0.00103445	0.0042271	0.00558015	0.00368861	0.00493482	0.00434216	0.00088861	
19	Bank charges	0.00021547	0.005961969	0.00240747	0.00433776	1.6522E-05	7.2013E-06	0	1.9632E-06	1.3803E-05	0.00064605	
20	Power & Fuel	0.01708704	0.019468839	0.02760656	0.01050616	0.01365051	0.01584092	0.01740917	0.01380302	0.01280254	0.02856257	
21	Bulk Purchases	0.00476387	0.003025367	0.00976167	0.01222925	0.02443937	0.00298704	0.00482003	0.00043006	0.00204582	0.05136035	
22	Hire Charges (e-tendering)	0.00037073	0.000243027	0.00033291	9.6515E-05	0.0002379	0.00021528	0.00037458	0.00052128	0.00041329	0.0005483	
23	Repairs & maintenance Infrastructure Assets	0.00549151	0.023988411	0.01801661	0.00065677	0.00962622	0.00035835	0.00021938	0.00179998	4.0452E-05	0	
24	Repairs & maintenance Civic Amenities	0.00832146	0	0	0.0104532	0.03642942	0.00138825	0.00034364	0.00341621	0.0009147	0.00122141	
25	Other operating & maintenance expenses	0.00087018	0.003978712	0.00089212	0.00111372	0.00256051	0.00036075	0.00329864	0.00517474	0.00049801	0.00051458	
26	Electricity	0.09124421	0.086879254	0.11044269	0.05282835	0.07496141	0.07847895	0.06935723	0.05005763	0.04265142	0.08728932	
27	Sanitation and Waste Management	0.04163595	0.011824128	0.00577736	0.01730809	0.01431715	0.00780158	0.01511462	0.02480478	0.01188525	0.00953233	
28	Grants	0.48723235	0.523551042	0.37494477	0.66038577	0.56474933	0.56670653	0.59102374	0.6100434	0.6796543	0.18399617	
29	Contributions	0.00179506	0.001605193	0.00998704	0.00169	0.0085071	0.00298964	0.00114695	0.02332384	0.00366092	0.01808744	
30	Subsidies	0.00187875	0.000564698	0.00048944	0	0	0	0	0	0	0	
31	Miscellaneous expenses (Violet)	0	0	0.00031807	0	0.0007655	7.9086E-05	7.4855E-05	0.00062421	0	0	

Table:23

Step 2: Rank the data.

Next, rank the data values in each row in descending order using the =RANK.AVG() function. The following formula shows how to calculate the rank for the proportion of Salaries, Wages and Bonus on year 2012:

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Revenue Expenditure	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22		RANK12	RANK13
2	Salaries, Wages and Bonus	0.28851031	0.269085123	0.37355523	0.19230603	0.20597394	0.25443783	0.24974332	0.20041118	0.20129014	0.50100865		=RANK.AVG(C2,\$C\$2:\$L\$2,0)	
3	Benefits and Allowances	0.00103624	0.010545143	0.02105383	0.00707171	0.00312346	0.01359288	0.00918365	0.02506833	0.00766742	0.02407712		RANK.AVG(number, ref,	
4	Employee Provident Fund	0.00974311	0.007899704	0.00979454	0.00499571	0.00898785	0.01842927	0.01252996	0.01653994	0.01598137	0.05798371			
5	Election	0.00403376	0.000216892	0.00046514	0	0	0.00400743	0	2.6821E-05	1.2091E-05	0.00067549			
6	Rent, Rates and Taxes	0.00210503	0.003332476	0.0015683	0.00082623	0.00552096	0.00508238	0.00510543	0.00218293	0.00191053	0.00631475			
7	Office Maintenance	0.0127859	0.009118856	0.00209784	0.00206081	0.00035657	0.0023205	0.00162406	0.00305219	0.00126523	0.00538587			
8	Communication Expenses	0.00174417	0.001336541	0.00251905	0.00114006	0.00073519	0.00124473	0.00079587	0.00040264	0.00038344	0.00072467			
9	Books & Periodicals	0.00042902	0.000149772	0.00010026	6.7188E-05	8.1777E-06	1.4955E-05	7.6172E-06	7.405E-06	3.1912E-06	6.8201E-06			
10	Printing and Stationery	0.00158376	0.003914149	0.00192363	0.00092949	0.00166723	0.00116228	0.00080052	0.00142652	0.00203167	0.00380724			
11	Travelling & Conveyance	0.00057113	0.000651301	0.00049833	0.00024093	0.0004658	0.00016727	0.00020068	0.00012356	5.3936E-06	0			
12	Insurance	0.00338264	0.002694286	0.00422402	0.00259098	0.00241535	0.00845162	0.00638619	0.00562324	0.00572292	0.00937871			
13	Fees	7.846E-05	8.57379E-05	0.00014255	0.00271608	0.00250007	0.00098469	0	0.0002708	0	0			
14	Legal Expenses	0.00101046	0.001790404	0.00187696	0.00036951	0.00275069	0.00070733	0.00015909	0.00010763	0.0001236	0.00021444			
15	Professional and other Fees	0.0029101	0.002542274	0.01045373	0.00755953	0.00282663	0	0.00030599	0	0.00109574	0.00108849			
16	Council meeting, Honorarium & sitting fees	0.0021396	0.001178118	0.00336314	0.00098324	0.00437349	0.00239649	0.00112005	0.00354818	0.0012054	0.002411			
17	Advertisement and Publicity	0.00702973	0.004368579	0.00538672	0.00350246	0.00380654	0.00420664	0.00516611	0.00227271	0.00237922	0.00427589			
18	Private security guard	0	0	0	0.00103445	0.0042271	0.00558015	0.00368861	0.00493482	0.00434216	0.00088861			
19	Bank charges	0.00021547	0.005961969	0.00240747	0.00433776	1.6522E-05	7.2013E-06	0	1.9632E-06	1.3803E-05	0.00064605			
20	Power & Fuel	0.01708704	0.019468839	0.02760656	0.01050616	0.01365051	0.01584092	0.01740917	0.01380302	0.01280254	0.02856257			
21	Bulk Purchases	0.00476387	0.003025367	0.00976167	0.01222925	0.02443937	0.00298704	0.00482003	0.00043006	0.00204582	0.05136035			
22	Hire Charges (e-tendering)	0.00037073	0.000243027	0.00033291	9.6515E-05	0.0002379	0.00021528	0.00037458	0.00052128	0.00041329	0.0005483			
23	Repairs & maintenance Infrastructure Assets	0.00549151	0.023988411	0.01801661	0.00065677	0.00962622	0.00035835	0.00021938	0.00179998	4.0452E-05	0			
24	Repairs & maintenance Civic Amenities	0.00832146	0	0	0.0104532	0.03642942	0.00138825	0.00034364	0.00341621	0.0009147	0.00122141			
25	Other operating & maintenance expenses	0.00087018	0.003978712	0.00089212	0.00111372	0.00256051	0.00036075	0.00329864	0.00517474	0.00049801	0.00051458			
26	Electricity	0.09124421	0.086879254	0.11044269	0.05282835	0.07496141	0.07847895	0.06935723	0.05005763	0.04265142	0.08728932			
27	Sanitation and Waste Management	0.04163595	0.011824128	0.00577736	0.01730809	0.01431715	0.00780158	0.01511462	0.02480478	0.01188525	0.00953233			
28	Grants	0.48723235	0.523551042	0.37494477	0.66038577	0.56474933	0.56670653	0.59102374	0.6100434	0.6796543	0.18399617			
29	Contributions	0.00179506	0.001605193	0.00998704	0.00169	0.0085071	0.00298964	0.00114695	0.02332384	0.00366092	0.01808744			
30	Subsidies	0.00187875	0.000564698	0.00048944	0	0	0	0	0	0	0			
31	Miscellaneous expenses (Violet)	0	0	0.00031807	0	0.0007655	7.9086E-05	7.4855E-05	0.00062421	0	0			

Table:24

Copy this formula to the rest of the cells:

	M	N	O	P	Q	R	S	T	U	V	W
1	Revenue Expenditure	RANK12	RANK13	RANK14	RANK15	RANK16	RANK17	RANK18	RANK19	RANK20	RANK21
2	Salaries, Wages and Bonus	3	4	2	10	7	5	6	9	8	1
3	Benefits and Allowances	10	5	3	8	9	4	6	1	7	2
4	Employee Provident Fund	7	9	6	10	8	2	5	3	4	1
5	Election	1	5	4	9	9	2	9	6	7	3
6	Rent, Rates and Taxes	7	5	9	10	2	4	3	6	8	1
7	Office Maintenance	1	2	6	7	10	5	8	4	9	3
8	Communication Expenses	2	3	1	5	7	4	6	9	10	8
9	Books & Periodicals	1	2	3	4	6	5	7	8	10	9
10	Printing and Stationery	6	1	4	9	5	8	10	7	3	2
11	Travelling & Conveyance	2	1	3	5	4	7	6	8	9	10
12	Insurance	7	8	6	9	10	2	3	5	4	1
13	Fees	7	6	5	1	2	3	9	4	9	9
14	Legal Expenses	4	3	2	6	1	5	8	10	9	7
15	Professional and other Fees	3	5	1	2	4	9.5	8	9.5	6	7
16	Council meeting, Honorarium & sitting fees	6	8	3	10	1	5	9	2	7	4
17	Advertisement and Publicity	1	4	2	8	7	6	3	10	9	5
18	Private security guard	9	9	9	6	4	1	5	2	3	7
19	Bank charges	5	1	3	2	6	8	10	9	7	4
20	Power & Fuel	5	3	2	10	8	6	4	7	9	1
21	Bulk Purchases	6	7	4	3	2	8	5	10	9	1
22	Hire Charges (e-tendering)	5	7	6	10	8	9	4	2	3	1
23	Repairs & maintenance Infrastructure Assets	4	1	2	6	3	7	8	5	9	10
24	Repairs & maintenance Civic Amenities	3	9.5	9.5	2	1	5	8	4	7	6
25	Other operating & maintenance expenses	7	2	6	5	4	10	3	1	9	8
26	Electricity	2	4	1	8	6	5	7	9	10	3
27	Sanitation and Waste Management	1	7	10	3	5	9	4	2	6	8
28	Grants	8	7	9	2	6	5	4	3	1	10
29	Contributions	7	9	3	8	4	6	10	1	5	2
30	Subsidies	1	2	3	7	7	7	7	7	7	7
31	Miscellaneous expenses (Violet)	8	8	3	8	1	4	5	2	8	8

Table:25

Step 3: Calculate the Friedman Rank Test:

Calculate the sum of the ranks for each column. Also calculate squared sum of ranks;

Hypothesis:

H_0 :=The mean rank of Revenue Expenditure is same over the years.

H_1 = The mean rank Revenue Expenditure is not same over the years.

The test is $F(t)=22.2290$ and the corresponding p-value is $p=0.00818$. Since the value is less than 0.05, we reject null hypothesis that the mean rank of Revenue Expenditure is same over the years.

	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
1	Revenue Expenditure	RANK12	RANK13	RANK14	RANK15	RANK16	RANK17	RANK18	RANK19	RANK20	RANK21		Bloks(Type)b	30		
2	Salaries, Wages and Bonus		3	4	2	10	7	5	6	9	8	1	Treatments(years)K	10		
3	Benefits and Allowances		10	5	3	8	9	4	6	1	7	2				
4	Employee Provident Fund		7	9	6	10	8	2	5	3	4	1	Squared Sum of Ranks	12/(bk(k+1))	0.00363636	
5	Election		1	5	4	9	9	2	9	6	7	3	sum(rank12)^2	19321		
6	Rent, Rates and Taxes		7	5	9	10	2	4	3	6	8	1	sum(rank13)^2	21756.25		
7	Office Maintenance		1	2	6	7	10	5	8	4	9	3	sum(rank14)^2	17030.25		
8	Communication Expenses		2	3	1	5	7	4	6	9	10	8	sum(rank15)^2	37249		
9	Books & Periodicals		1	2	3	4	6	5	7	8	10	9	sum(rank16)^2	24649		
10	Printing and Stationery		6	1	4	9	5	8	10	7	3	2	sum(rank17)^2	27722.25		
11	Travelling & Conveyance		2	1	3	5	4	7	6	8	9	10	sum(rank18)^2	36100		
12	Insurance		7	8	6	9	10	2	3	5	4	1	sum(rank19)^2	27390.25		
13	Fees		7	6	5	1	2	3	9	4	9	9	sum(rank20)^2	44944		
14	Legal Expenses		4	3	2	6	1	5	8	10	9	7	sum(rank21)^2	22201		
15	Professional and other Fees		3	5	1	2	4	9.5	8	9.5	6	7	total	278363	3b(k+1)	990
16	Council meeting, Honorarium & sitting fees		6	8	3	10	1	5	9	2	7	4	alpha	0.05		
17	Advertisement and Publicity		1	4	2	8	7	6	3	10	9	5				
18	Private security guard		9	9	9	6	4	1	5	2	3	7	F(t)	22.229091		
19	Bank charges		5	1	3	2	6	8	10	9	7	4	critical value	16.918978		
20	Power & Fuel		5	3	2	10	8	6	4	7	9	1	chi-square			
21	Bulk Purchases		6	7	4	3	2	8	5	10	9	1				
22	Hire Charges (e-tendering)		5	7	6	10	8	9	4	2	3	1	p-value	0.0081806		
23	Repairs & maintenance Infrastructure Assets		4	1	2	6	3	7	8	5	9	10				
24	Repairs & maintenance Civic Amenities		3	9.5	9.5	2	1	5	8	4	7	6	REJECT NULL?	YES		
25	Other operating & maintenance expenses		7	2	6	5	4	10	3	1	9	8				
26	Electricity		2	4	1	8	6	5	7	9	10	3	min.sum of ranks	30		
27	Sanitation and Waste Management		1	7	10	3	5	9	4	2	6	8	max.sum of ranks	300		
28	Grants		8	7	9	2	6	5	4	3	1	10	sum of all ranks	1650		
29	Contributions		7	9	3	8	4	6	10	1	5	2	exp. Sum Ho	165		
30	Subsidies		1	2	3	7	7	7	7	7	7	7				
31	Miscellaneous expenses (Violet)		8	8	3	8	1	4	5	2	8	8	Hypothesis			
32	Sum of Ranks		139	147.5	130.5	193	157	166.5	190	165.5	212	149	Ho=Revenue Expenditure is same over the years			
33													H1=Revenue Expenditure is not same over the years			

Table:26

Step 4: Conclusion: We have significant evidence to conclude that the proportion of amount Revenue Expenditure allocated over the ten years is statistically significantly different.

Step 5: To investigate further, we can perform post-hoc tests to determine which pairs of years have significantly different rankings.

Performing the following test in SPSS by selecting "Nonparametric Tests" from the "Analyse" menu and then choosing "Related Samples" and "Friedman Test".

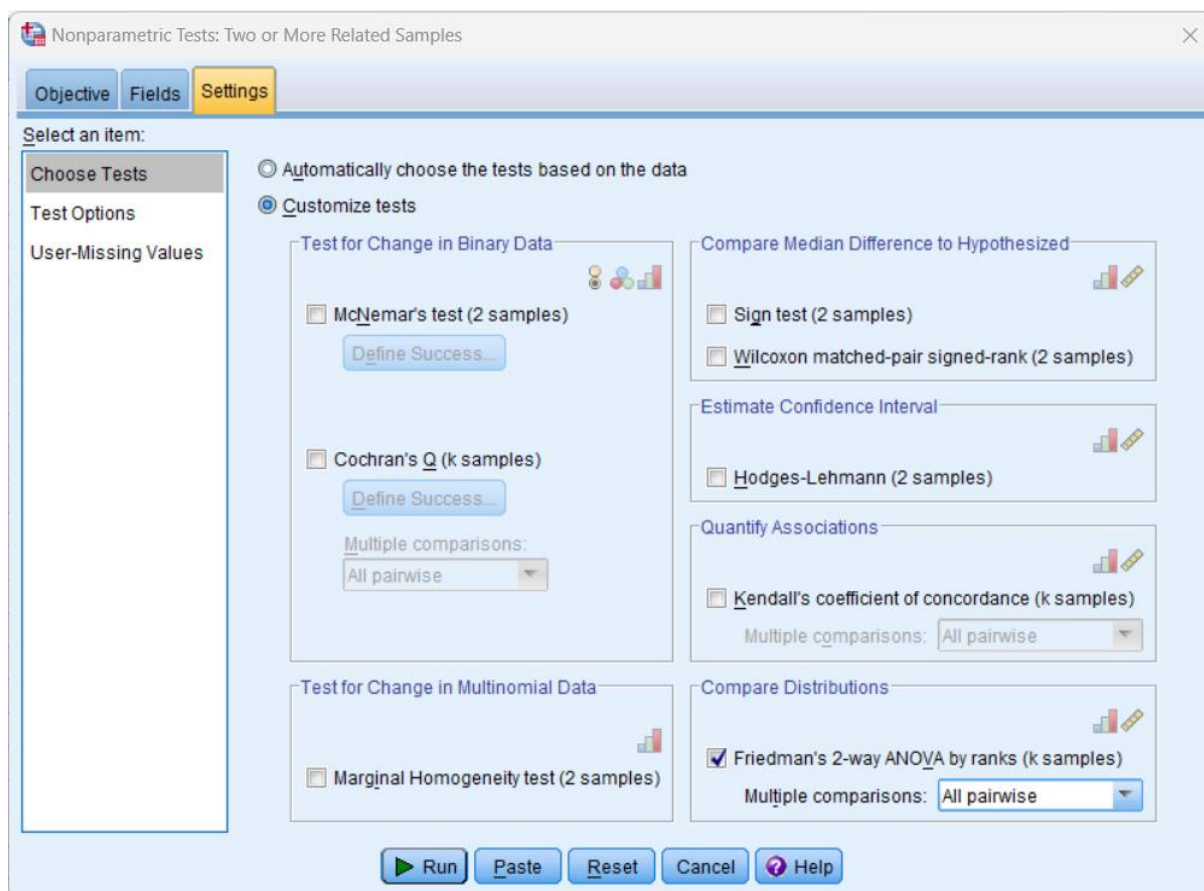
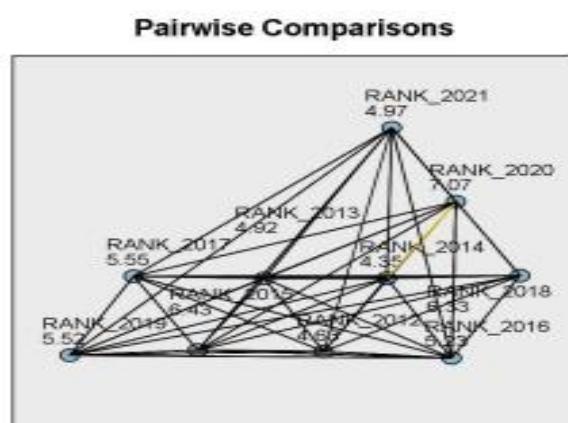


Table:27

Step 6: Result (Output and Interpretation):



Each node shows the sample average rank.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
RANK_2014-RANK_2012	.283	.782	.362	.717	1.000
RANK_2014-RANK_2013	.567	.782	.725	.469	1.000
RANK_2014-RANK_2021	-.617	.782	-.789	.430	1.000
RANK_2014-RANK_2016	-.883	.782	-1.130	.258	1.000
RANK_2014-RANK_2019	-1.167	.782	-1.492	.136	1.000
RANK_2014-RANK_2017	-1.200	.782	-1.535	.125	1.000
RANK_2014-RANK_2018	-1.983	.782	-2.537	.011	.503
RANK_2014-RANK_2015	-2.083	.782	-2.665	.008	.346
RANK_2014-RANK_2020	-2.717	.782	-3.475	.001	.023

Table:28

The p-value is (0.023) i.e. We can say that Rank of year 2014 and Rank of year 2020 is differ statistically significantly. So, from that the revenue expenditure in 2014 and 2020 are different.

3. Kendall's tau correlation

Kendall's tau correlation coefficient value of 1: This indicates a perfect positive correlation, meaning that the rankings of the two variables move in exactly the same direction for each year. If the rank of one variable increases, the rank of the other variable also increases, and vice versa.

Kendall's tau correlation coefficient value of -1: This indicates a perfect negative correlation, meaning that the rankings of the two variables move in exactly the opposite direction for each year. If the rank of one variable increases, the rank of the other variable decreases, and vice versa.

Kendall's tau correlation coefficient value of 0: This indicates no correlation or independence, meaning that the rankings of the two variables do not show any consistent pattern or relationship.

A] For Tax Revenue (Correlation Between Year)

Kendall's tau correlation coefficient for Tax Revenue

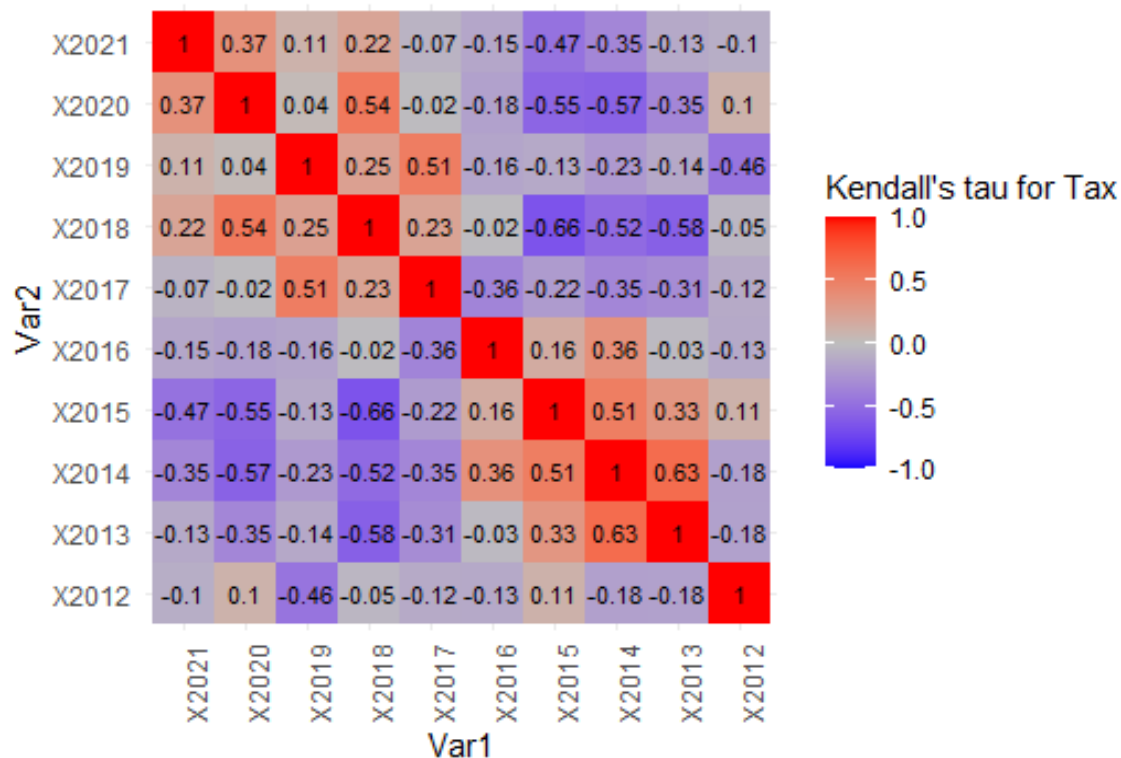


Fig:7.1

Interpretation: Here the above heatmap of tax collection ranking over the years. The above figure shows correlation among years ranking of various taxes. Here you can see that some of near diagonal values are significantly positive correlation that means the consecutive year having positive correlation than that of other years.

e.g. rank of tax in 2013 is somewhat same as in 2014 means collection of some of the taxes in 2014 is same as in 2013.

On the other hand, the off-diagonal values have negative correlation means they are moving in opposite direction and some has negligible correlation.

e.g. correlation between year 2018 and 2015 is -0.66 it shows the rank of taxes in 2018 is different as compared to 2015 means tax collection Structure has changing significantly in these years

.B] For Non-Tax Revenue

Kendall's tau correlation coefficient for Non-Tax Revenue

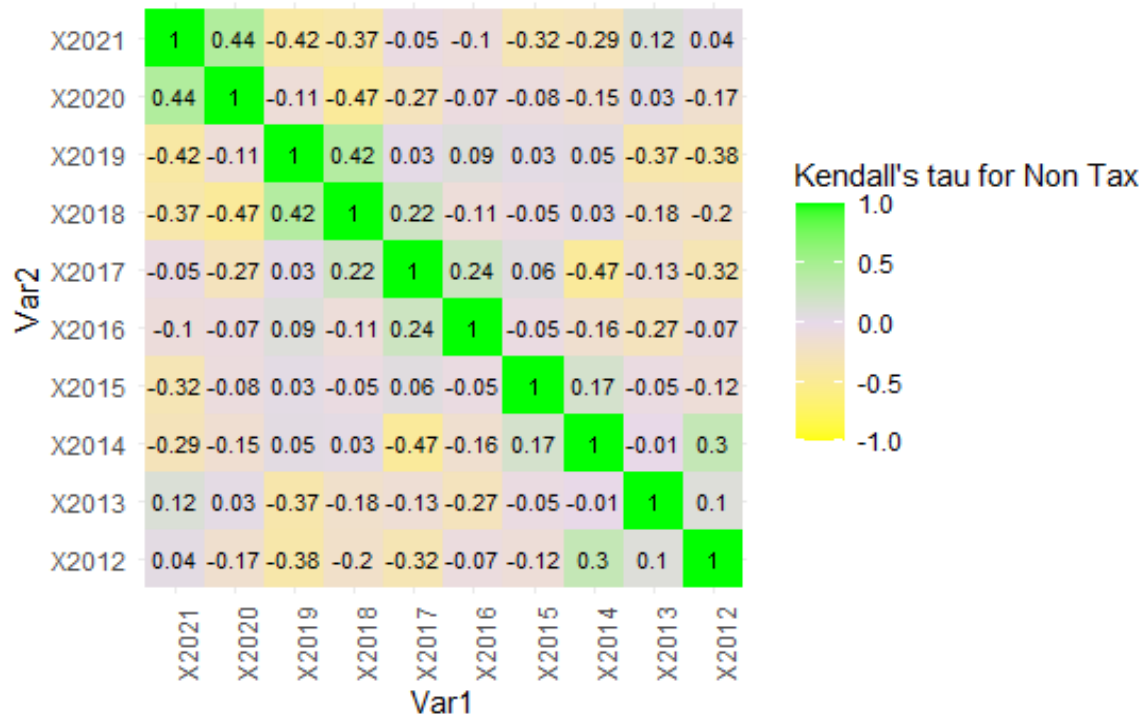


Fig:8.1

Interpretation: This is for non-tax revenue we have perform Kendell tau correlation on this. The above diagram shows correlation among years ranking of various non-tax revenue (i.e. fees, charges). Here you can see that some of near diagonal values are significantly positive correlation that means the consecutive year having positive correlation than that of other years. e.g. correlation between rank of tax in 2020 and in 2021 is 0.44 i.e. the for these both the tax collection structure is same.

On the other hand, the off-diagonal values have negative correlation means they are moving in opposite direction so there structure is different.

e.g., correlation between ranking of non-tax revenue year 2018 and 2020 is -0.47 it shows the non-tax collection is different in 2018 than 2020

C] For Capital Expenditure

Kendall's tau correlation coefficient for Capital Expenditure

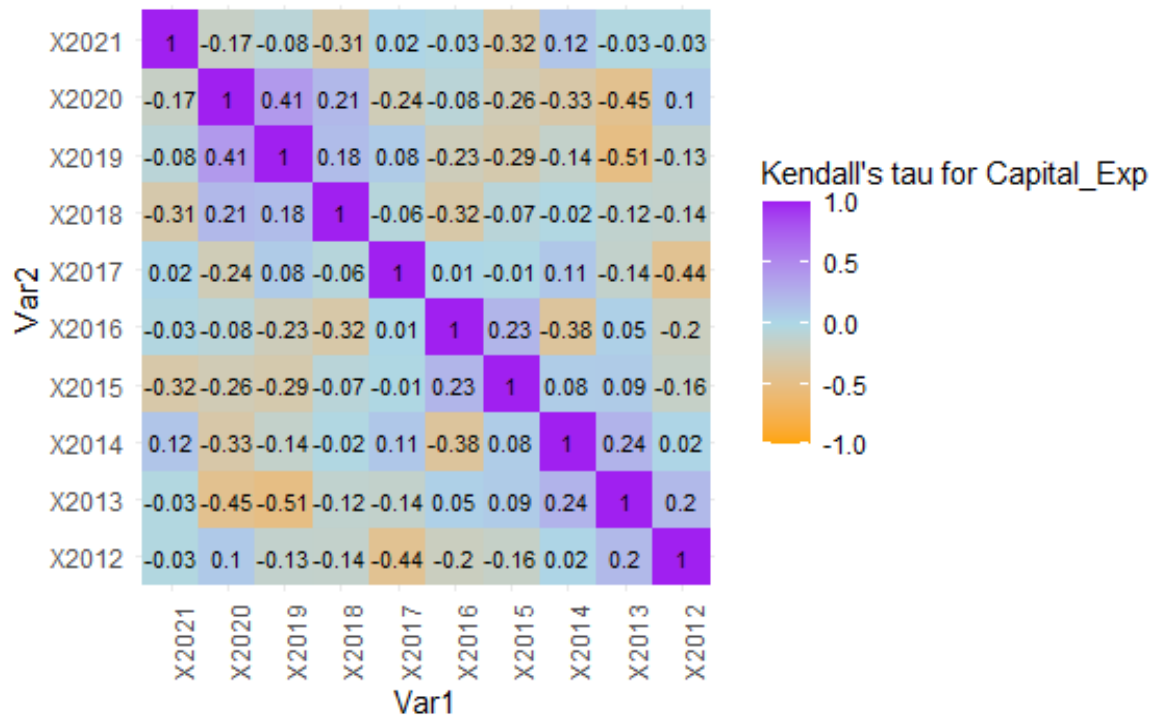


Fig:9.1

Interpretation: In Expenditure part the most of the values are negative that means the capital expenditure pattern is keep changing year by year.

DJ For Revenue Expenditure

Kendall's tau correlation coefficient for Revenue Expenditure

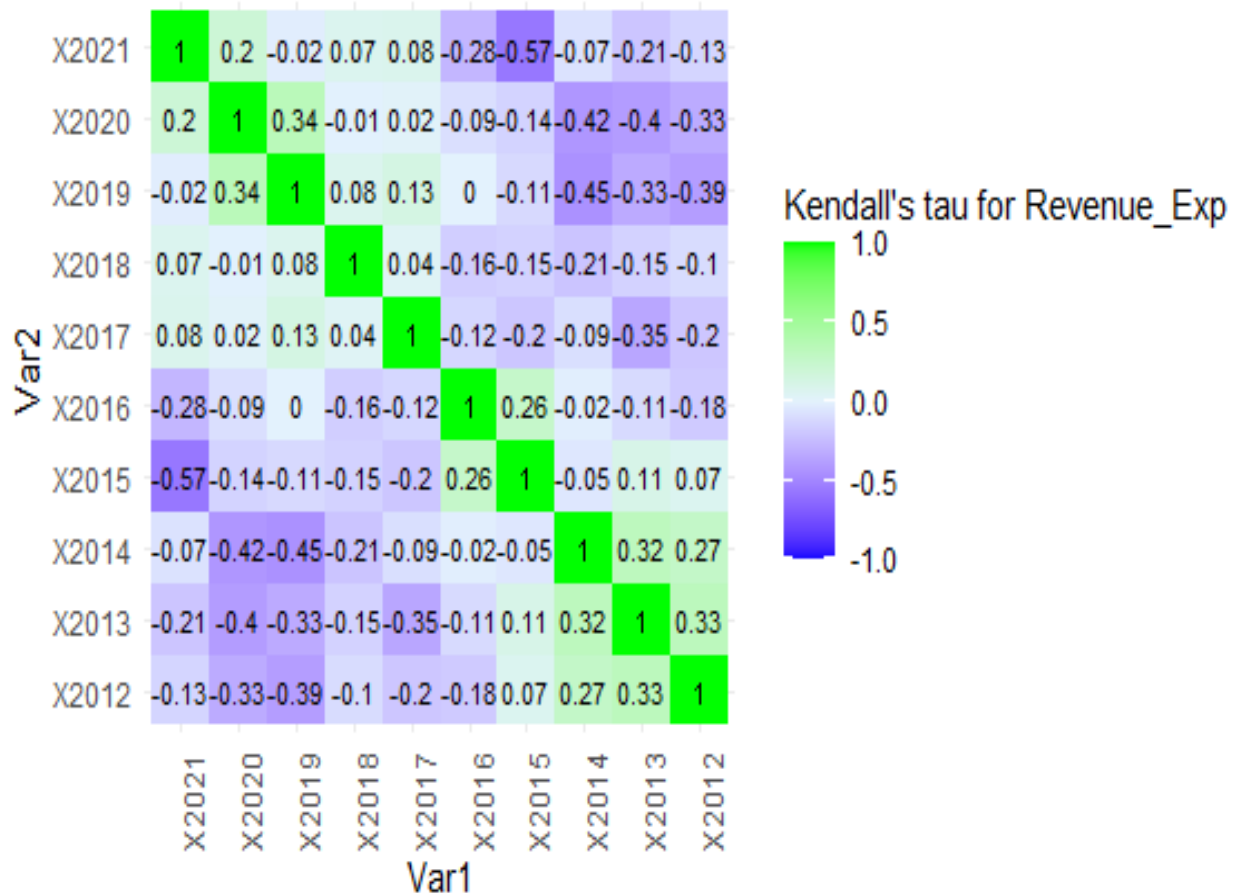


Fig:10.1

Interpretation: In Revenue Expenditure the values are not much large and positive only consecutive years have slight positive correlation means revenue expenditure pattern is not much changing consecutively it need the 3 to 4 years gap to change the revenue expenditure pattern.

4.Socio Economic Profile

Occupation	Frequency
Professional or technical or service personnel	53
Business	46
Other	15
Agriculture	2
Manual labour	1

Source: Primary data

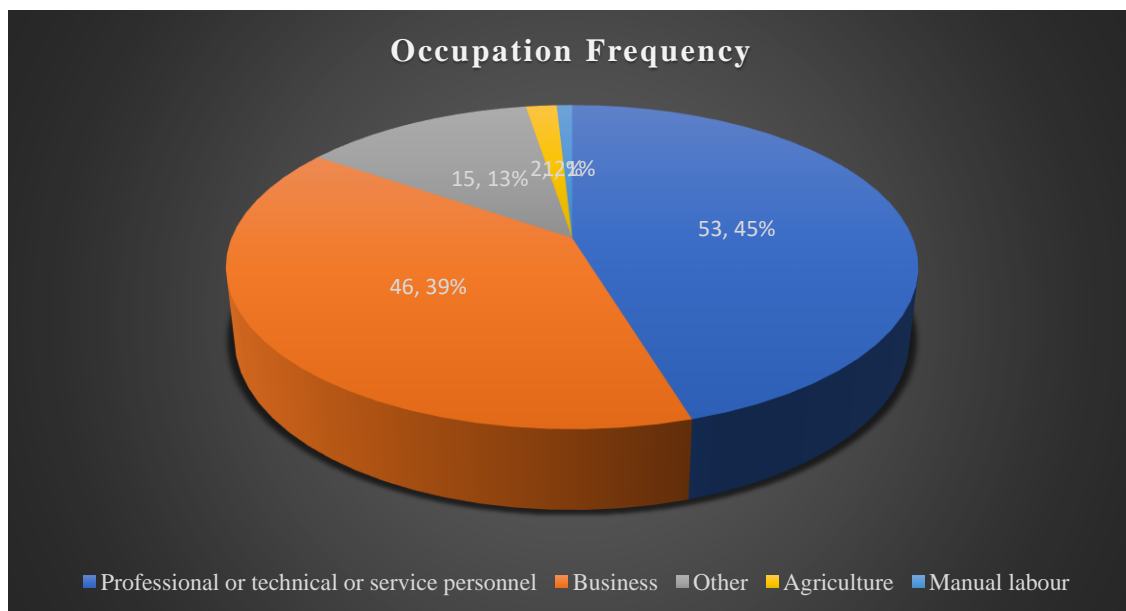


Fig:11.1

In this survey we found that the majority of respondents (53 out of 117) identified as professional or technical or service personnel, which represents about 45% of the total. The second most common occupation category was Business, with 46 respondents (about 39% of the total). The remaining respondents were spread across the Other, Agriculture, and Manual labour categories, each representing less than 10% of the total

Family members	Frequency
One	2
Two	19
Three	13
Four or more	66

Source: Primary Data

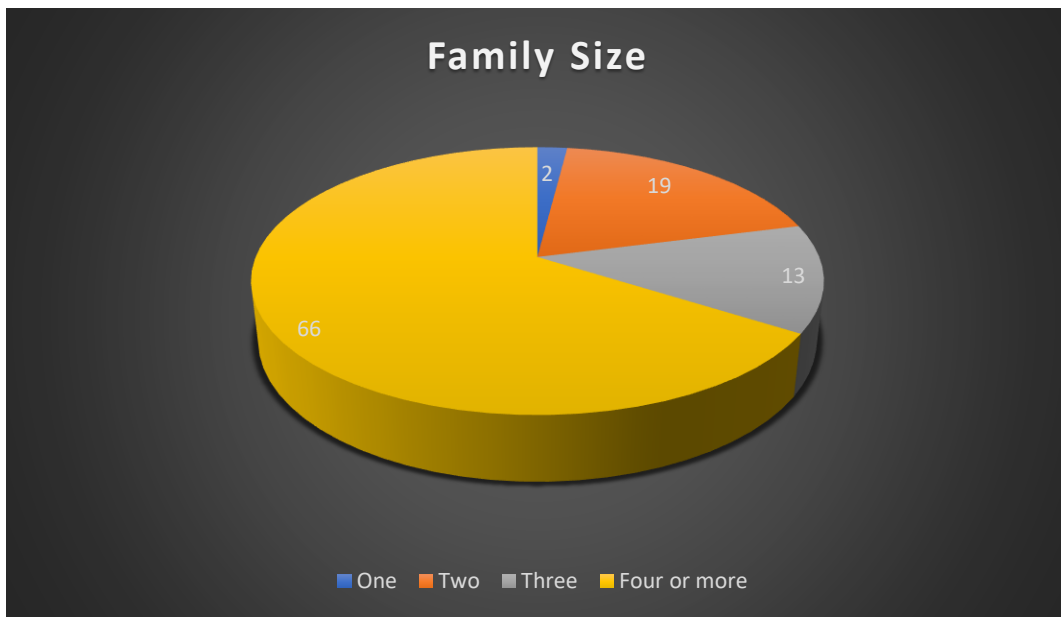


Fig:12.1

we can conclude that the majority of households in the given data have four or more family members.

Sanitation and Cleanliness	Frequency
Poor	3
Fair	11
Good	42
Excellent	44

Source: Primary data

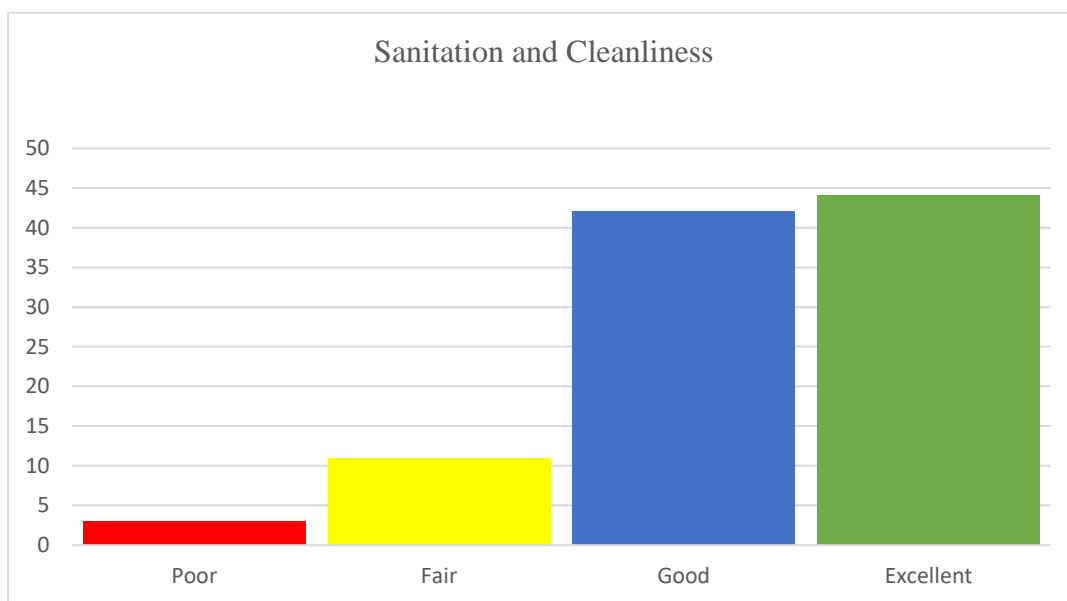


Fig:13.1

we can conclude that a majority of the respondents rated their sanitation and cleanliness as good or excellent. Only a small percentage of respondents rated their sanitation and cleanliness as fair or poor. This indicates that overall, the sanitation and cleanliness levels in the area are perceived to be relatively good. However, it is important to note that these ratings are based on individual perceptions and may not necessarily reflect the actual conditions in the area.

Power Supply	Frequency
Poor	26
Fair	24
Good	37
Excellent	33

Source: Primary data

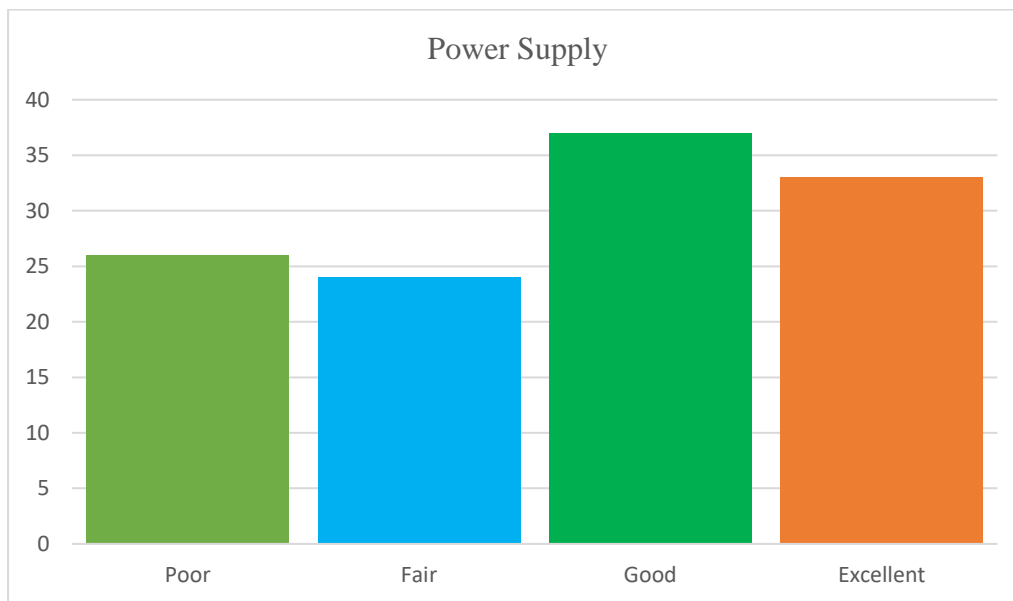


Fig:14.1

From the above Graph, we can conclude that the majority of the households have a power supply that ranges from Fair to Excellent. Specifically, Good and Excellent power supply are the most common categories among the households surveyed, while Poor power supply is the least common. Overall, it seems that most households have a reliable power supply, although there is still a significant minority that experiences problems with their electricity

Roads	Frequency
Poor	4
Fair	9
Good	29
Excellent	58

Source: Primary data

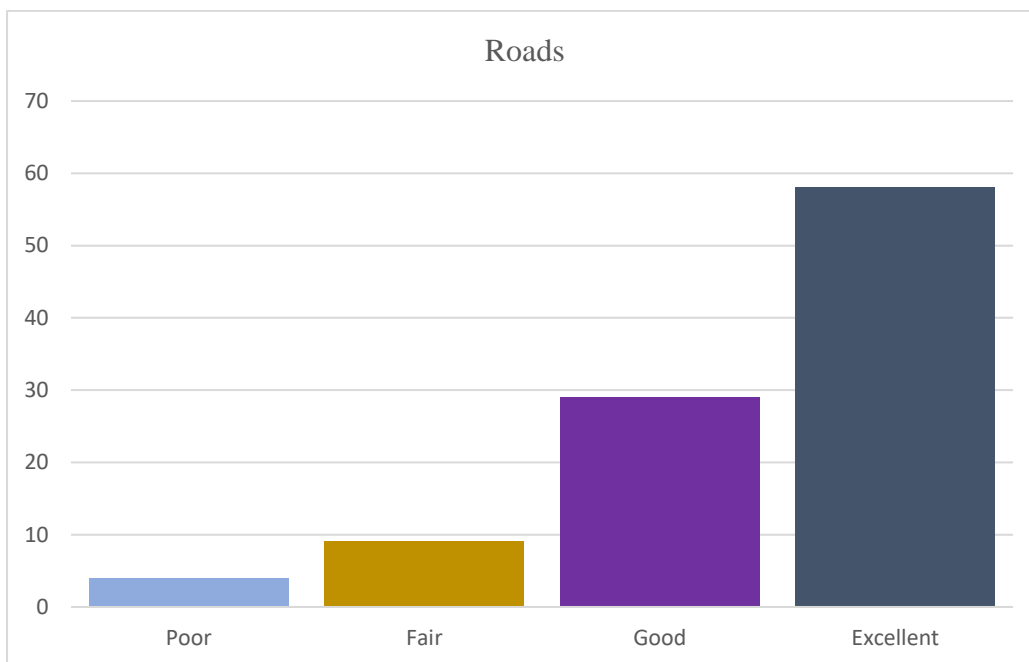


Fig:16.1

From the above graph of the "Roads" rating we can conclude that the majority of the responses indicate that the roads are "Good" or "Excellent". This suggests that overall, the quality of roads is satisfactory for the majority of the respondents. However, we should note that without more information about the specific location and population, it's difficult to make general conclusions.

Health Facilities	Frequency
Poor	4
Fair	16
Good	45
Excellent	35

Source: Primary data

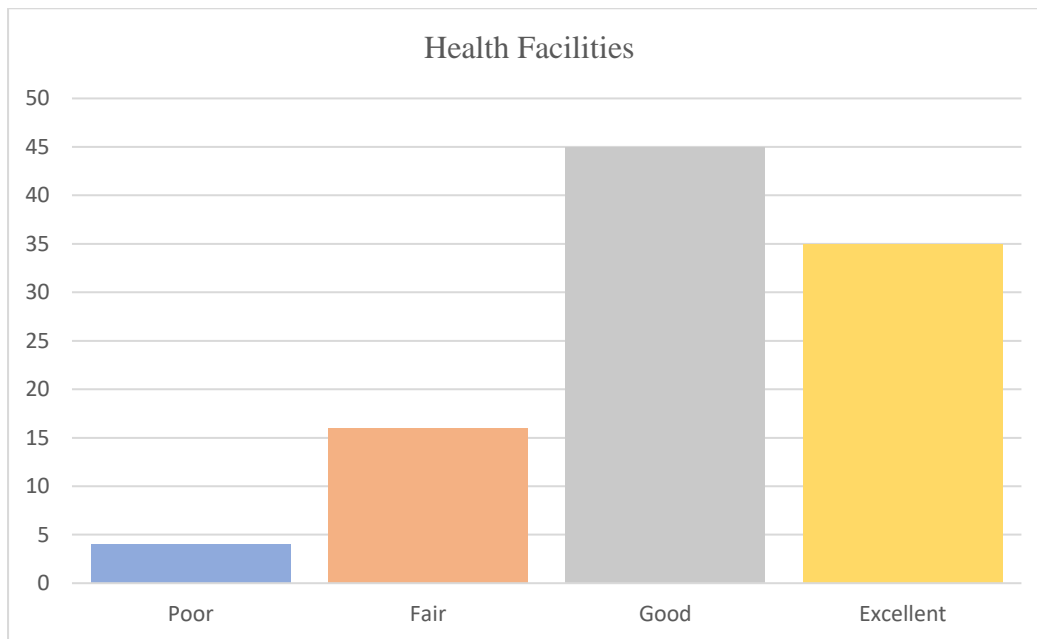


Fig:17.1

we can see that the majority of the responses are "Good" or "Excellent," with only a few instances of "Fair" or "Poor." This suggests that overall, the quality of health facilities is perceived to be relatively high in the municipal area .

Interpretation: the data suggests that most areas have good to excellent performance in education, sanitation and cleanliness, roads, and health facilities. However, there are some areas with poor power supply facilities.

6. People Satisfaction (PSAT) Score Analysis

People Satisfaction (PSAT) Score Analysis						
	Number of Ratings				PSAT Score Calculation	
Facilities	1	2	3	4	Average Rating	PSAT Score
Sanitation Cleanliness	7	9	46	57	3.3	87%
Sewerage Drainage	14	26	56	23	2.7	66%
Water Supply	11	12	39	57	3.2	81%
Roads	10	1	42	66	3.4	91%
Parks	9	9	43	58	3.3	85%
Health Facilities	8	8	48	55	3.3	87%
Streetlighting	7	4	53	55	3.3	91%
Power Supply	21	24	32	42	2.8	62%

Table:29

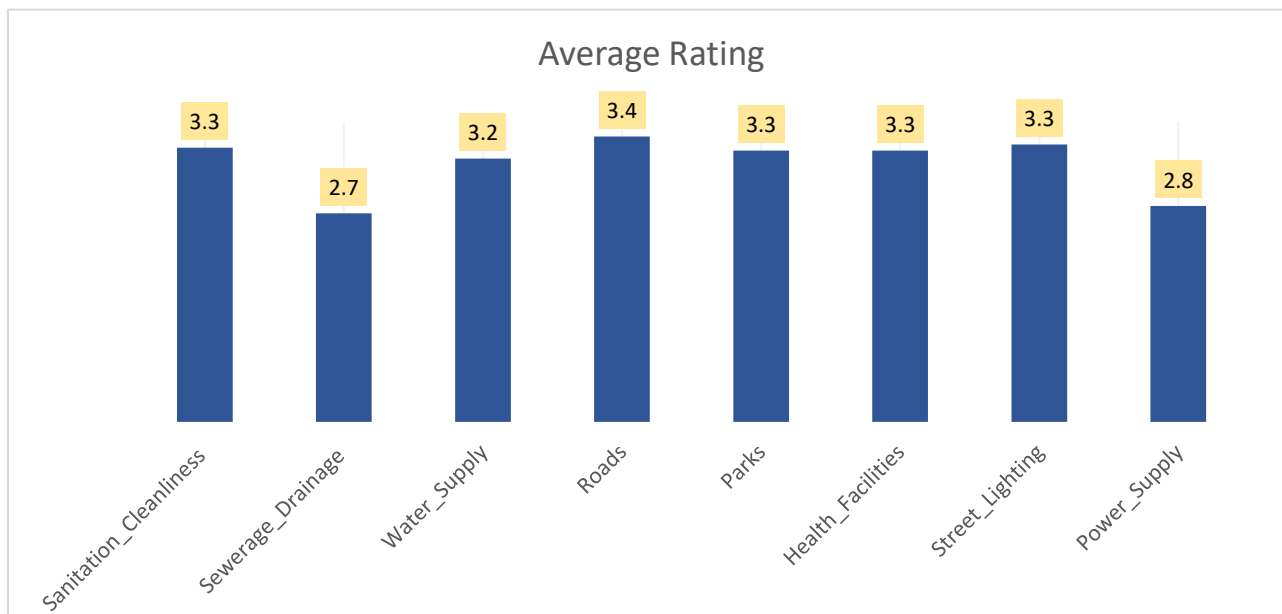


Fig:18.1

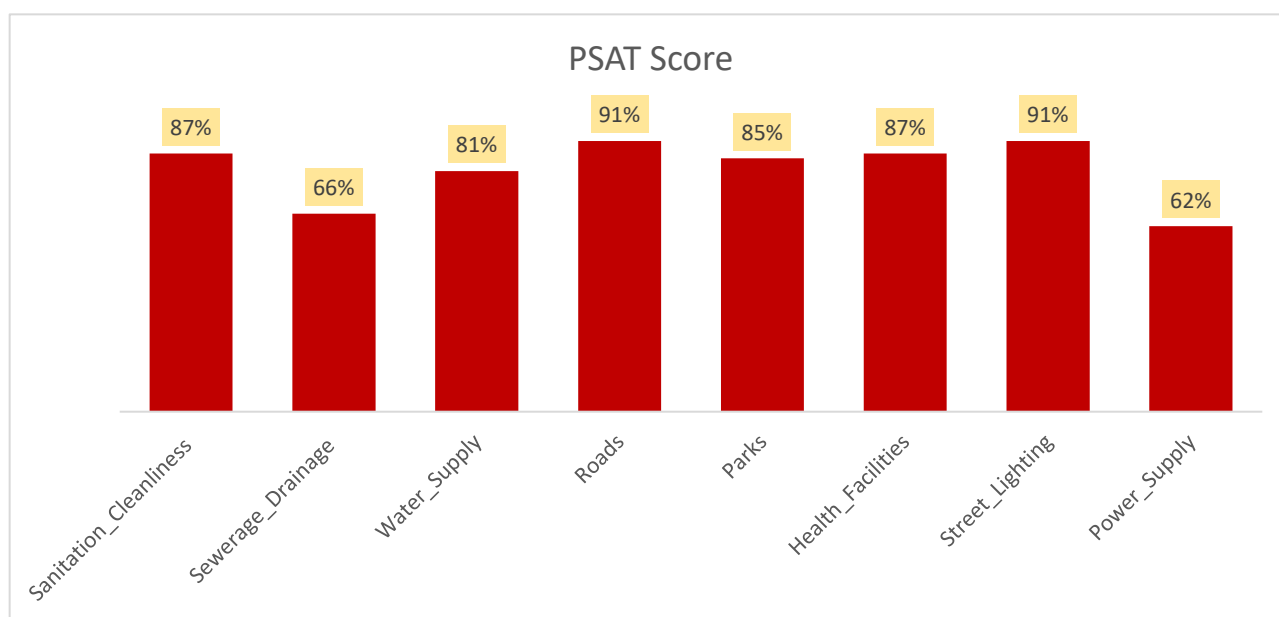


Fig:19.1

Interpretation: From the Above figures we can see that the frequency of rating excellent to the facilities are more but average rating of facilities are 2.7 to 3.4 means according to overall experience of people is good about facilities provided by municipality and from figure 19.2 we calculated the peoples satisfaction score percentage(PSAT).

Conclusion

- From the Forecasting the revenue collection shows upward trend so we can say that the revenue collection will increase.
- In case of expenditure although variation is large in previous years but forecasting shows that steady trend.
- Tax revenue and non-tax revenue has not much difference in their collection during past 10 years
- In spending capital expenditure has not change significantly, on the other hand there is some change in the revenue expenditure for some particular year.
- Tax revenue and non-tax revenue comprises of various things so year on year their respective collection also the same and some has changing over time.
- In spending the changes are frequent over the years i.e. spending keep changing.
- Overall performance of Municipality is good from the people's experience.

Bibliography

- 1) RBI Working Paper
Municipal Finances: An Assessment
- 2) YouTube ,Google, Chrome Browser

Appendix:-

R-Code:

```
##Load dataset

library(forecast)

data=read.csv(file.choose(),header=T)

##Exponential Smoothing

##Tax Revenue

tt=data.frame(data$tax_rev)

ts=ts(tt,start=c(2012,1),frequency = 1)

##Holt's Model

holt_t=holt(ts,h=3,beta = 0.003)

holt_t$model

autoplot(holt_t,fcol="blue",fill="red",ylab="Tax Revenue",xlab="Year")

accuracy(holt_t)

##Non-tax Revenue

nn=data.frame(data$nontax_rev)

tsn=ts(nn,start=c(2012,1),frequency = 1)

##Model

holt_n=holt(tsn,h=3,beta=0.002)

holt_n$model

autoplot(holt_n,ylab="Non-Tax Revenue",xlab="Year")

accuracy(holt_n)

##Capital Expenditure
```



```

ce=data.frame(data$capital_exp)

tsc=ts(ce,start=c(2012,1),frequency = 1)

#Model

model=holt(tsc)

holt_c=holt(tsc,h=3,beta = 0.01)

holt_c$model

autoplot(holt_c,ylab="Capital Expenditure",xlab="Year")

accuracy(holt_c)

```

##Revenue Expenditure

```

re=data.frame(data$revenue_exp)

tsr=ts(re,start=c(2012,1),frequency

#Model

holt_r=holt(tsr,h=3)

holt_r$model

autoplot(holt_r,ylab="Revenue Expenditure",xlab="Year")

accuracy(holt_r)

```

##Kendell's tau Rank Correlation

```
# Load libraries
```

```
library(ggplot2)
```

```
library(reshape2)
```

#For Tax Revenue

```
# Define the data frame
```

```

df1 <- data.frame(

  Tax = c("Property Tax", "Water Tax", "Sewerage Tax", "Conservancy (Sanitation) Tax",
"Lighting Tax", "Education Tax", "Vehicle Tax", "Tax on Animals", "Professional Tax",
"Advertisement Tax", "Octroi & Toll", "Others Taxes"),

  `2012` = c(1, 9, 10, 10, 10, 2, 2, 8.5, 1, 6, 1, 4),
  `2013` = c(8, 10, 1, 1, 2, 9, 1, 5, 3, 10, 4, 3),
  `2014` = c(6, 7, 2, 2, 3, 6, 5, 8.5, 5, 9, 5, 9),
  `2015` = c(7, 8, 5, 6, 5, 7, 7, 8.5, 2, 7, 2, 7),
  `2016` = c(3, 5, 4, 5, 4, 4, 9, 8.5, 7, 8, 7, 10),
  `2017` = c(9, 2, 8, 8, 6, 8, 4, 2, 8, 1, 3, 8),
  `2018` = c(5, 3, 7, 7, 7, 3, 8, 1, 9, 5, 6, 5),
  `2019` = c(10, 6, 9, 9, 1, 10, 10, 6, 10, 4, 9, 6),
  `2020` = c(4, 4, 6, 4, 9, 1, 6, 3, 6, 3, 8, 2),
  `2021` = c(2, 1, 3, 3, 8, 5, 3, 4, 4, 2, 10, 1)

)

# Compute Kendall's tau coefficient

kendall_df1 <- cor(df1[, -1], method = "kendall")

# Melt the data frame to long format

melted_df1 <- melt(kendall_df1)

melted_df1$Var1 <- factor(melted_df1$Var1, levels = rev(unique(melted_df1$Var1)))

melted_df1$Var2 <- factor(melted_df1$Var2, levels = unique(melted_df1$Var2))

# Create the heatmap

ggplot(melted_df1, aes(x = Var1, y = Var2, fill = value)) +

  geom_tile() +

  scale_fill_gradient2(low = "blue", mid = "gray", high = "red", midpoint = 0,
    limit = c(-1, 1), name = "Kendall's tau for Tax") +

  geom_text(aes(label = round(value, 2)), color = "black", size = 3) +

  coord_equal() +

  theme_minimal() +

```

```
theme(axis.text.x = element_text(angle = 90, hjust = 1))
```

#For Non-Tax Revenue

```
# Define the data frame
```

```
df2 <- data.frame(
```

```
  Non_Tax = c(" Empanelment_and_Registration_Charges", " Licensing_Fees",  
              "Fees_for_Grant_of_Permit", "Fees_for_Certificate_or_Extract",  
              "Development_Charges", "Regularization_Fees", "Penalties_and_Fines",  
              "Other_Fees", "User_Charges", "Entry_Fees",  
              "Service_Administrative_Charges", "Other_Charges",  
              "Fees_Remission_and_Refund", "Sale_of stores_&_scrap",  
              "Rent_from_Civic_Amenities", "Rent_from_Guest_Houses",  
              "Other_rents", "Interest", "Miscellaneous_Income"),
```

```
  `2012` = c(10, 10, 1, 8, 7, 8, 10, 3, 6, 2, 9, 2, 9, 5, 4, 3, 6, 3, 4),  
  `2013` = c(8, 2, 3, 6, 4, 3, 8, 10, 7, 3, 6, 3, 3, 7, 2, 1, 4, 7, 9),  
  `2014` = c(9, 9, 7, 10, 8, 2, 4, 1, 10, 5, 7, 5, 10, 1, 6, 4, 7, 5, 8),  
  `2015` = c(6, 5, 4, 3, 6, 4, 2, 7, 8, 8, 2, 7, 6, 3, 5, 2, 8, 2, 3),  
  `2016` = c(5, 7, 5, 7, 10, 10, 3, 8, 5, 9, 5, 1, 7, 9, 9, 10, 2, 6, 5),  
  `2017` = c(1, 4, 8, 4, 2, 9, 6, 9, 3, 10, 3, 8, 4, 10, 8, 5, 3, 1, 7),  
  `2018` = c(3, 8, 10, 9, 1, 1, 5, 6, 1, 6, 4, 6, 8, 8, 10, 8, 10, 4, 10),  
  `2019` = c(2, 6, 9, 5, 5, 5, 1, 2, 2, 7, 1, 4, 5, 2, 7, 6, 9, 9, 6),  
  `2020` = c(4, 1, 6, 2, 9, 6, 7, 4, 9, 4, 8, 9, 2, 4, 1, 9, 5, 10, 1),  
  `2021` = c(7, 3, 2, 1, 3, 7, 9, 5, 4, 1, 10, 10, 1, 6, 3, 7, 18, 2) )
```

```
# Compute Kendall's tau coefficient
```

```
kendall_df2 <- cor(df2[, -1], method = "kendall")
```

```
# Melt the data frame to long format
```

```
melted_df2 <- melt(kendall_df2)
```

```
melted_df2$Var1 <- factor(melted_df2$Var1, levels = rev(unique(melted_df2$Var1)))
```

```

melted_df2$Var2 <- factor(melted_df2$Var2, levels = unique(melted_df2$Var2))

# Create the heatmap

ggplot(melted_df2, aes(x = Var1, y = Var2, fill = value)) +

geom_tile() +

scale_fill_gradient2(low = "yellow", mid = "#E7D9EA", high = "green", midpoint = 0,

    limit = c(-1, 1), name = "Kendall's tau for Non Tax") +

geom_text(aes(label = round(value, 2)), color = "black", size = 3) +

coord_equal() +

theme_minimal() +

theme(axis.text.x = element_text(angle = 90, hjust = 1))

```

##For Capital Expenditure

```
# Define the data frame
```

```

df3 <- data.frame(Capital_Exp = c("Office Buildings and Quarters", "Civic amenities
    & Service Centers", "Roads & Bridges", "Sewerage and
    Drainage", "Waterways", "Public Lighting", "Hospital",
    "Vehicles", "Furniture, Fixtures, Fittings and Electrical
    Appliances", "Other Equipment: Computer & Machinery",
    "Fire Services", "Cemetery", "Garden", "Deposits",
    "Advances", "loans", "Interest", "Other(Bill deduction)"),

`2012` = c(8, 5, 3, 4, 5, 9, 1, 7, 8.5, 5, 6, 4, 10, 2, 7, 2, 7, 3),
`2013` = c(8, 6, 2, 3, 10, 2, 7, 6, 8.5, 8.5, 7, 8, 7, 5, 3, 1, 7, 6),
`2014` = c(8, 8, 1, 7, 6, 5, 5, 4, 8.5, 8.5, 9, 6, 5, 1, 5, 9, 2, 8),
`2015` = c(8, 2, 6, 10, 9, 4, 8, 10, 2, 8.5, 10, 10, 4, 6, 8, 7, 3, 4),
`2016` = c(1, 1, 10, 1, 8, 1, 6, 8, 1, 3, 4, 9, 8, 8, 2, 4, 7, 1),
`2017` = c(8, 4, 8, 5, 1, 6, 9, 3, 6, 8.5, 8.5, 2, 10, 4, 9, 7, 7),
`2018` = c(5, 9, 5, 8, 3, 7, 10, 5, 5, 4, 5, 7, 1, 4, 6, 3, 7, 9),
`2019` = c(4, 7, 4, 6, 4, 10, 4, 1, 3, 2, 3, 3, 9, 9.5, 9, 7, 5),
`2020` = c(3, 10, 7, 9, 2, 8, 3, 9, 4, 1, 1, 2, 6, 7, 9.5, 6, 7, 2),

```

```

`2021`=c(2,3,9,2,7,3,2,2,8.5,6,2,1,9,3,1,5,1,10)
)

# Compute Kendall's tau coefficient

kendall_df3 <- cor(df3[, -1], method = "kendall")

# Melt the data frame to long format

melted_df3 <- melt(kendall_df3)

melted_df3$Var1 <- factor(melted_df3$Var1, levels = rev(unique(melted_df3$Var1)))

melted_df3$Var2 <- factor(melted_df3$Var2, levels = unique(melted_df3$Var2))

# Create the heatmap

ggplot(melted_df3, aes(x = Var1, y = Var2, fill = value)) +

  geom_tile() +
  scale_fill_gradient2(low = "orange", mid = "#add8e6", high = "purple",midpoint=0,
    limit = c(-1, 1),name = "Kendall's tau for Capital_Exp") +
  geom_text(aes(label = round(value, 2)), color = "black", size = 3) +
  coord_equal() +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 90, hjust = 1))

```

##For Revenue Expenditure

```
# Define the data frame
```

```

df4 <- data.frame(

  Revenue_Exp = c("Salaries, Wages and Bonus ", "Benefits and Allowances",
    "Employee Provident Fund", "Election", "Rent, Rates and Taxes",
    "Office Maintenance", "Communication Expenses", "Books & Periodicals",
    "Printing and Stationery", "Travelling & Conveyance", "Insurance", "Fees",

```

"Legal Expenses", "Professional and other Fees", "Council meeting, Honorarium & sitting fees", "Advertisement and Publicity", "Private security guard", "Bank charges", "Power & Fuel", "Bulk Purchases", "Hire Charges (e-tendering)", "Repairs & maintenance Infrastructure Assets", "Repairs & maintenance Civic Amenities", "Other operating & maintenance expenses", "Electricity", "Sanitation and Waste Management", "Grants", "Contributions", "Subsidies", "Miscellaneous expenses"),

```
`2012`=c(3,10,7,1,7,1,2,1,6,2,7,7,4,3,6,1,9,5,5,6,5,4,3,7,2,1,8,7,18),
`2013`=c(4,5,9,5,5,2,3,2,1,1,8,6,3,5,8,4,9,1,3,7,7,1,9.5,2,4,7,7,9,2,8),
`2014`=c(2,3,6,4,9,6,1,3,4,3,6,5,2,1,3,2,9,3,2,4,6,2,9.5,6,1,10,9,3,3,3),
`2015`=c(10,8,10,9,10,7,5,4,9,5,9,1,6,2,10,8,6,2,10,3,10,6,2,5,8,3,2,8,7,8),
`2016`=c(7,9,8,9,2,10,7,6,5,4,10,2,1,4,1,7,4,6,8,2,8,3,1,4,6,5,6,4,7,1),
`2017`=c(5,4,2,2,4,5,4,5,8,7,2,3,5,9.5,5,6,1,8,6,8,9,7,5,10,5,9,5,6,7,4),
`2018`=c(6,6,5,9,3,8,6,7,10,6,3,9,8,8,9,3,5,10,4,5,4,8,8,3,7,4,4,10,7,5),
`2019`=c(9,1,3,6,6,4,9,8,7,8,5,4,10,9.5,2,10,2,9,7,10,2,5,4,1,9,2,3,1,7,2),
`2020`=c(8,7,4,7,8,9,10,10,3,9,4,9,9,6,7,9,3,7,9,9,3,9,7,9,10,6,1,5,7,8),
`2021`=c(1,2,1,3,1,,8,9,2,10,1,9,7,7,4,5,7,4,1,1,1,10,6,8,3,8,10,2,7,8)
)
```

```
# Compute Kendall's tau coefficient
```

```
kendall_df4 <- cor(df4[, -1], method = "kendall")
```

```
# Melt the data frame to long format
```

```
melted_df4 <- melt(kendall_df4)
```

```
melted_df4$Var1 <- factor(melted_df4$Var1, levels = rev(unique(melted_df4$Var1)))
```

```
melted_df4$Var2 <- factor(melted_df4$Var2, levels = unique(melted_df4$Var2))
```

```
# Create the heatmap
```

```
ggplot(melted_df4, aes(x = Var1, y = Var2, fill = value)) +
```

```
  geom_tile() +
```

```
scale_fill_gradient2(low = "blue", mid = "#e3f2fd", high = "green", midpoint = 0,  
  limit = c(-1, 1), name = "Kendall's tau for Revenue_Exp") +  
geom_text(aes(label = round(value, 2)), color = "black", size = 3) +  
coord_equal() +  
theme_minimal() + theme(axis.text.x = element_text(angle = 90, hjust = 1))
```

Annexure A

Questionnaire

#For Socio-Economic Profile

Assessment of Municipal Facilities

1. What is your current occupation?

- ☐ Agriculture
- ☐ Professional or technical or service personnel
- ☐ Business
- ☐ Manual labour
- ☐ Other

2. What is your level of education?

- ☐ No formal education
- ☐ Primary school education
- ☐ Secondary school education
- ☐ Higher secondary school education
- ☐ Graduate or post-graduate degree

3. What is your annual household income?

- ☐ Less than Rs. 50,000
- ☐ Rs. 50,000 - Rs. 1,50,000
- ☐ Rs. 1,50,000 - Rs. 3,00,000
- ☐ Rs. 3,00,000 - Rs. 5,00,000
- ☐ Rs. 5,00,000 or more

4. How many people currently live in your household?

- ☐ One
- ☐ Two
- ☐ Three
- ☐ Four or more

5. How would you rate the given Municipal Facilities in your area?

Facilities	Poor	Fair	Good	Excellent
Sanitation and Cleanliness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sewerage and Drainage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Power Supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Roads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Parks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Health Facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Street Lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

