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Empirical Analysis Of Factors Affecting The Air-Traffic And Revenue Of Regional Airports Of India

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Abstract: Unlike the reported status of many profit-making airports in the developed countries, the expenditure of most of the non-major airports of India has been observed higher than their income resulting in losses year after year. This study compiles airport wise data of twenty-seven regional airports spread across fifteen states of India. In accordance to five independent airport related variables, about 62 % variation in total income has been explained by assumed independent variables of movements of aircrafts and about 78 % variation in total Income has been explained by the assumed independent variables of movements of passengers. The reasoning of variations is expected to help the respective airports to form a suitable strategy either improve the existing factors or rope in new avenues for attracting income. The available statistical tools have been used for calculating the Linear Regression/ Modelling among the studied variables including annual total income, passenger movements, aircraft movements, aircraft operational hours and accessibility to nearest major airport.

Key words : Business performance , aviation , regional Airports.

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I. Introduction :

In continuation of our ongoing research work Singh et al 2021**[1]** on the business performance. The variables widely recognized and reported to be influencing income of airport as per the studies done at foreign airports may not hold the same significance at Indian airports owing to their varying operating conditions and economic profile of regional airports of India. Identifying airport- wise factors and their extent of influencing total income is therefore required rather than trying to generalise and adopt an uniform and centralized approach and policy for addressing the economic viability of non-major airports. Air travel is the fastest and safest mode of travel and transport sectors and it provides connectivity, social and employment opportunities, boosts local economy, tourism and contributes to GDP. It has been forecasted that the commercial airline fleet of Indian airlines would be doubled and India s aviation market status would reach third position in the world by 2030 .Even though infrastructure of many non-major regional airports have been upgraded with huge capital & operating costs , total income of about 85 % of total number airports has been many times lower than their running expenditure .Therefore, it is high time and imperative that factors at airport level which influence the total income of an airport are studied so that a proper frame work for its economic viability could be worked out.

II. Aviation Potential of India

The study reported in Oxford Economics 2011 on the potential of Indian Aviation sector it has been pointed out that Aviation Sector contributes INR 330 billion (0.5%) to the Indian GDP & supports 1.7 million (17 lakhs) jobs in India. It comprises of Direct Output of the Aviation Sector (Air Space, Airlines, Airports, Ground Services) - INR 147 billion & supports 2,76,000 jobs, Aviation Sector's Supply Chain – INR 107 billion &supports 8,41,000 jobs, Spending of the Employees of the Aviation sector & its Supply Chain – INR 77 billion and supports 6,05,000 jobs. In addition, INR 582 billion in Catalytic Benefits thru Tourism which raises the overall contribution to INR 912 billion or 1.5 % of GDP& supports employment to further 7.1 million 9 (71 lakhs) people.

(i) Global Airline Fleet forecast to increase from 19,400 (2014) to 39,500 (2030) Revenue Market forecasts of GHA (Ground Handling Agencies) -INR 39 billion by 2017
(ii) General Aviation –INR 16 billion by 2017
(iii) MRO (Maintenance , Repair and overhaul) –INR 70 billion by 2020.

III. Indian Airports, Traffic and Income

As per the Airport Economic Regulatory Authority (AERA) of the Ministry of Civil Aviation for deciding and regulating the Aeronautical charges after its formation in 2009 and based on the annual passenger traffic, 23 airports during 2009 and 83 airports in 2019 have been categorised as major and non-major airports respectively . It has been reported that the income of more than 85 % of airports has been many times less than their operating costs and thus resulting in losses. For looking towards possibilities of increasing income of loss making non-major airports, an insight of variables which influence the total income at airports located in varying demographical and operating conditions of India is essential especially in view of the forecast that India would occupy the third position in the Global Aviation Market by 2030.

Out of 486 total airports, airstrips, flying schools and military bases available in the country airports for civil commercial operation (Airports Authority of India ,2017-18) **[3]**, about 127 (100 operational + 27 Non - operational)airports including defence enclaves are under AAI , 4 international airports are under JV /Private ownership , remaining 9 are under State Govt ,Private ownership and some of them are in unused condition . More than fifty of AAI s airport infrastructure including runways, terminal and en route air navigation systems have since been upgraded both on air and land side with all modern facilities and services to cater to AB-320 & B-737-800 aircrafts and as per the license standards of DGCA & ICAO.

Even though 100 airports are handling traffic and 27 airports are fit for operations spread across length and breadth of the country are available for wider connectivity ,more than 60 % of the aircraft and 75 % of passenger movements of total movements were handled by 6 metro airports resulting enormous concentration of load , congestion ,delay and environmental concerns at those big city airports and under/no utilisation of other airports which have to be maintained at huge costs for maintaining their licensing standards and civil aviation requirements of the DGCA and ICAO. It was reported that in 2017-18, out of 129 airports owned and managed by AAI, as many as 94 aerodromes owned and were in losses.(News Paper Report ,2019, Reply) **[4].** The losses are mainly due to low revenue generation to meet the total expenditure of the respective airports. AAI has been taking pro- active steps to enhance revenue and reduce losses. Airport Aeronautical Revenue /Performance as a function of aircraft, passenger and cargo movement has been studied and reported extensively. However, that remains many times lower than maintenance and operating costs and thus resulting in heavy losses as reported in case of many India airports.

IV. Income for Airport Operators:

Airports are the prime interface for aircraft operations between air and land and their ownership, operation and management may be under government or private sector ownership. In the earlier days air traffic and aviation, airport infrastructure & navigation installation and equipment and other supporting services were created just for safe, secure and efficient operations of aircrafts and passengers with very little focus on earning revenue for airport. With the phenomenal increase in air traffic year after year and in view of the increasing capital and operating costs of airports for upgrading and maintaining the same as per international standards, need has been felt by the civil aviation to adopt some business model for earning income for airports. As per the general norms and guide lines of the world aviation bodies such as International Civil Aviation Organisation (ICAO) , International Air Transport Association (IATA), Federal Aviation Authority (FAA) Airport authorities or its operators are allowed to charge from airline operators and other supporting service providers for providing the airport infrastructure , services consisting of en-route and ground based air traffic navigation, safety , security and passenger facilitation.

Even now more than 75 % of total income comes from the charges levied directly on airline operators and aircraft operations and the remaining income comes by other sources and activities which may still be indirectly related to the air traffic activities . The broad components of aeronautical (excluding en- route Air Route Navigation service charges which are not airport specific but route based) and non-aeronautical income as categorised for Indian airports are given in Table 1 .

Table-1 Components of Total Income of Airport

Aeronautical Income	**Non- aeronautical Income**
Landing, Parking and Housing Charges (LPH)	Covered space rentals and license fee for offices and concessionaires like Restaurant ,Snack bars, TR stalls ,shops etc
Passenger Service Fee (PSF)	Advertising /Hoardings inside and outside areas
User Development Fee (UDF) for Domestic departing passenger	Car Parking
User Development Fee (UDF) for International departing passenger	Airport Admission fee
Extension of Watch hour Charges	Open and Paved Area rentals
Ground Handling Revenue	Land lease for Fuel Stations ,Hangers and other purposes
Royalty on Common User Terminal Charges (CUTE)	Flight Catering Services

Fuel Throughput Charges	Other income

V. Airport wise Influencing Variables & Methodology

Compiling data on nine varying operating factors of twenty seven non-major airports of India related to five years ie:2013 to 2018 & verifying for any significant relationship between the following factors using Simple Linear Regression Method & Excel Data Analysis:

i) Total Income -- vs- Aircraft Movement
ii) Total Income -- vs- Passenger Movement
iii) Total Income -- vs – Airport Operational Hours
iv) Total Income -- vs- Airport Terminal Area
v) Total Income -- vs –Airport Land Allotment Area
vi) Passenger Movement -- vs – District Population
vii) Passenger Movement -- vs – Per Capita Income

The data from 27 airports spread across the length and breadth of India has been treated for Regression Analysis using the following variables &functions:

A -Dependent Variable Yij - as function of (independent variable Xij) Where Y --- Total Income in Rs. lakhs (0.1 millions), X1--- Passenger Movements in lakhs (0.1 millions, X2--- Operational Hours of airport in hours, X3---- Terminal Area in lakh (0.1 millions) sq.met area, X4------ Land Allotment Area in lakh (0.1 millions) sq.met area

B -Dependent Variable Yij - as function of (independent variable Xij) Where Y --- Passenger Traffic in Rs. lakhs (0.1 millions), X1--- District Population in lakhs (0.1 millions) X2--- District Per Capita Income in lakhs (0.1 millions, i----- at airport i (1 to 27 airports), j----- years (1 to 5 years)

The details of location and data of 27 airports selected along with Regression Analysis of variables influencing Total Income and Passenger Traffic are brought out in the following paragraphs:

VI. Factors Influencing Airport Income

Some studies have shown that small airports because of their location disadvantage with less potential for traffic demand unlike metro or major airports cannot contribute significantly to regional economic development and also that the relation between air traffic and economic development cannot be explained in the absence of real causative filed data including the OD details **[5]**

Studies on one of the African airports reported that the airport facility might not be the attractive economy generator for its surrounding hinterland. **[6]**

Studies and publications on factors influencing the income of airports in some countries have considered the following variables for building /predicting relationships and the same are cited below:

i) Population and GDP of district in which airport is located- **[7, 8]**
ii) Terminal utilisation& Passenger, Aircraft landings - US airports **[9-14]**
iii) Initiatives to develop the airports as Greenfield/aq Low cost airport **[15]**
iv) Regulatory approaches adopted by AERA **[16]**
v) GDP and IIP elasticity of traffic –**[17]**
vi) Integrating the stakeholders view in low-cost regional airport development **[18]**
vii) Evaluation of the factors for the low cost airline's choice factors of airports **[19]**

Table 2-List of State wise Airports considered for compiling data :

Summarised Observations of data compiled

Twenty seven non- major airports falling in fifteen states and spread across the length and breadth of India have been chosen for evaluation so as to cover the overall geographical locations and representative of varying aircraft, passenger movements incomes and other local conditions.

Observations of data pertaining to 27 non- major airports of 15 states:

i) Five airports are designated for international, two as custom airports with international operations and the remaining twenty airports are for domestic operations;
ii) Five airports are located in the capital cities of states;
iii) Out of 27 airports chosen, except for Trichy International airport all other 26 airports were reported to be running in losses till 2017-18;
iv) Additional source of aeronautical income for Airports with international operations comes from User Development Fee (as approved by AERA) which is not available for airports only for domestic operations ;
v) air craft movement – from 0.000018 to 0.18692 lakhs (0.10 million);
vi) passenger movement- from 0.00069 to 22.69 lakhs (0.10 million);
vii) income-from 9 to 11225 lakhs (0.10 million)

To verify the assumption that with the increase movements of aircrafts and, there would be an invariable increase in the total income, airport wise details for five years from 2013-14 to 2017-18 with their values in the ascending order are compiled and shown in Table 3 below:

S.No	State & Number of Airports	Airports Considered (Pax Traffic range from 0.101 to 20.87 lakhs)	Passenger Traffic Range in lakhs (0.1 millions) during 2017-18	Income Range in lakhs (0.1 millions)	District Per Capita Income Range in lakhs (0.1million)	District Population Range in lakhs (0.1million) 2011 census	Nearest Metro Airport Dist in km
1	Andhra Pradesh (3)	1.Vijayawada (International),2. Tirupati (International) , 3. Rajahmundry	2.68 to 7.46	467 to 987	1.59 to 2.44	41.74 to 51.54	135 to 561
2	Assam (1)	1.Dibrugarh	3.36	978	0.342	13.76	443
3	Bihar (1)	1.Gaya (Customs)	1.86	899	0.175	43.91	482
4	Chattisgarh (1)	1.Raipur	16.28	5146	0.371	40.63	1216
5	Gujarat (5)	1. Vadodara,2. Rajkot,3. Surat, ,4.Bhavnagar, 5.Porbandar	0.42 to 10.0	331 to 3103	-	5.85 to 60.81	280 to 889
6	Himachal Pradesh (1)	1.Shimla	0.00069	28.0	1.52	8.14	343
7	Karnataka (2)	1.Hubli, 2.Mysuru	0.2 to 0.49	124 to 201	1.12 to 1.13	18.47 to 30.01	146 to 412
8	Madhya Pradesh (3)	1.Bhopal,2.Indore ,3.Khujaraho	0.56 to 22.69	257 to 2108	1.04 to 1.07	23.71 to 32.76	585 to 763
9	Maharashtra (1)	1.Aurangabad	3.34	1094	1.07	37.01	368
10	Manipur (1)	1.Imphal (International)	9.87	1670	0.19	4.56	487
11	Punjab (1)	1.Ludhiana	0.101	18	1.52	34.18	310
12	Rajasthan (1)	1.Udaipur	11.47	4018	0.845	30.68	662
13	Tamilnadu (4)	1.Trichy (International) 2.Madurai (Customs), 3.Tuticorin, 4. Salem	0.01to 15.13	9 to 11225	0.65	17.5 to 34.82	202 to 580
14	Uttaranchal (1)	1.Dehradun	11.24	2634	1.95	16.96	257
15	Uttar Pradesh (1)	1.Varanasi (International)	20.87	8896	0.50	36.76	682

Table 3: Aircraft Movement Airport wise in lakhs (0.1 millions)

S. NO		2013-14	2014-15	2015-16	2016-17	2017-18
	Airport	X 2 Acft	X 2 Acft	X 2 Acft	X 2 Acft	X 2 Acft
1	Salem	0.00022	0.00006	0.00006	0.00004	0.000018
2	Ludhiana	0.00186	0.00088	0.00006	0.00049	0.00232
3	Shimla	0.00014	0.00019	0.00008	0.00024	0.00526
4	Khujaraho	0.0117	0.00812	0.00768	0.00762	0.01015
5	Hubli	0.0138	0.00585	0.00902	0.00648	0.01086
6	Porbandar	0.01337	0.01417	0.00696	0.00457	0.01241
7	Tuticorin	0.01286	0.01389	0.01378	0.0152	0.01404
8	Bhavnagar	0.00732	0.0144	0.01529	0.01462	0.02046
9	Gaya	0.01437	0.01635	0.02093	0.02193	0.02439
		2013-14	2014-15	2015-16	2016-17	2017-18
	Airport	X 2 Acft	X 2 Acft	X 2 Acft	X 2 Acft	X 2 Acft
10	Aurangabad	0.04096	0.04141	0.03713	0.03799	0.03758
11	Dibrugarh	0.02328	0.03992	0.03213	0.02755	0.03839
12	Rajkot	0.02911	0.03344	0.04674	0.0461	0.04489
13	Imphal	0.05344	0.04803	0.06078	0.06598	0.06737
14	Tirupati	0.0297	0.02985	0.05264	0.06612	0.07181
15	Bhopal	0.07446	0.05375	0.07755	0.06949	0.07205
16	Vadodara	0.06439	0.05634	0.07339	0.0833	0.07338
17	Rajamundry	0.07492	0.07101	0.06641	0.07846	0.0857
18	Udaipur	0.05636	0.05467	0.07462	0.09084	0.09842
		2013-14	2014-15	2015-16	2016-17	2017-18
	Airport	X 2 Acft	X 2 Acft	X 2 Acft	X 2 Acft	X 2 Acft

19	Mysore	0.00442	0.0019	0.00842	0.00031	0.00473
20	Surat	0.02034	0.02219	0.02569	0.04651	0.10762
21	Vijayawada	0.0428	0.04639	0.06676	0.10333	0.11998
22	Dehradun	0.0478	0.0484	0.04962	0.09485	0.12281
23	Trichy	0.09836	0.09694	0.1043	0.11165	0.12801
24	Raipur	0.09279	0.08425	0.10185	0.1128	0.12802
25	Madurai	0.07862	0.07728	0.09589	0.11671	0.13578
26	Varanasi	0.0804	0.08801	0.11664	0.15035	0.1565
27	Indore	0.13785	0.14371	0.14858	0.14396	0.18692

It may be noted in general from the above details that at most of the above twenty seven airports aircraft movements generally increase year after year except at some airports where there could be a decrease in some year due to drop in traffic demand and local conditions and other reasons. The extent of dependency of total income of an airport on the aircraft movements handled by it during years from 2013 -14 to 2017-18 are brought out by using Linear Regression method in the latter paragraphs of this paper. To verify the assumption that with the increase movements of passengers, there would be an invariable increase in the total income, airport wise details for five years from 2013-14 to 2017-18 with their values in the ascending order are compiled and shown in Table 4 below:

Table 4: Passenger Movement Airport wise in lakhs (0.1 millions)>>

S. NO	**Year**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
	Airport	**X 1 Pax**	**X 1 Pax**	**X 1 Pax**	**X 1 Pax**	**X 1 Pax**
1	Shimla	0.00036	0.00069	0.00058	0.00022	0.00069
2	Salem	0.00013	0.0001	0.00013	0.0001	0.01
3	Ludhiana	0.02389	0.00836	0.00021	0.00098	0.101
4	Mysore	0.1572	0.0701	0.0119	0.00031	0.2
5	Bhavnagar	0.6673	0.6822	0.4307	0.22456	0.35
6	Porbandar	0.2181	0.20148	0.15716	0.03384	0.42
7	Hubli	0.7765	0.3179	0.38973	0.25928	0.49
8	Khujaraho	0.8068	0.65802	0.62747	0.58861	0.56
9	Tuticorin	0.7174	0.8076	0.91978	1.0241	0.96
		2013-14	**2014-15**	**2015-16**	**2016-17**	**2017-18**
	Airport	**X 1 Pax**	**X 1 Pax**	**X 1 Pax**	**X 1 Pax**	**X 1 Pax**
10	Gaya	1.0221	1.288	1.57144	1.776	1.86
11	Rajamundry	1.129	1.537	2.23903	2.68	2.68
12	Aurangabad	4.479	4.268	3.01046	3.269	3.34
13	Dibrugarh	2.483	3.192	3.19646	3.36851	3.36
14	Rajkot	3.064	3.584	4.13207	4.05518	3.65
15	Tirupati	2.72	2.45	3.7106	4.86	5.84
16	Surat	1.735	1.368	1.93	1.94688	6.81
17	Bhopal	4.296	4.162	6.62615	6.76015	7.22
18	Vijayawada	1.942	2.31	6.22354	6.22354	7.46
		2013-14	**2014-15**	**2015-16**	**2016-17**	**2017-18**
	Airport	**X 1 Pax**	**X 1 Pax**	**X 1 Pax**	**X 1 Pax**	**X 1 Pax**
19	Imphal	6.287	6.121	7.66877	8.863	9.87
20	Vadodara	6.86	7.12	9.31092	11.03981	10
21	Dehradun	3.069	3.786	4.71542	8.82564	11.24
22	Udaipur	4.351	4.578	7.11197	10.89899	11.47
23	Madurai	6.705	6.872	8.423	9.78919	14.47
24	Trichy	10.158	11.892	12.97212	13.59447	15.13
25	Raipur	8.395	9.253	12.06844	13.96179	16.28
26	Varanasi	8.262	10.2	13.83962	19.16454	20.87
27	Indore	11.14	13.53	16.92892	17.84073	22.69

To verify the assumption that with the increase movements of aircrafts and passengers , there would be an invariable increase in the total income, airport wise details for five years from 2013-14 to 2017-18 with their values in the ascending order are compiled and shown in Table 5 below:

Table 5: Income Airport wise in lakh rupees (0.1 million)

S.No		**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
	Airport	**Y -Income**	**Y -Income**	**Y -Income**	**Y -Income**	**Y -Income**
1	Salem	10	9	151	8	9
2	Ludhiana	21	24	18	23	18
3	Shimla	5	8	2	5	28
4	Hubli	177	104	124	95	124
5	Bhavnagar	181	209	118	74	130
6	Tuticorin	146	174	165	189	196
7	Mysore	152	153	229	293	201
8	Khujaraho	377	313	267	264	257
9	Porbandar	97	324	284	327	331
		2013-14	2014-15	2015-16	2016-17	2017-18
	Airport	Y -Income	Y -Income	Y -Income	Y -Income	Y -Income
10	Rajamundry	448	372	467	548	467
11	Gaya	437	882	899	913	899
12	Vijayawada	609	598	927	1704	927
13	Dibrugarh	699	1038	978	991	978
14	Tirupati	869	1278	987	1339	987
15	Rajkot	779	911	1067	1126	1067
16	Aurangabad	1313	1360	1094	1406	1094
17	Imphal	1285	1354	1670	1784	1670
18	Bhopal	1468	1604	2106	2545	2108
		2013-14	2014-15	2015-16	2016-17	2017-18
	Airport	Y -Income	Y -Income	Y -Income	Y -Income	Y -Income
19	Surat	633	559	403	926	2548
20	Dehradun	820	933	1189	2020	2634
21	Vadodara	1983	2007	2572	3222	3103
22	Udaipur	1667	1754	2386	3546	4018
23	Madurai	1824	1959	2459	2978	4190
24	Raipur	2620	3001	3893	4813	5146
25	Indore	3113	3710	4535	5288	6246
26	Varanasi	3303	3868	4986	7008	8896
27	Trichy	6288	6767	8337	9004	11225

It may be noted in general from the above details of twenty seven airports that for some airports the total income may not necessarily increase year after year and that there could be a decrease in some year due to drop in traffic demand and local conditions and other reasons To verify the assumption that the there would be an yearly increasing trend in the movements of aircrafts , passengers, and total income , airport wise details for five years from 2013-14 to 2017-18 with their values in the ascending order are compiled and plotted in Figures 1 to 9 below:

Fig: 1 Airport wise Annual Aircraft Movements in lakhs (0.1 million) - 9 Airports

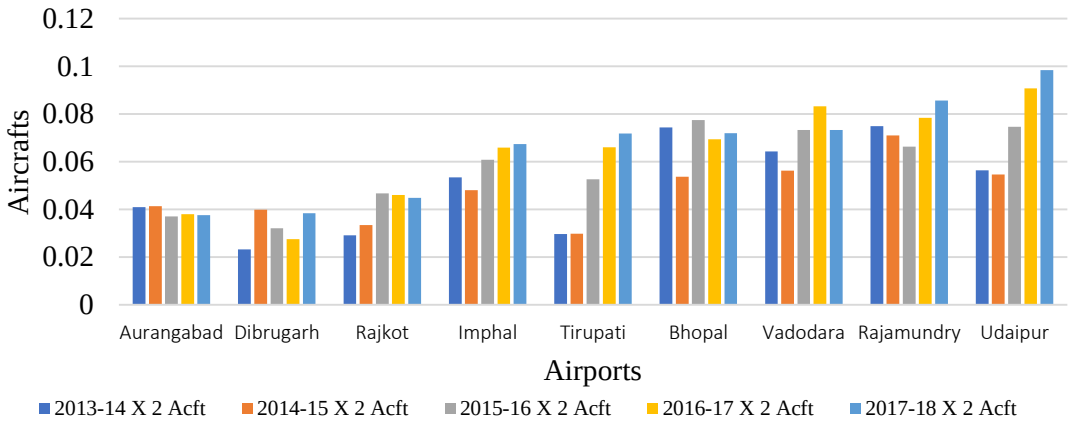


Fig: 2 Airport wise Annual Aircraft Movements in lakhs (0.1 million) -

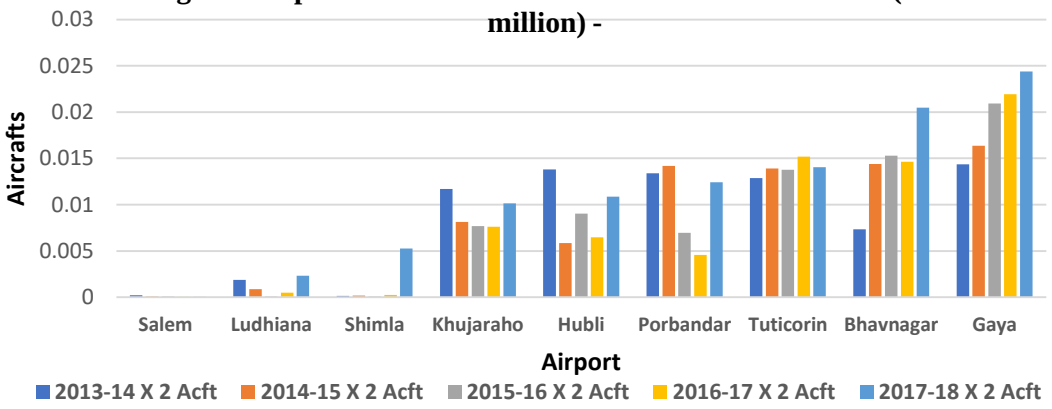


Fig: 3 Airport wise Annual Aircraft Movements in lakhs (0.1 million) -

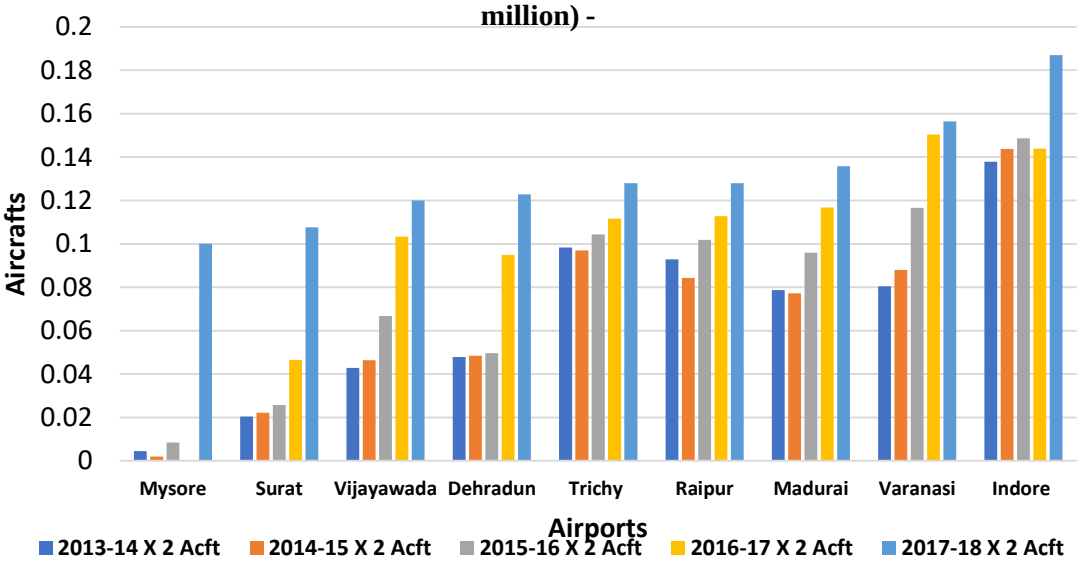


Fig: 4 Airport wise Annual Passenger Movements in lakhs (0.1 million)

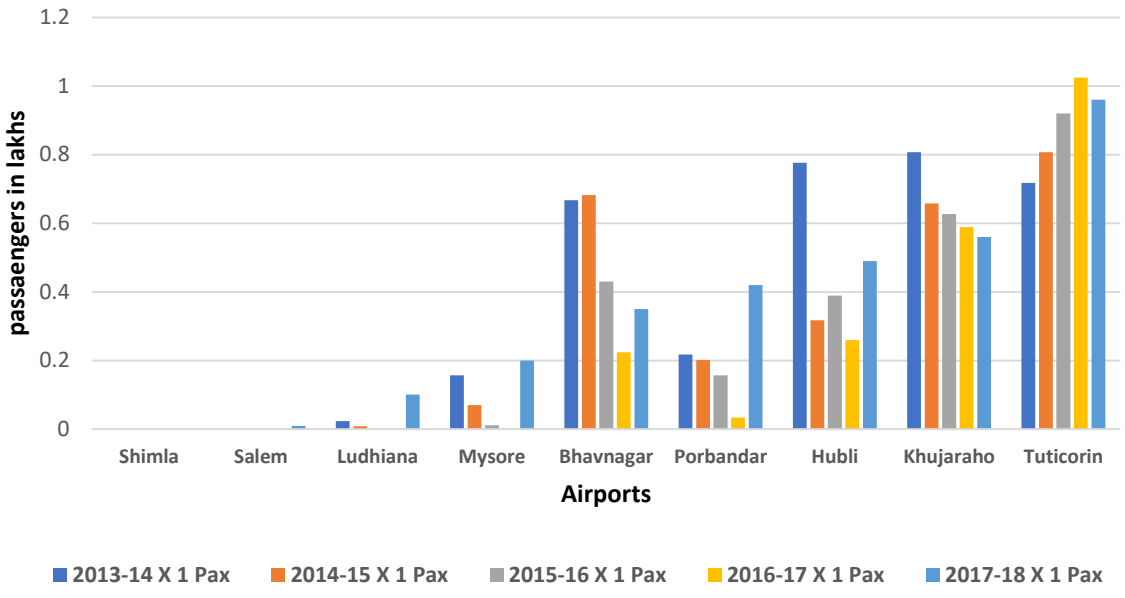


Fig: 5 Airport wise Annual Passenger Movements in lakhs (0.1 million) -

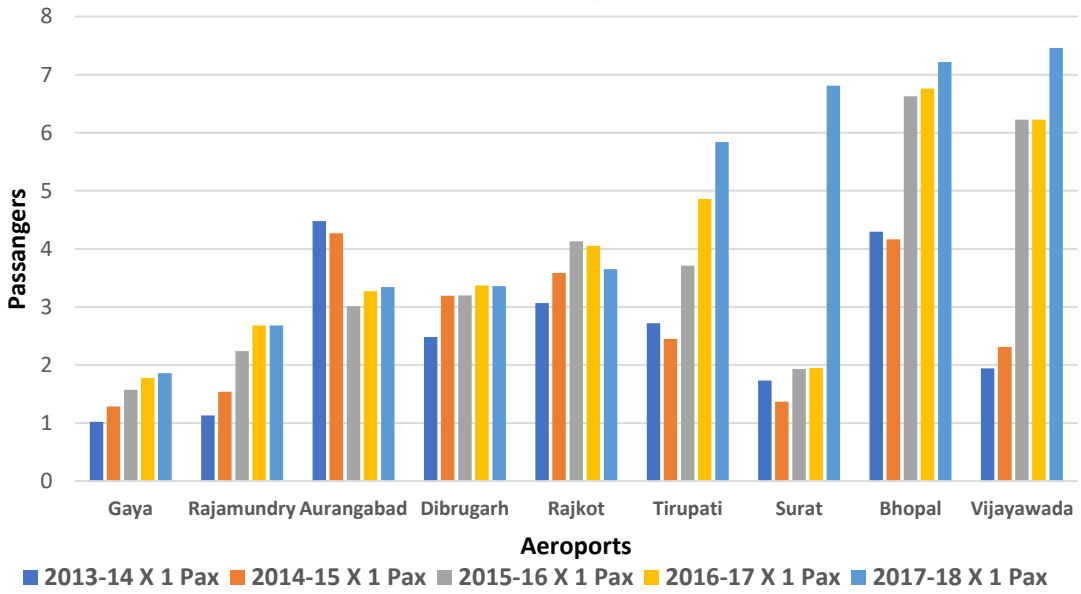


Fig: 6 Airport wise Annual Passenger Movements in lakhs (0.1 million) - 9 airports

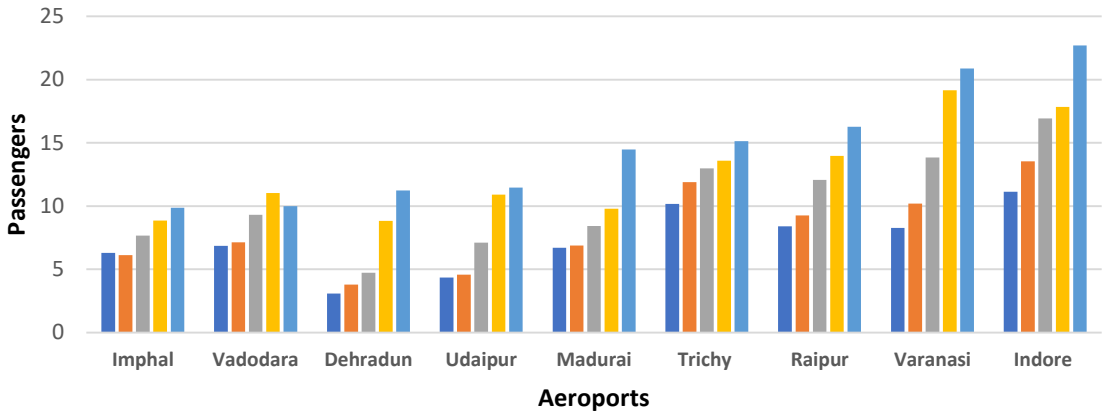


Fig: 7 Airport wise Annual Total Income in lakhs (0.1 million) -

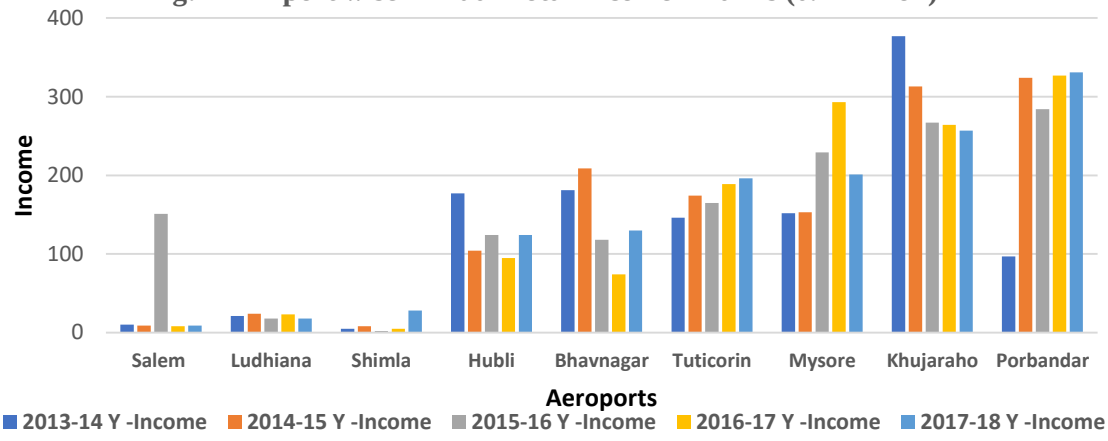
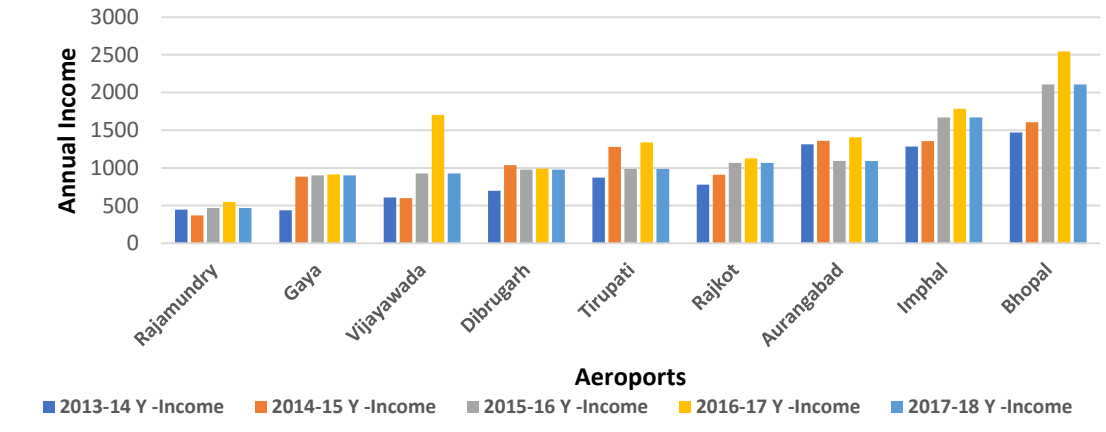
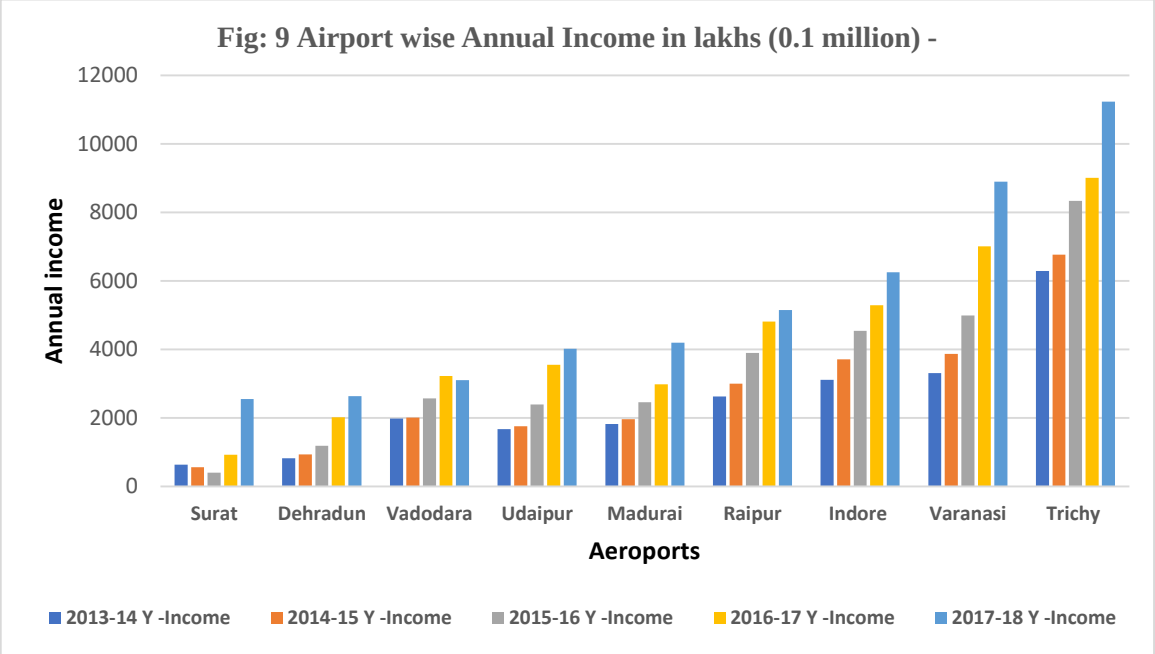


Fig: 8 Airport wise Annual Income in lakhs (0.1 million) -



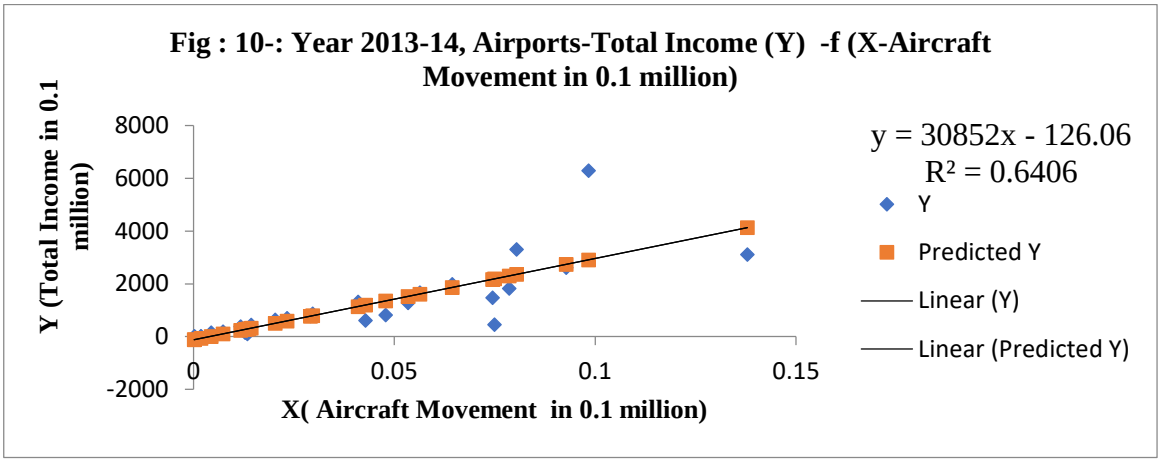


Total Income vs Aircraft Movements –Verifying Through Linear Regression

For each of the twenty seven airports, movements of passengers, aircrafts and total income, details for five years from 2013-14 to 2017-18 with their values in the ascending order were compiled and shown in Tables 3 to 5. Assuming that the total Income is dependent on aircraft movements data of the same from Table 3 and Table 5 were used to run linear regression using Excel Data Analysis and year wise plots along with regression equation
and R2 values are shown in Figures 10 to 14

Table 6 : Total Income –f(Aircraft Movements) during 2013-14

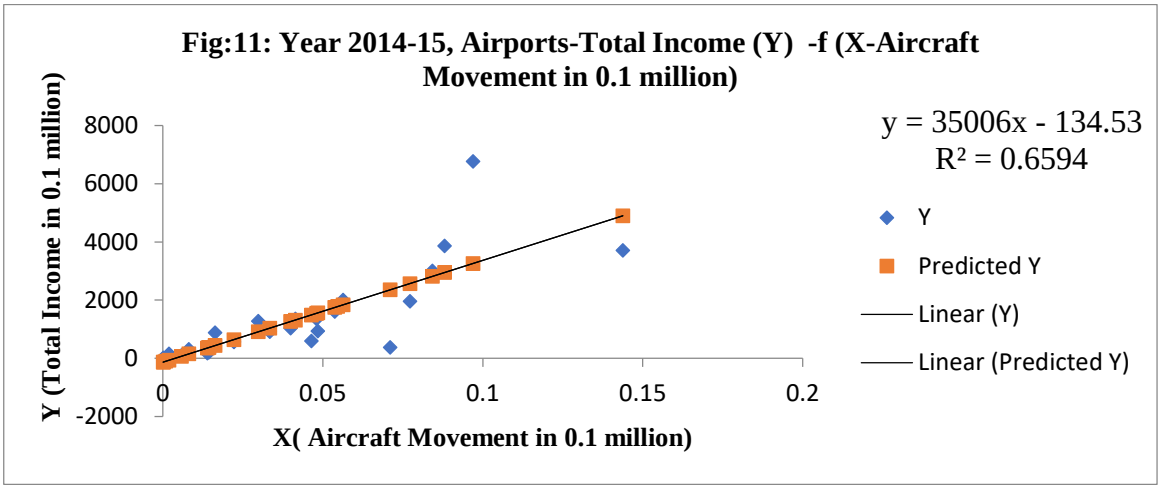
SUMMARY OUTPUT Year 2013-14,								
Regression Statistics								
Multiple R	0.800402887							
R Square	0.640644781							
Adjusted R Square	0.626270572							
Standard Error	849.2813001							
Observations	27							
ANOVA								
	df	***SS***	***MS***	***F***	***Significance F***			
Regression	1	32146705	32146705	44.56905	5.38E-07			
Residual	25	18031968	721278.7					
Total	26	50178673						
	Coefficients	***Standard Error***	***t Stat***	***P-value***	***Lower 95%***	***Upper 95%***	***Lower 95.0%***	***Upper 95.0%***
Intercept	-126.0637608	252.6512	-0.49896	0.622167	-646.409	394.2812	-646.409	394.2812
X Variable 1	30851.53472	4621.257	6.676005	5.38E-07	21333.88	40369.19	21333.88	40369.19



From the above plot of Linear Regression it may be noted that from the observations of total income and corresponding aircraft movements for each of twenty seven airports , the equation that describes the plot is Y (Total Income) = 30852 X (Aircraft Movement) --126.0. Its R2 value is 0.640 which signifies a good fit between total Income and aircraft movements. From the above Regression Statistics, it has been observed that the R square value for this assumed model of total income depending on aircraft movements for 27 selected airports is 0640 and as per ANOVA results , significance value and p values are much below 0.05 for 2013-14 and hence it may be concluded that this assumed model explains the variability of response data around its mean with a good fit.

Table No. 7 : Total Income –f(Aircraft Movements) during 2014-15

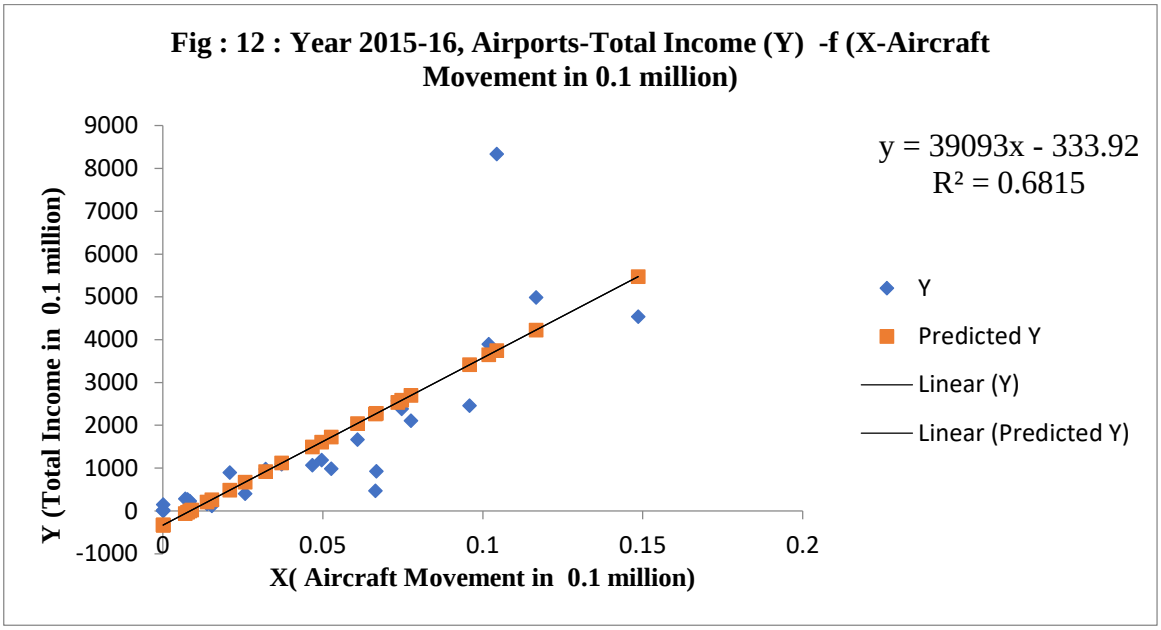
SUMMARY OUTPUT Year 2014-15,								
Regression Statistics								
Multiple R	0.812017							
R Square	0.659372							
Adjusted R Square	0.645747							
Standard Error	911.2926							
Observations	27							
ANOVA								
	df	***SS***	***MS***	***F***	***Significance F***			
Regression	1	40188908	40188908	48.39389	2.72E-07			
Residual	25	20761354	830454.2					
Total	26	60950263						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-134.535	271.4075	-0.49569	0.624441	-693.509	424.4396	-693.509	424.4396
X Variable 1	35005.79	5032.046	6.956572	2.72E-07	24642.1	45369.48	24642.1	45369.48



From the above plot of Linear Regression it may be noted that from the observations of total income and corresponding aircraft movements for each of twenty seven airports , the equation that describes the plot is Y (Total Income) = 35006 X (Aircraft Movement) --134.5. Its R2 value is 0.659 which signifies a good fit between total income and aircraft movements. From the above Regression Statistics, it has been observed that the R square value for this assumed model of total income depending on aircraft movements for 27 selected airports is 0659 and as per ANOVA results , significance value and p values are much below 0.05 for 2014-15 and hence it may be concluded that this assumed model explains the variability of response data around its mean with a good fit.

Table No . 8 : Total Income –f(Aircraft Movements) during 2015-16

SUMMARY OUTPUT FOR THE YEAR 2015-16								
Regression Statistics								
Multiple R	0.825502							
R Square	0.681454							
Adjusted R Square	0.668712							
Standard Error	1113.84							
Observations	27							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	66351456	66351456	53.48162	1.16E-07			
Residual	25	31016007	1240640					
Total	26	97367463						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-333.919	336.9352	-0.99105	0.331158	-1027.85	360.0119	-1027.85	360.0119
X Variable 1	39092.78	5345.572	7.313113	1.16E-07	28083.36	50102.19	28083.36	50102.19

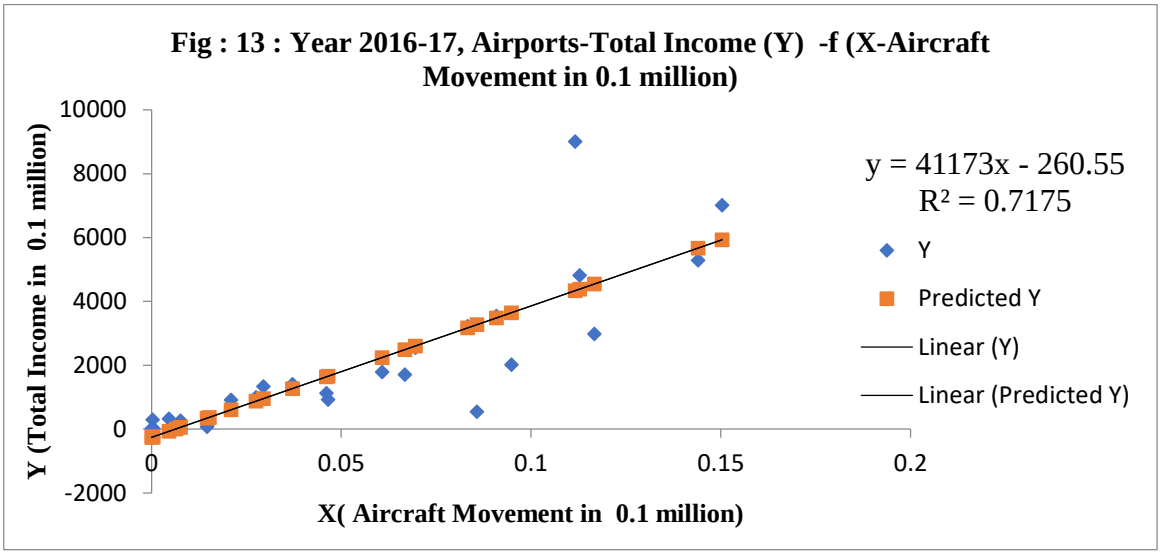


From the above plot of Linear Regression it may be noted that from the observations of total income and corresponding aircraft movements for each of twenty seven airports , the equation that describes the plot is Y (Total Income) = 39093 X (Aircraft Movement) –333.90 . Its R2 value is 0.681 which signifies a good fit between total income and aircraft movements. From the above Regression Statistics, it has been observed that the R square value for this assumed model of total income depending on aircraft movements for 27 selected airports is 0681 and as per ANOVA results , significance value and p values are much below 0.05 for 2015-16 and hence it may be concluded that this assumed model explains the variability of response data around its mean with a good fit.

From the above Regression Statistics, it has been observed that the R square value for this assumed model of total income depending on aircraft movements for 27 selected airports is 0681 and as per ANOVA results , significance value and p values are much below 0.05 for 2015-16 and hence it may be concluded that this assumed model explains the variability of response data around its mean with a good fit.

Table 9 : Total Income –f(Aircraft Movements) during 2016-17

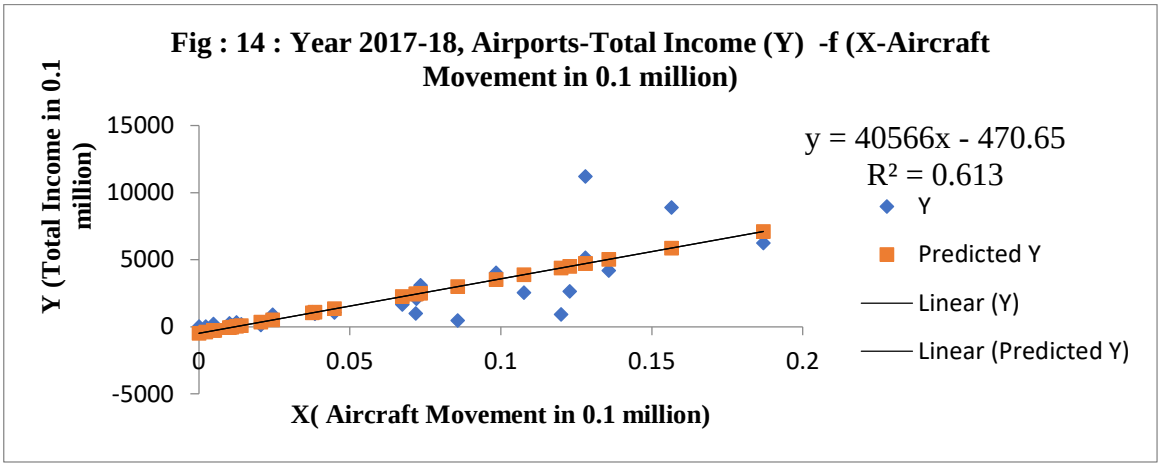
SUMMARY OUTPUTFOR THE YEAR 2016-17								
Regression Statistics								
Multiple R	0.847078							
R Square	0.717541							
Adjusted R Square	0.706242							
Standard Error	1240.762							
Observations	27							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	97770436	97770436	63.5083	2.52E-08			
Residual	25	38487266	1539491					
Total	26	1.36E+08						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-260.546	365.2643	-0.71331	0.482262	-1012.82	491.7302	-1012.82	491.7302
X Variable 1	41173.11	5166.524	7.96921	2.52E-08	30532.46	51813.76	30532.46	51813.76



From the above plot of Linear Regression it may be noted that from the observations of total income and corresponding aircraft movements for each of twenty seven airports , the equation that describes the plot is Y (Total Income) = 41173 X (Aircraft Movement) –260.5 Its R2 value is 0.717 which signifies a good fit between total Income and aircraft movements. From the above Regression Statistics, it has been observed that the R square value for this assumed model of total income depending on aircraft movements for 27 selected airports is 0.717 and as per ANOVA results , significance value and p values are much below 0.05 for 2016-17 and hence it may be concluded that this assumed model explains the variability of response data around its mean with a good fit.

Table No. 10 : Total Income –f(Aircraft Movements) during 2017-18

SUMMARY OUTPUT FOR THE YEAR 2017-18								
Regression Statistics								
Multiple R	0.782922							
R Square	0.612967							
Adjusted R Square	0.597486							
Standard Error	1802.892							
Observations	27							
ANOVA								
	df	***SS***	***MS***	***F***	***Significance F***			
Regression	1	1.29E+08	1.29E+08	39.59396	1.39E-06			
Residual	25	81260487	3250419					
Total	26	2.1E+08						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-470.646	548.6421	-0.85784	0.399132	-1600.6	659.3037	-1600.6	659.3037
X Variable 1	40565.7	6446.805	6.292373	1.39E-06	27288.26	53843.15	27288.26	53843.15



From the above plot of Linear Regression it may be noted that from the observations of total income and corresponding aircraft movements for each of twenty seven airports , the equation that describes the plot is Y (Total Income) = 40566 X (Aircraft Movement) –470.60. Its R2 value is 0.613 which signifies a good fit between total Income and aircraft movements. From the above Regression Statistics, it has been observed that the R square value for this assumed model of total income depending on aircraft movements for 27 selected airports is 0.613 and as per ANOVA results , significance value and p values are much below 0.05 for 2017-18 and hence it may be concluded that this assumed model explains the variability of response data around its mean with a good fit.

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