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Export of food items from different ports and statistical analysis and forecast

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Abstract
Export business is one of the leading businesses which fetch foreign trade and eventually helps raise economic stability. It enhances the local network through its growth of procurement of raw material and manufacturing the export worthy goods. All these activities can be optimized more efficiently if sound forecast is made based on past records. Analysis of the past records and derivation of conclusions is a part to be taken care of during the manufacturing process and after the forecast. This procedure deals with the segment which helps the planning and procurement of the goods and inventory of raw material to be purchased and stalked.
In this paper the chronological records have been analyzed and using the regression analysis forecast is predicated.

Keywords: ports, export, foods (R.T.S), anova

1. Introduction
Content of this research paper pertaining to export of RTS (Food) from three different ports during the time-slot of four different years (2013 to 2016 inclusive) has been analyzed in two parts. The first part deals with 'data Analysis and graphical presentation while the second part deals with analysis of variance. These two parts jointly give a complete analysis and helps draw sound forecast.

1.1 Data Analysis: In this section we analyze the given data which is in the tabular form. There are three ports (Two active ports and one dry port of India.) We have data of RTS food exported during the years Jan. 2013 up to Dec.2016. On finding averages of first order (mean and Mode) of each year and on finding averages of second order (std. Deviation) we are able to understand the measure of variation in data. Thus four years coefficients of variations when compared together it indicates the year in which the flow of data was stable.

1.2 Graphical Presentation: In this section we have considered the same data and plotted four graphs one for each year. The same process is repeated for each port and thus as an end result we have 12 such graphs. The important point is to derive conclusion for each graph and thus for all the four graphs associated with each port. Also on making general comparison of some feature like months during which maximum or minimum export has taken place all these graphs will be useful.

1.3 Regression lines and short term forecast: One of the most important and critical part in data analysis is short term forecasting. This part is better resolved when most of the data items is subjectively not too far from the mean. In such cases attempts fitting linear regression lines give better forecasts. The regression lines have been tested for short term forecast and the results for the first quarter of the year 2017 are found almost close. This assures best fit.

1.4 ANOVA: The second part deals with analysis of variance. This can be performed in two different ways with null hypothesis suggested for claimed equalities of means. Considering a fix port we claim that equality of means of export quantity for different years. This process can be repeated for three different ports under consideration. On the other end we consider the combined export units for one port during four years and follow the same procedure for all different ports and then apply ANOVA claiming equality amongst their means.

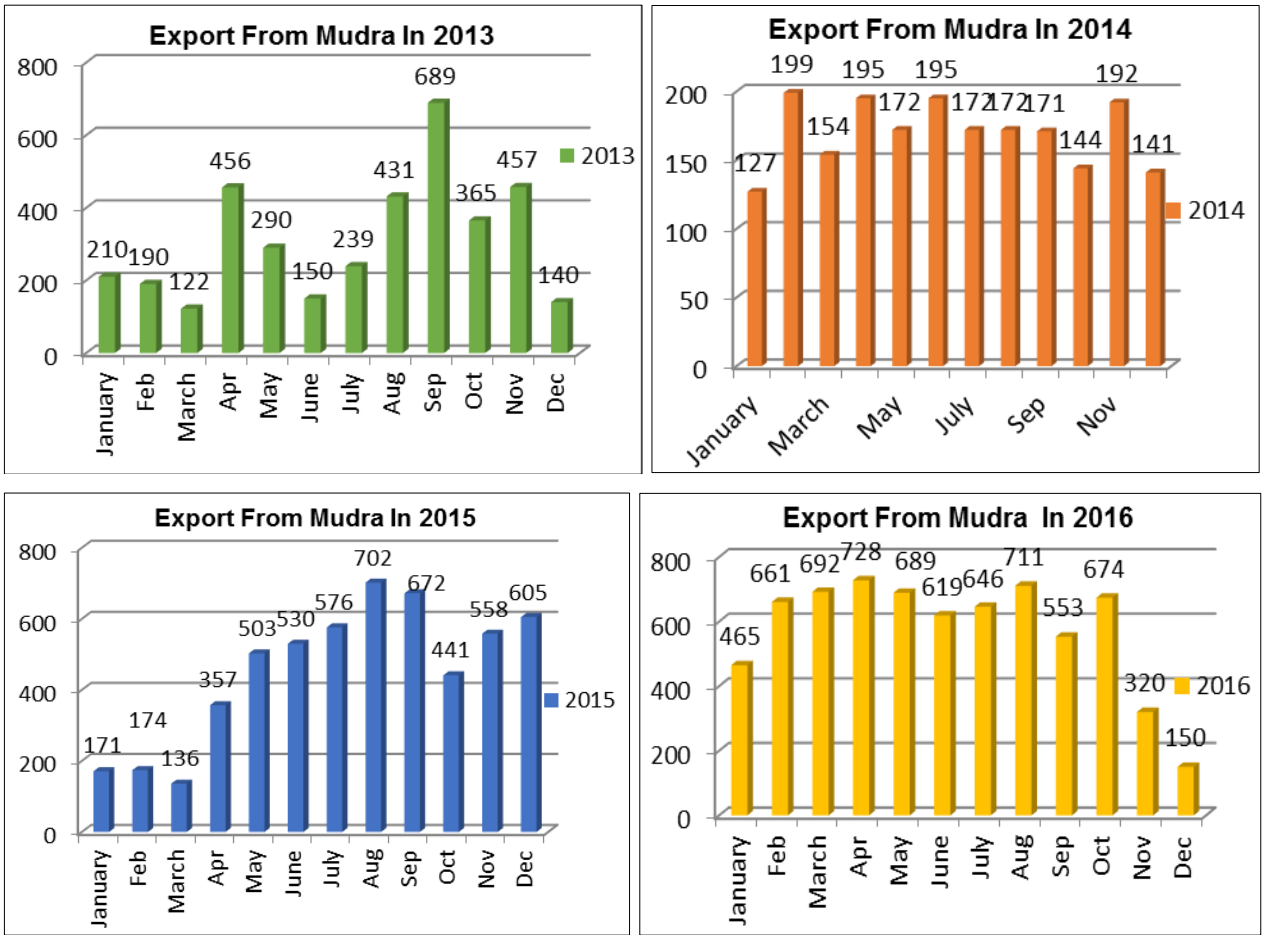
2. Tables, graphs, and derivations: In this section we give the primary export data from each port during the four years and find some basic measures likely to be used for further work to be followed.

2.1 Export in terms of '000 units
Port: Mundra

(Table no. 2.1(a))

	X1	X2	X3	X4
	2013	2014	2015	2016
January	210	127	171	465
Feb	190	199	174	661
March	122	154	136	692
Apr	456	195	357	728
May	290	172	503	689
June	150	195	530	619
July	239	172	576	646
Aug	431	172	702	711
Sep	689	171	672	553
Oct	365	144	441	674
Nov	457	192	558	320
Dec	140	141	605	150
Σx(Total)	3739	2034	5425	6908
monthly avg.	311.5833	169.5	452.0833	575.66667
S.D	164.288	22.74313	190.3621	171.0245
C.V	1.8965	7.4528	2.3748	3.3659
Grand total	18106			
Grand avg.	377.2083			

Graphical presentation Export



2.1.1 Considering the graphs for different year, we initially derive the following points described below.
Port Mundra

Table 2.1(b)

Year	Maximum Export (Months)	Minimum Export (Months)
2013	September	March
2014	Feb, May, July, Nov.	Jan.
2015	August, Sept.	March
2016	April, August	December

General observations

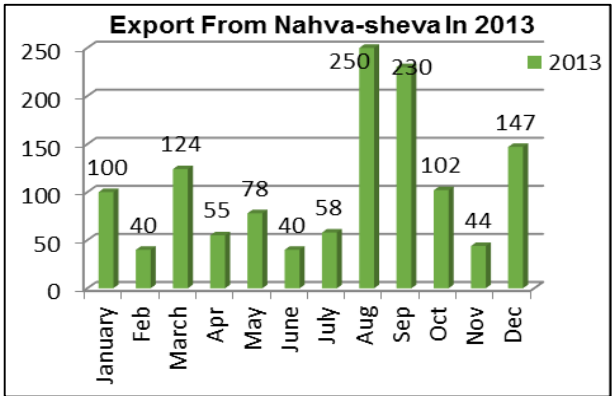
1. Export amount rises during the second half of the year while about the first quarter of a year it declines.
2. From the year 2013 the total export figures exhibit rising trend.

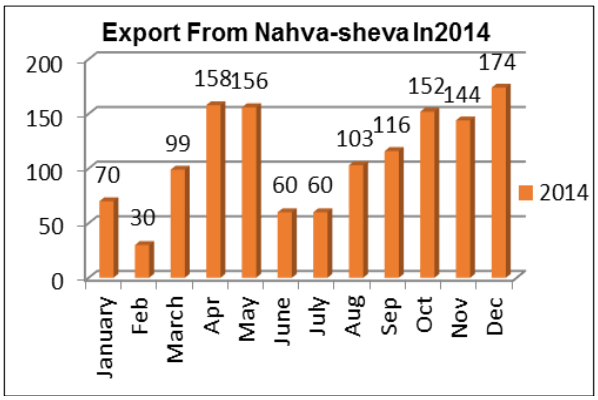
2.2 Export in terms of '000 units Total export food items from Nahva-sheva

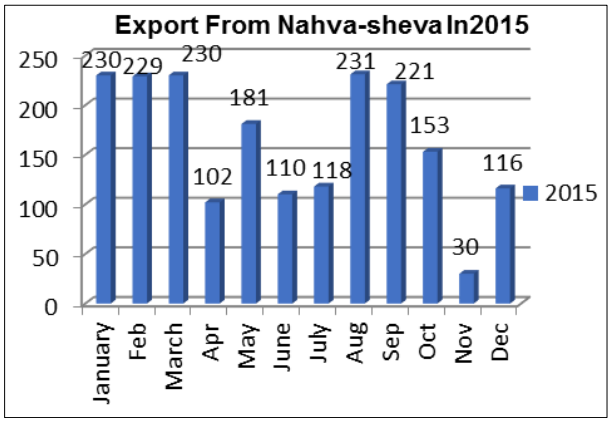
Table 2.2(a)

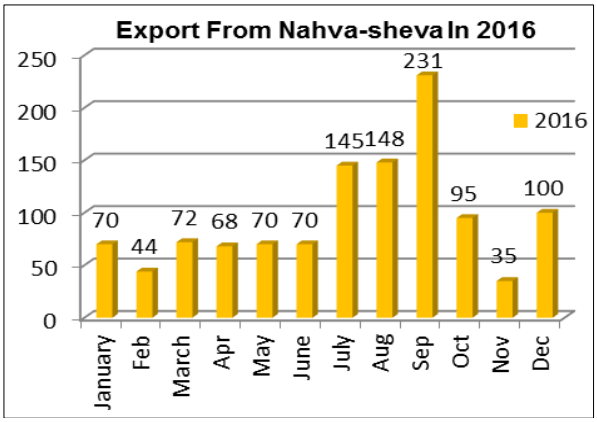
	X1	X2	X3	X4
	2013	**2014**	**2015**	**2016**
January	100	70	230	70
Feb	40	30	229	44
March	124	99	230	72
Apr	55	158	102	68
May	78	156	181	70
June	40	60	110	70
July	58	60	118	145
Aug	250	103	231	148
Sep	230	116	221	231
Oct	102	152	153	95
Nov	44	144	30	35
Dec	147	174	116	100
Σx (Total)	1268	1322	1951	1148
monthly avg.	105.6667	110.1667	162.5833	95.666667
S.D	68.5642	45.3152	64.6767	52.5663
C.V	1.5411	2.4311	2.5137	1.8199
Grand total	5689			
Grand avg. (mean)	118.5208333			

Graphical presentation of export









2.2.1 Considering the graphs for different year, we initially derive the following points described below.

Table 2.2(b): Port Nahva sheva

Year	Maximum Export (Months)	Minimum Export (Months)
2013	August	February, June
2014	December	February
2015	August	November
2016	September	November

General observations

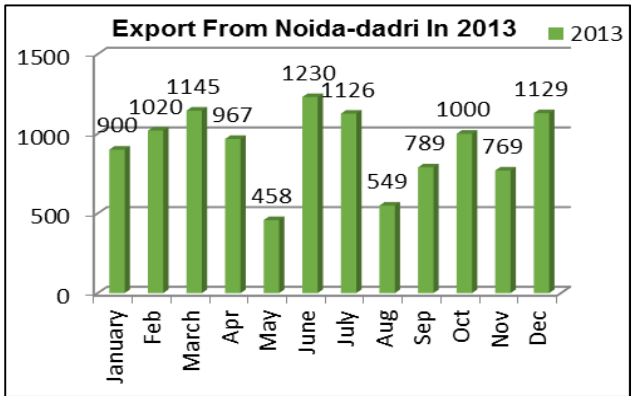
1. Export amount rises during the second half of the year while in the months February and November it shows declining trend.
2. During these years the export units from Nahva Sheva port exhibits fluctuating trend.

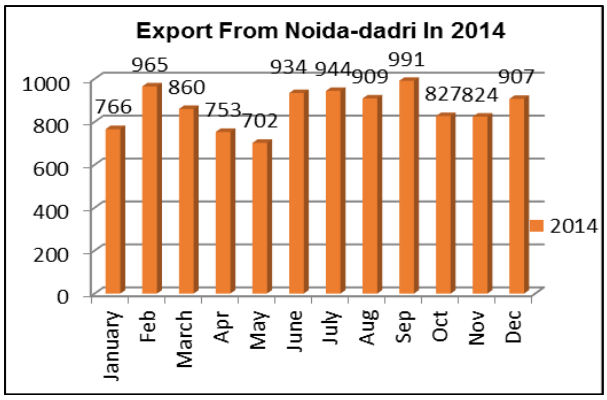
2.3 Export in terms of '000 units

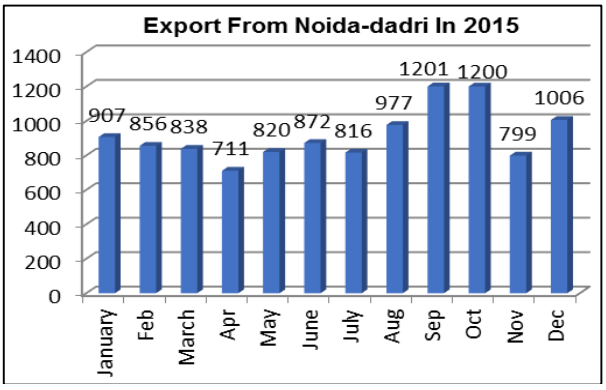
Table 2.3(a): Total export food items from Noida-Dadri

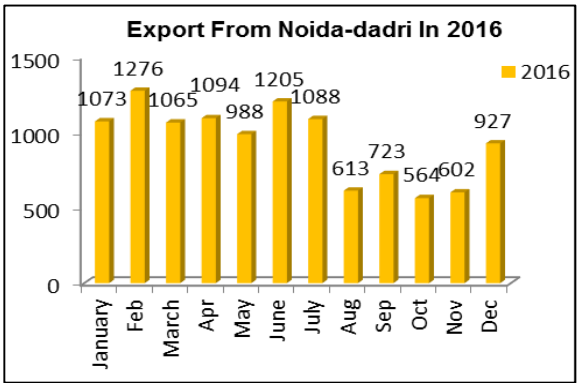
	X1	X2	X3	X4
	2013	**2014**	**2015**	**2016**
January	900	766	907	1073
Feb	1020	965	856	1276
March	1145	860	838	1065
Apr	967	753	711	1094
May	458	702	820	988
June	1230	934	872	1205
July	1126	944	816	1088
Aug	549	909	977	613
Sep	789	991	1201	723
Oct	1000	827	1200	564
Nov	769	824	799	602
Dec	1129	907	1006	927
Σx(Total)	11082	10382	11003	11218
monthly avg.	923.5	865.166	916.916	934.833
S.D.	231.43	87.8643	147.287	236.96
C.V.	3.99	9.84	6.2253	3.9451
Grand total	43685			
Grand avg.	910.1041667			

Graphical presentation of export









2.3.1 Considering the graphs for different year, we initially derive the following points described below.

Table 2.3(b): Port Mundra

Year	Maximum Export (Months)	Minimum Export (Months)
2013	June	May
2014	September	May
2015	September	April
2016	February	October

General observations

1. Export amount rises during the second half of the year while in the months April and May it shows declining trend.
2. From the year 2013 the total export figures indicates approximately steady trend.

3. Linear equations: The main purpose of most of the statistical activities is analysis and making future projections. The study of the different export data (dependent variable) of RTS in different years (independent variable), on assumptions of linearity, can be mathematically be correlated using regression equations as shown below.

3.1 Export units from Mundra port

Table 3.1

Year(x)	Average (Y)	X Y	X^2
1	311.58	311.58	1
2	169.5	339	4
3	452.08	1356.24	9
4	575.66	2302.64	16
AVG.	377.205		
S.D	152.019		
Σ = 10	Σ = 1508.82	Σ= 4309.46	Σ =30

Here, we can use liner trend (Normal equations) equation y = a + b X then,
$\Sigma = 4a + b \quad \Sigma = a\Sigma + b\Sigma^2$
i.e. 1508.82 = 4a + 10b ……. (1) 4309.46 = 10a + 30b (2)

On solving the equations 1 and 2 and get the value of a and b then,
a = 108.5 and b = 107.482
This makes the forecasting regression equation as y= 108.5 + 107.482x (3)
This equation, to a certain extent, be used for forecasting activities. We take x= 5 in order to make average forecast for the next year 2017.
For x = 5 we have Y = 108.5+ 107.482(5) = 645.91 units.
On comparison with the mean observations of the previous years, generally observing increasing trend, the forecast figure confirms the same.
We use the above linear trend equation to find the forecast of the export for the year 2017 (x = 5). Putting x = 5 in the above equation we get export forecast for the year 2017; Y = 645.91 units (4)
In the next part we find the probable validity of the prediction. We use the mean and standard deviation.
Mean = X = 377.2, Std. deviation = S = 152 units.

Assuming normality in discrete variate, the said range groups are as follows.
[X- S, X +S] =
[X +2 S, X+2S] = [377.2 – 2 x 152, 377.2 + 2x 152] = [73.2, 681.2]

The prediction = 645.91 which falls in the above range and hence probable assurance is 95%.
This way we may continue for the recurrence predictions also. This signifies the correctness of regression line.

3.2 Export units from Nahva sheva port

Table 3.2

Year(x)	Average (Y)	X Y	X^2
1	105.66	105.66	1
2	110.16	220.32	4
3	162.58	487.74	9
4	95.66	382.64	16
Σ = 10	Σ =474.06	Σ=1196.36	Σ =30

Here, we can use liner trend equation y = a + b X then,
$\Sigma = 4a + b \quad \Sigma = a\Sigma + b\Sigma^2$
i.e. 474.06 = 4a + 10b ……. (1)
1196.36 = 10a + 30b ……. (2)

To solve the equations 1 and 2 and get the value of a and b then,
a = 112.91 and b = 2.242 and
This makes the forecasting regression equation as y= 112.91 +2.242x (3)
This equation, to a certain extent, be used for forecasting activities. We take x= 5 in order to make average forecast for the next year 2017.
For x = 5 we have Y = 112.91 + 2.242 (5) = 124.12 units.
On comparison with the mean observations of the previous years, generally observing increasing trend, the forecast figure confirms the same.
We use the above linear trend equation to find the forecast of the export for the year 2017 (x = 5). Putting x = 5 in the above equation we get export forecast for the year 2017; Y = 124.12 units

3.3 Export units from Noida dadri port

Table 3.3

Year(x)	Average (Y)	X Y	X^2
1	923.5	923.5	1
2	865.16	1730.32	4
3	916.92	2750.76	9
4	934.83	3739.32	16
Σ = 10	Σ = 3640.41	Σ= 9143.9	Σ =30

Here, we can use liner trend equation y = a + b X then,
$\Sigma = 4a + b \quad \Sigma = a\Sigma + b\Sigma^2$
i.e. 3640.41 = 4a + 10b (1)

9143.9 = 10a + 30b (2)

To solve the equations 1 and 2 and get the value of a and b then,

a = 888.66 and b = 8.575

This makes the forecasting regression equation as y= 888.66 +8.575x (3)

This equation, to a certain extent, be used for forecasting activities. We take x= 5 in order to make average forecast for the next year 2017.

For x = 5 we have Y = 888.66 + 8.575 (5) = 931.535 units.

On comparison with the mean observations of the previous years, generally observing increasing trend, the forecast figure confirms the same.

We use the above linear trend equation to find the forecast of the export for the year 2017 (x = 5). Putting x = 5 in the above equation we get export forecast for the year 2017; Y = 931.535 units

4.1 Export of frozen food from Mundra port:

Hypothesis:

$H_{o:}$ The mean export units do not differ significantly.

(That there is no difference in the mean export units in the export activities of these years

H1: The mean of export units differ.

(In case if there is at all a small amount of variations then it can be contributed to sampling fluctuations and occasional skips in primary data.) Level of significance 0.05

Table 4.1(a)

	2013	2014	2015	2016	Total
January	210	127	171	465	973
February	190	199	174	661	1224
March	122	154	136	692	1104
April	456	195	357	728	1736
May	290	172	503	689	1654
June	150	195	530	619	1494
July	239	172	576	646	1633
August	431	172	702	711	2016
September	689	171	672	553	2085
October	365	144	441	674	1624
November	457	192	558	320	1527
December	140	141	605	150	1036
Total	3739	2034	5425	6908	18106
Square table					
January	44100	16129	29241	216225	305695
February	36100	39601	30276	436921	542898
March	14884	23716	18496	478864	535960
April	207936	38025	127449	529984	903394
May	84100	29584	253009	474721	841414
June	22500	38025	280900	383161	724586
July	57121	29584	331776	417316	835797
August	185761	29584	492804	505521	1213670
September	474721	29241	451584	305809	1261355
October	133225	20736	194481	454276	802718
November	208849	36864	311364	102400	659477
December	19600	19881	366025	22500	428006
Total	1488897	350970	2887405	4327698	9054970

N = 48, C.F = = = 6829734.1

Total Sum of Squares = C.F = 9054970 – 6829734.1= 2225236

S.S due to various years = - C.F = 7939031 – C.F = 1109296

Error sum of square = T.S.S – S.S.C = 1115940

Anova Table

Table 4.1(b)

Source of variation	D. F	S.S	M.S.S (S.S/D.F)	F. Cal	F. Tab
S.S due to various years	3	1109296	369765.333	14.579 35	2.81
Error	44	1115940	25362.2727		
Total	47	2225236			

From the table, the value of F at 5% level of significance is 2.81

Since, the calculated value of F for different years is 14.57935.

Since calculated value is more than the table value it false a rejection region and hence; Null hypothesis H_0 is rejected.

So we accept the alter native hypothesis accepted the mean export differ significantly.

4.2 Export of frozen food from Nahva sheva port

In the same way export of frozen food from Nahva sheva port, the data are shown in table no 2.2 (a).

Hypothesis: $H_{o:}$ The mean export units do not differ significantly.

(That there is no difference in the mean export units in the export activities of these years

H1: The mean of export units differ.

(In case if there is at all a small amount of variations then it can be contributed to sampling fluctuations and occasional skips in primary data.)

Level of significance 0.05

Then, N = 48, C.F = = 674265.02

Total Sum of Squares = C.F = 871061 – 674265.02 = 196796

S.S due to various years = - C.F = 32386.06

Error sum of square = T.S.S – S.S.C = 164409.9

Anova Table

Table 4.2(a)

Source of variation	D.F	S.S	M.S.S (S.S/D.F)	F. Cal	F. Tab
S.S due to various years	3	32386.06	10795.3533	2.889093	2.81
Error	44	164409.9	3736.58864		
Total	47	196796			

From the table, the value of F at 5% level of significance is 2.81
Since, the calculated value of F for different years is 2.889093
Since calculated value is more than the table value it false a rejection region and
Hence; Null hypothesis H_0 is rejected.
So we accepted the alternative hypothesis accepted the mean export differ significantly.

4.3 Export of frozen food from Noida dadri port

In the same way export of frozen food from Noida dadri port, the data are shown in table no. 2.3(a).

Hypothesis: H_o: The mean export units do not differ significantly.
(That there is no difference in the mean export units in the export activities of these years
H1: The mean of export units differ.
(In case if there is at all a small amount of variations then it can be contributed to sampling fluctuations and occasional skips in primary data.) Level of significance 0.05
Then, N = 48, C.F = = 39757901
Total Sum of Squares = C.F = 41461743 – 39757901 = 1703842
S.S due to various years = - C.F = 34281.23
Error sum of square = T.S.S – S.S.C = 1669561

Anova Table

Table 4.3(a)

Source of variation	D.F	S.S	M.S.S (S.S/D.F)	F. Cal	F. Tab
S.S due to various years	3	34281.23	11427.0767	0.301152	2.81
Error	44	1669561	37944.5682		
Total	47	1703842			

From the table, the value of F at 5% level of significance is 2.81
Since, the calculated value of F for different years is 0.301152.
Since calculated value is less than the table value.
Hence; Null hypothesis H_0 is accepted.

4.4 Averages of various ports

	2013	2014	2015	2016	Total
Mundra	311.5833	169.5	452.08	575.66	1508.823
Nahva sheva	105.66	110.16	162.58	95.66	474.06
Noida dadri	923.5	865.17	916.91	934.83	3640.41
Total	1340.7433	1144.83	1531.57	1606.15	5623.29
Square table					
Mundra	97084.15	28730.25	204376.3	331384.4	661575.2
Nahva sheva	11164.04	12135.23	26432.26	9150.836	58882.35
Noida dadri	852852.3	748519.1	840723.9	873907.1	3316002
Total	961100.4	789384.6	1071533	1214442	4036460

Hypothesis: H_o: The mean export units do not differ significantly.
(That there is no difference in the mean export units in the export activities of these years.
H1: The mean of export units differ.
(In case if there is at all a small amount of variations then it can be contributed to sampling fluctuations and occasional skips in primary data.) Level of significance 0.05
N = 3*4 = 12, C.F = = = = 2635115.87
Total Sum of Squares = C.F = 4036457.91 – 2635115.87 = 1401341
S.S due to various years = - C.F = 2677884 – C.F = 42765.31
Error sum of square = T.S.S – S.S.C = 1358576

Anova Table

Source of variation	D.F	S.S	M.S.S (S.S/D.F)	F. Cal	F. Tab
S.S due to various years	3	42765.31	14255.1033	0.083941	4.07
Error	8	1358576	169822		
Total	11	1401341			

From the table, the value of F at 5% level of significance is 4.07
Since, the calculated value of F for different years is 0.0839.
Since calculated value is less than the table value.
Hence; Null hypothesis H_0 is accepted.

5. Conclusion

The different sections treated in this article points out different suggestions and directives based on statistical calculations. Firstly it is directive, looking at the graphical presentation, suggesting the months during which the export

business hikes up and also in which it lags behind. This is useful for business corporations to plan their export related activities. Application of ANOVA with proper hypothesis, helps selection ports as ports authorities remain flexible in adjusting sea-fair during such period.

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