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Statistical Analysis of Clay Mining of Bikaner

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INTRODUCTION

Bikaner is bestowed with huge deposits of non-metallic minerals including Ball clay. Ball clay is the raw material for the ceramic industries. The Bikaner region is well known for their clay minerals. Bikaner contributes about 90% of ball clay in the economy of north-western Rajasthan. All these resources, which generate millions of rupees as revenue for the government’s exchequer, have vast employment potential but they are not given their due importance in the development of this region.

CLAY MINERAL RESOURCES IN BIKANER DISTRICT

The Bikaner district alone accounts for more than 90% of Rajasthan’s total clay production. There are 148 leases of Ball clay in the year 2020-21 in Bikaner district. Clay deposits are found in following places: Khari Charnan, Guda, Kotri, Mudh, Kolayat, Inda Ka Bala, Madhogarh, Nal, Guda.

Mineral	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Ball Clay	89	91	105	114	114	114	124	124	139	148
Total	414	407	449	435	238	238	248	248	281	294

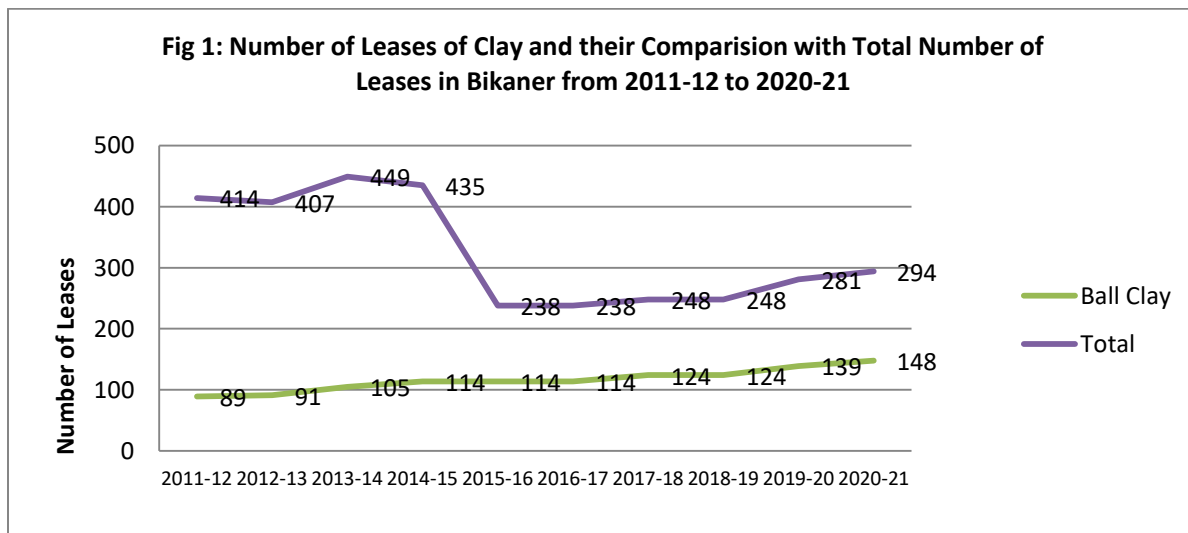




Table 2: Mining Area of Clay in Bikaner (2011-12 to 2020-21)

Mineral	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Ball Clay	5009.21	5303.75	5353.75	5353.75	5353.75	5353.75	5353.75	5353.75	4719	5548
Total	14624.45	14913.11	15067.5	14231.2	13983.47	13983.47	13983.47	13983.47	12817.74	13630

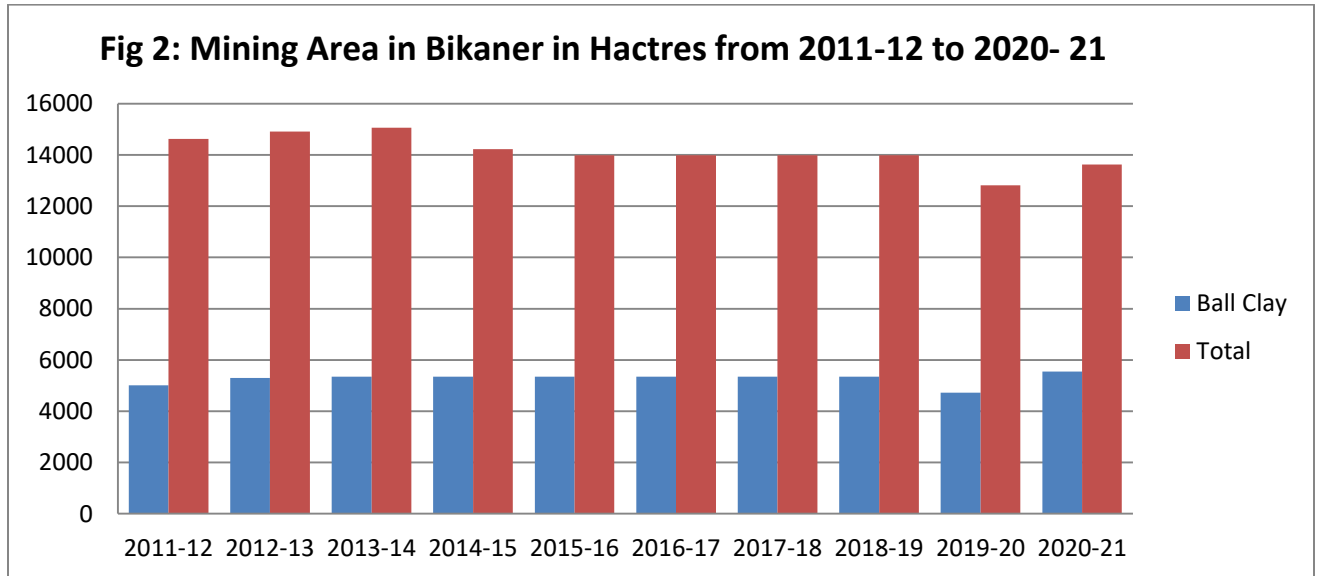


Table 3: Production of Clay in Bikaner in Thousand Tonnes (2011-12 to 2020-21)

Mineral	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Ball Clay	2116.551	2474.187	3111.317	3118.457	3402.161	3437.288	3677.169	4743.289	3014.106	4094.522
Total	20873.572	18724.297	22226.951	19577.28	16902.818	14649.229	16563.59	10231.762	8511.327	9709.654

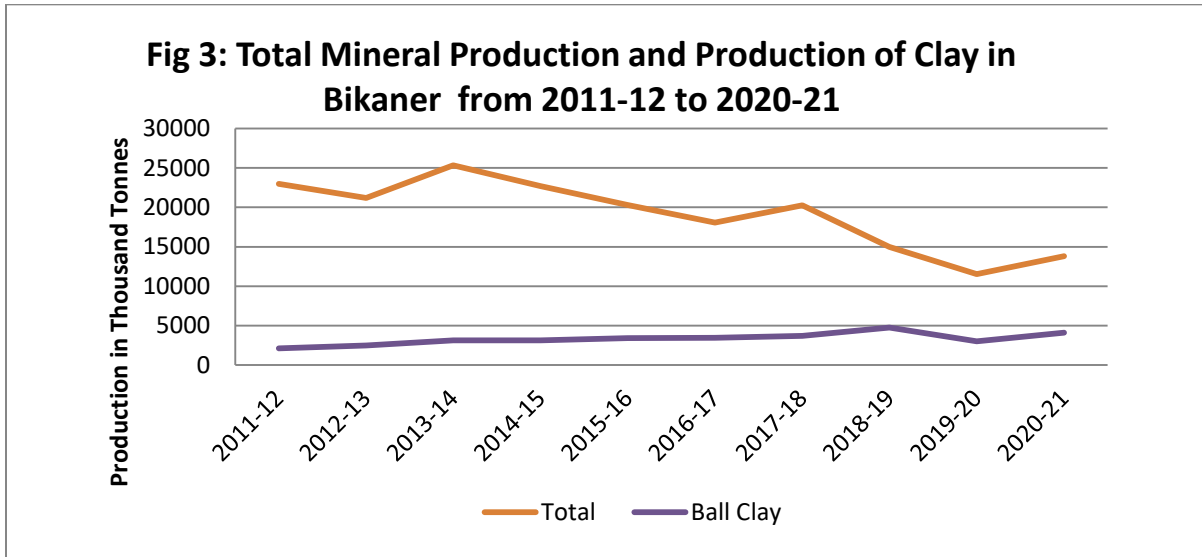


Table 4: Sale Value of Clay in Bikaner in Lac Rupees (2011-12 to 2020-21)

Mineral	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Ball Clay	8466.204	13608.03	14934.32160.	17151.51	23815.127	24061.016	25740.183	33203.023	21098.74	28661.65
Total	73589.978	79727.51	71364.92	77752.6	72444.839	71859.618	72079.99	73512.584	59695.98	70006.96

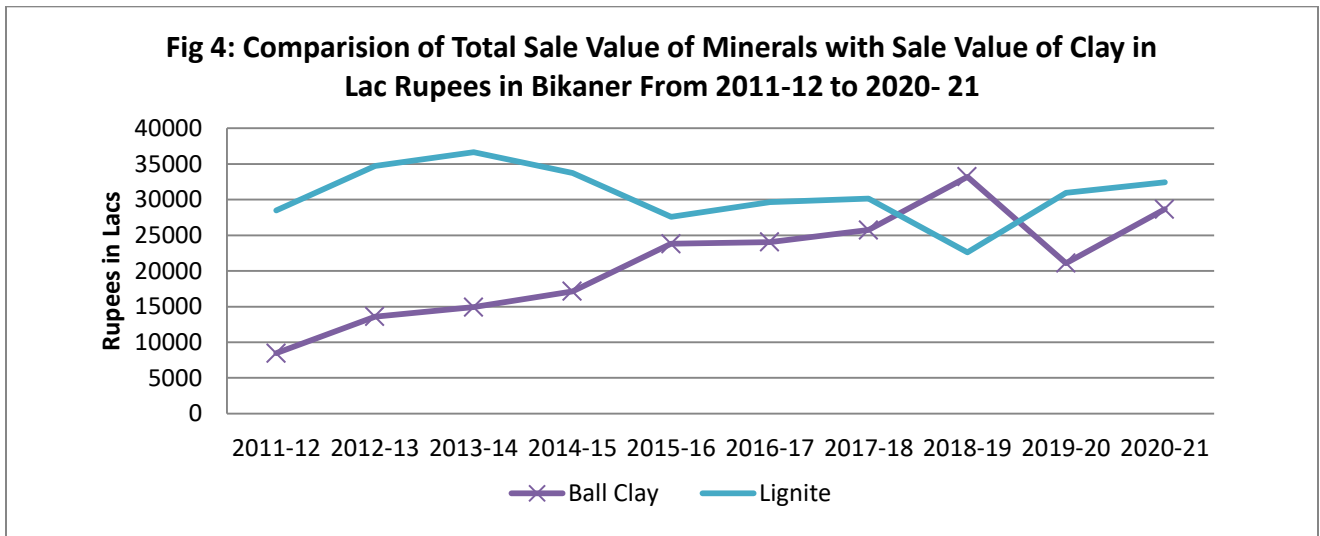


Table 5: Revenue from Clay in Bikaner in Thousand Rupees (2011-12 to 2020-21)

Mineral	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Ball Clay	53522.775	85222.83	124540.2	140544.2	206079.29	222268.81	212140.72	273216.06	334366.6	295695.2
Total	569028.9	748326.4	743980.3	800987.7	741553.38	794173.7	975052.85	956734.85	1087100	725814.5

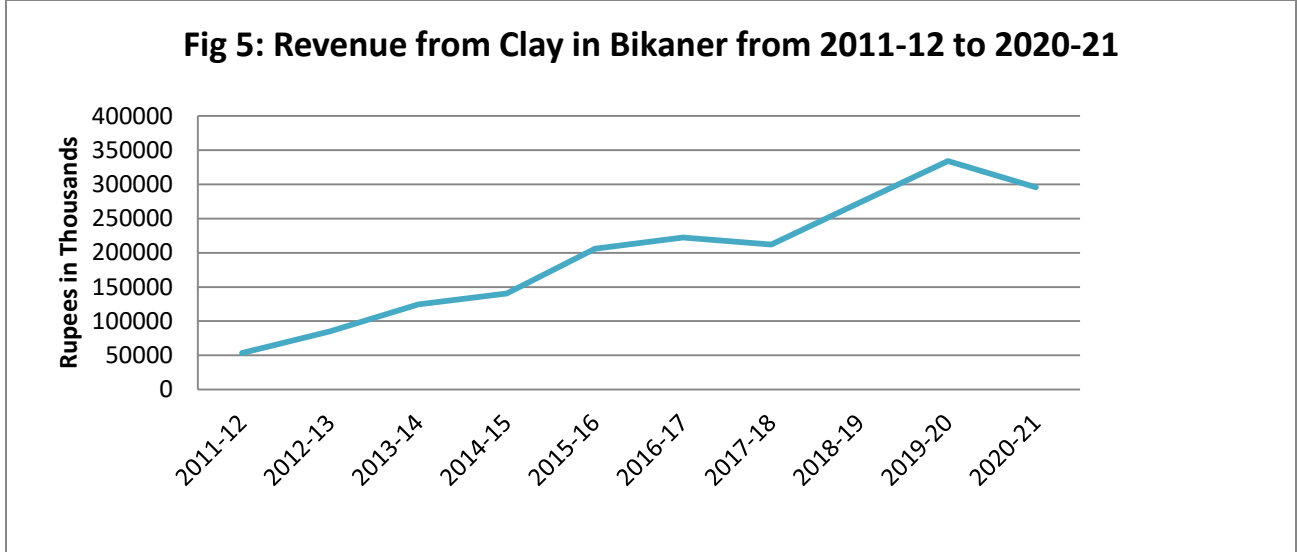
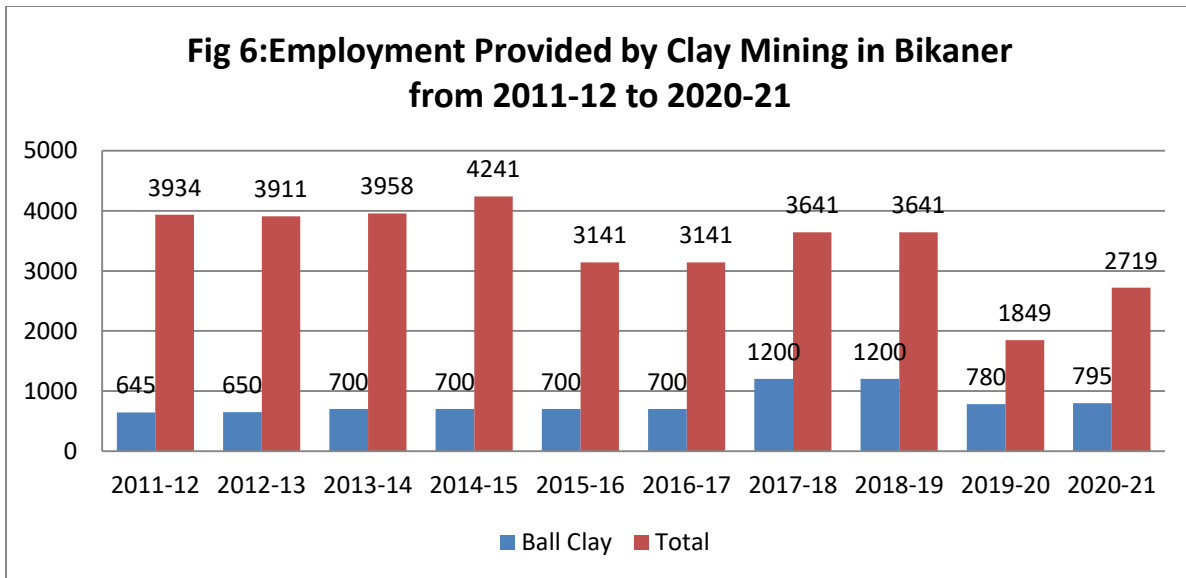


Table:6: Employment provided by Clay Mining in Bikaner (2011-12 to 2020-21)

Mineral	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Ball Clay	645	650	700	700	700	700	1200	1200	780	795
Total	3934	3911	3958	4241	3141	3141	3641	3641	1849	2719



1.2 Statistics and Time Series Analysis of Clay Mining in Bikaner

The Table 1 to Table 6 and Figure 1 to Figure 6 show the Number of leases, Mining area, Production, Revenue, Sale Value and Employment in Bikaner in Mineral Sector and their comparisons with Clay.



These Tables and Figures clearly indicate that Ball clay is the chief contributor in the above mentioned parameters in Bikaner from 2011-12 to 2020-21. The Ball Clay shifted to Minor mineral category from the year 2015-16. Data presented in Table 1 to Table 6 show that ball clay is dominant among minerals produced in Bikaner which contribute significantly in government’s revenue. Ball clay and Gypsum contributed. 63.8% of the total revenue earned by the government from various minerals.

Data of last 10 years of ball clay production proves its vitality in Bikaner. The maximum clay production comes from Bikaner. From the mineral point of view Bikaner district can be called the clay district. Out of 294 mining leases in this district in the year 2020-21, 148 are for ball clay (Table 1). Mining leases of Ball clay has been shown rising trend. Number of leases in the year 2011-12 was 89 which are 148 in the year 2020-21. Total mining area of Ball clay is increases from 5009.21 hectare in 2011-12 which is 5548 hectare in 2020-21 (Table 2.). Ball clay and gypsum constituted about 71.04 % of the mining area of Bikaner in the year 2011-12 which increases up to 76.10% in the year 2021-22. This increase in mining areas and mining leases of ball clay also reflects in production too. In 2011-12, the percentage contribution of ball clay was 10.14 % (2116.551 thousand tonnes) of the total mineral production of Bikaner (Table 3 & Fig 4). This contribution in the year 2018-19 was recorded 46.36% and 42.17% in the year 2021-22. In the year 2019-20 the production is 35.41% (3014.106 thousand tonnes). (it is the impact of Lockdown due to COVID).

However, the sale value increased more than 3 times, 8466.204lac rupees (11.5% of total sale value) in the year 2011-12 to 28661.65lac rupees in the year 2020-21 that is 40.94% of the total sale value of minerals in Bikaner. The maximum sale value was recorded in the year 2018-19, which were 33203.023lac rupees. (Table 4 and Fig 6). The share of Sale Value of Ball Clay in the year 2020-21 is 40.94%.

Revenue increases 550 % in the last 10 years from 53522.775 thousand rupees in the year 2011-12 (9.4% of total revenue) to 295695.2 thousand rupees in the year 2020-21 (40.74% of the total revenue). The trend of revenue of Ball clay was in general increasing but shows decline in the year 2013-14 and 2019-20 (Table 5 & Fig 8).

1.3 Time Series Analysis of Production, Sale Value and Revenue of Clay Mining in Bikaner

On the basis of these data regarding minerals of Bikaner, a Time Series Analysis related with Production (Table 3) Revenue (Table 4) and Sale value (Table 5) of Ball clay, has been done. Their trend values are calculated by adopting OLS technique. The results are depicted in the following table (Table 7):

Trend equation: $Y = a + bt$

Where,

a = intercept

b = coefficient of trends

t = time

Significance of coefficient is indicated by ‘t’ value as * at 5 % level.

Table 7 presents the results of least square trend equations of time series data of ten years regarding production, revenue and sale value of their concerning minerals- Gypsum, Ball clay, kankar- bajari, limestone and brick earth. ‘t’ values are marked by *, at 5% level of significance.

Table 7: Results of Time Series Analysis of Production, Revenue and Sale Value of Ball Clay Mining in Bikaner.

Minerals	Trend equation of Production	Trend equation of Revenue	Trend equation of Sale Value
Ball clay 't' value	3318.9047+190.6182t .278	194859.6811+290702.5333t 3.275*	21073.8126+2310.6207t2. 014*

*, significant at 5% level of significance.

Under mineral production, ball clay is the principal minerals found in Bikaner, and shows a high growth rate in production which is depicted by their positive value of production coefficient. The rise in production in Ball Clay is not much significant. Least square trend in revenue from clay has positive coefficient indicating the



rising trend over the time period of ten years. As far as sale value is concerned, there is a significant rise in sale value of Ball clay.

On the basis of these estimated least square equations (Table 7) trend values are calculated of and presented in Table 8 to Table 10 and their respective graphical presentation are depicted in Fig. 10 to Fig 12.

Table 8: Least Square Trend Values in Production of Ball Clay in Bikaner from 2011-12 to 2020-21
 $Y = 3318.9047 + 190.6182t$

Years	Production in Thousand Tonnes	$a+bt = Yc$
2011-12	2116.551	2461.11
2012-13	2474.187	2651.73
2013-14	3111.317	2842.35
2014-15	3118.457	3032.97
2015-16	3402.161	3223.59
2016-17	3437.288	3414.21
2017-18	3677.169	3604.83
2018-19	4743.289	3795.45
2019-20	3014.106	3986.07
2020-21	4094.522	4176.69

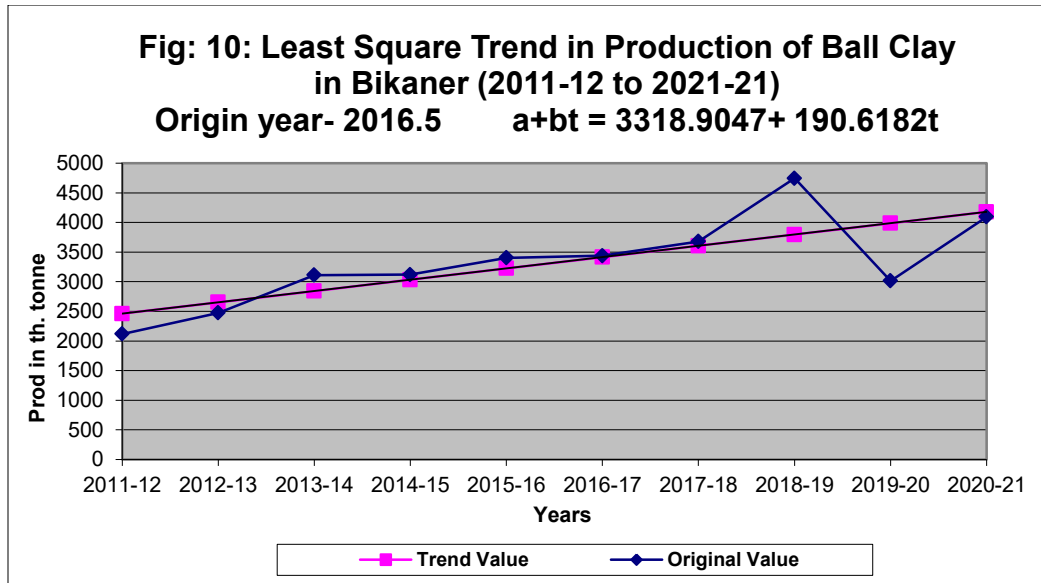


Table 9: Least Square Trend Values in Revenue of Ball Clay in Bikaner from 2011-12 to 2021-22
 $Y = 194859.6811 + 290702.5333t$

Years	Revenue in Lac Rs.	$a+bt = Yc$
2011-12	53523	61198.28125
2012-13	85222.825	90900.81455
2013-14	124540	120603.3479
2014-15	140544	150305.8812
2015-16	206079	180008.4145



2016-17	222269	209710.9478
2017-18	213140.722	239413.4811
2018-19	273216.06	269116.0144
2019-20	334366.618	298818.5477
2020-21	295695	328521.081

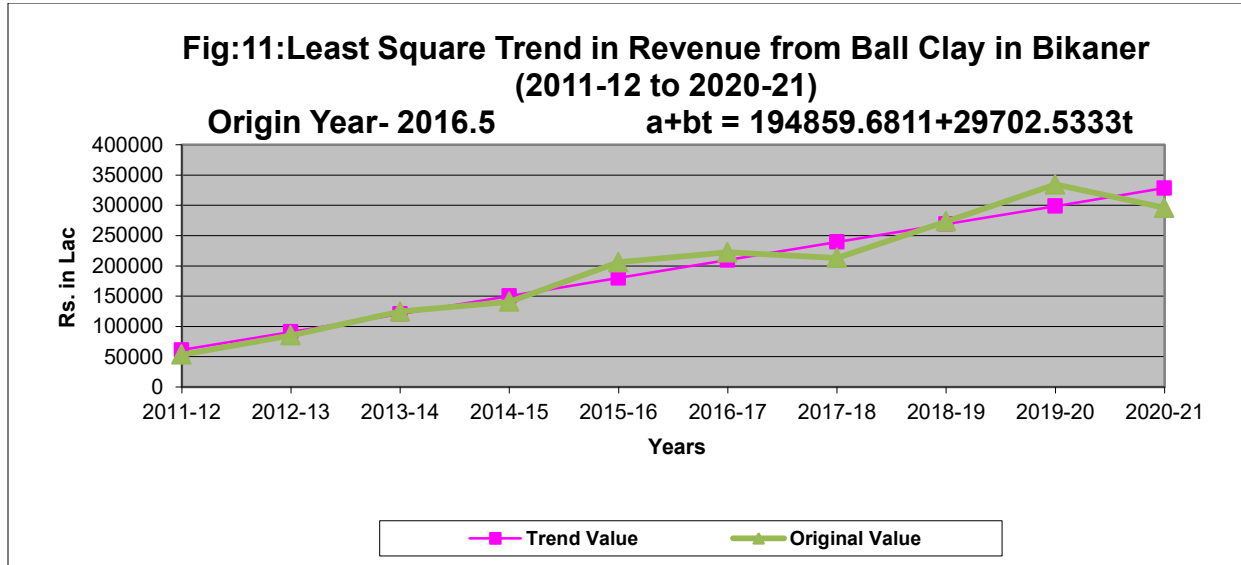


Table 10: Least Square Trend Values in Sale Value of Ball Clay in Bikaner from 2011-12 to 2020-21
 $Y = 21073.8126+2310.6207t$

Years	Sale Value	$a+bt = Yc$
2011-12	8466	11486.26905
2012-13	13608.0285	13616.87175
2013-14	14934	15747.47445
2014-15	17152	17878.07715
2015-16	23815.127	20008.67985
2016-17	24061.016	22139.28255
2017-18	25740.183	24269.88525
2018-19	33203.023	26400.48795
2019-20	21098.742	28531.09065
2020-21	28661.654	30661.69335



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