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Employment Status in Mining of Minerals in Bikaner, Rajasthan (Time Series Analysis)

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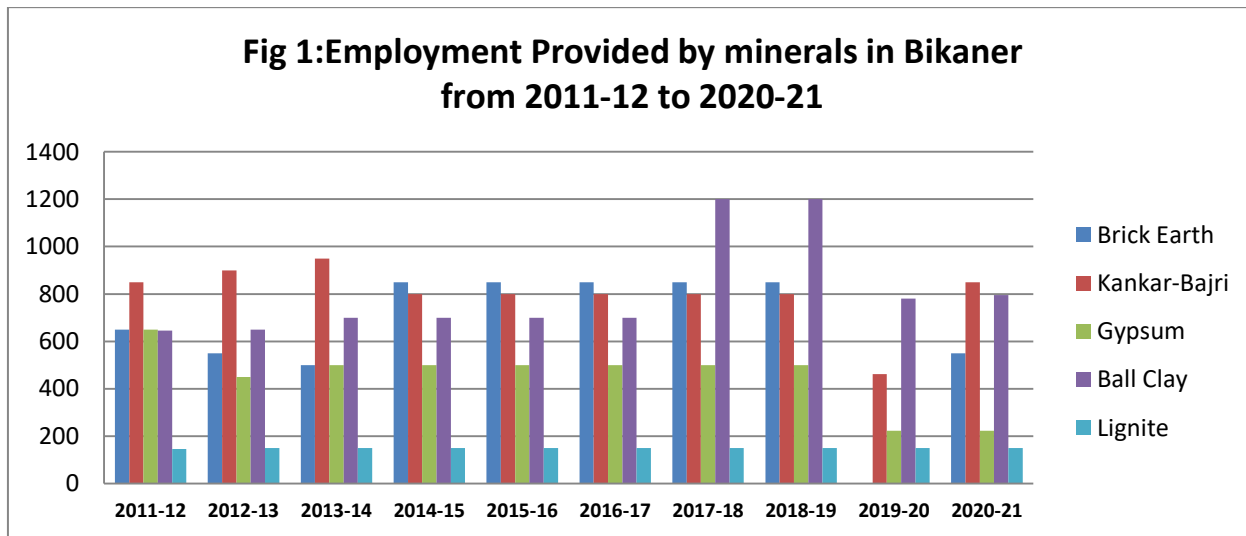
INTRODUCTION: Bikaner is located in North-Western part of Rajasthan and forms a part of the ‘the great Indian Thar desert’. Most of the areas of the district are covered with sand and sandy alluvium. It has a semi-arid climate with extreme temperature variation and scanty rain fall. Though Bikaner is deprived of the metallic mineral deposits it is bestowed with huge deposits of non-metallic minerals including Ball clay, gypsum, bajari, limestone, and lignite and masonry stones. Ball clay and gypsum are the raw material for the ceramic and POP industries. The Bikaner region is well known for their clay and Gypsum minerals. Bikaner contributes about 90% of ball clay and 80% of gypsum 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.

Employment in Mining Sector of Bikaner

Bikaner district has some very important nonmetallic mineral deposits of the state. It has vast deposits of lignite and gypsum, besides clay, fuller’s earth, Kankar, bajari and Lime stone. Majority of mines in Bikaner are unsystematic and un-organized and mine owners face the problem of labour shortage in mining areas. Also, due to upward trend in labour wages, the mine owners are unable to coordinate between the cost and demand of minerals.

In beginning of the study period the employment increased from 2011 to 2021 but after this period employment did not increase significantly in Bikaner (Table 3).

Mineral	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Brick Earth	650	550	500	850	850	850	850	850	0	550
Fuller's Earth	3	3	3	3	3	3	3	3	6	5
Kankar-Bajri	850	900	950	800	800	800	800	800	462	850
Limestone (Burning)	25	25	30	25	25	25	25	25	72	72
Masonry Stone	30	30	30	30	30	30	30	30	72	27
Sandstone	50	50	90	80	80	80	80	80	80	48
Murrum	0	0	0	0	0	0	0	0	0	0
Stone Ballast	700	900	800	900	0	0	0	0	0	0
Marble	180	200	204	200	0	0	0	0	0	0
Gypsum	650	450	500	500	500	500	500	500	222	222
Ball Clay	645	650	700	700	700	700	1200	1200	780	795
Selenite	5	3	1	3	3	3	3	3	5	0
Lignite	146	150	150	150	150	150	150	150	150	150
Total	3934	3911	3958	4241	3141	3141	3641	3641	1849	2719



Time Series Analysis of Employment Status in Mining of Minerals in Bikaner

Least square equation: $Y = a + bt$

Estimated trend equation:

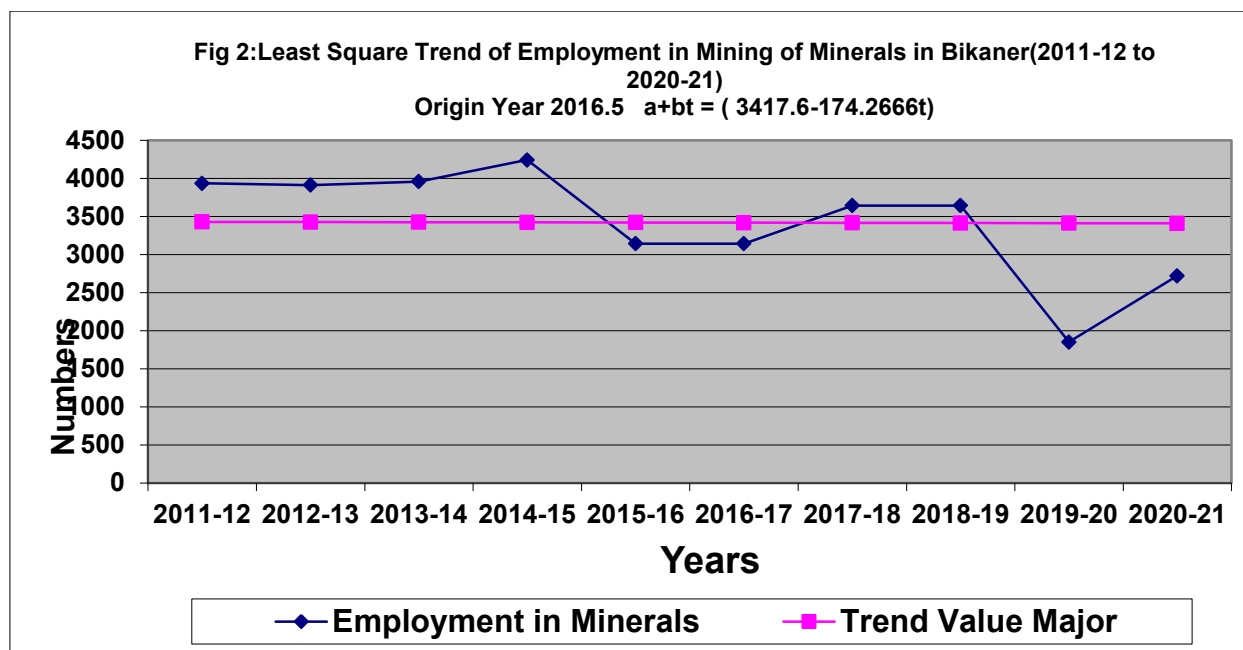
$$Y_c = 559.2 + 42.48t \text{ ----- (3)}$$

Estimated 't' value: = 1.349

(Insignificant at 5% level of significance)

In equation number (3) the coefficient of employment is positive but it is not significant as its 't' value suggests i.e. the employment is not increasing at the expected rate. On the basis of the least square equation number (3) the trend values are estimated in Table 20 and its graphical presentation is depicted in Fig. 2.

Years	Minerals	a+bt = Yc
2011-12	3934	3427.10535
2012-13	3911	3424.99305
2013-14	3958	3422.88075
2014-15	4241	3420.76845
2015-16	3141	3418.65615
2016-17	3141	3416.54385
2017-18	3641	3414.43155
2018-19	3641	3412.31925
2019-20	1849	3410.20695
2020-21	2719	3408.09465



The estimated trend values in Table 2 and Figure 2 reveal a dissatisfactory rise in minerals. Ball clay and gypsum play a key role among minerals in providing employment. The Table 2 and Figure 2 are showing a downward trend in employment. In other words, the status of employment is not increasing at the expected rate. In spite of the maximum production of ball clay and the significant production of gypsum, the rate of decrease in employment in minerals is 174.26 persons annually, which is not a good sign for the development of the mining sector.

Mineral wise Employment Status in Bikaner:

Employment in Minerals has been represented in the Table 3 during the study period. (1998-99 to 2007-08).

Table 3: Mineral wise Employment Status in Bikaner(2011-12 to 2020-21)

YEAR	Ball clay	Gypsum	Bajari	Lignite	Brick Earth
2011-12	645	650	850	146	650
2012-13	650	450	900	150	550
2013-14	700	500	950	150	500
2014-15	700	500	800	150	850
2015-16	700	500	800	150	850
2016-17	700	500	800	150	850
2017-18	1200	500	800	150	850
2018-19	1200	500	800	150	850
2019-20	780	222	462	150	0
2020-21	795	222	850	150	550
Total	8070	4544	8012	1496	6500

Source: DMG, Rajasthan

On the basis of the data given in Table 3 of the employment based on minerals found in Bikaner, Time series Analysis has been done and their trend values are calculated by Ordinary Least Square technique (OLS). The results are depicted in Table 4

Least square equation: $Y = a + bt$

Where

Y = Trend value in employment of major/minor minerals.



- a = intercept
- b = slope of the trend line/rate of change
- t = time (no. of years)

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

The results of Least Square Trend Equations of employment status of various minerals found in Bikaner are shown in Table 4 and 't' values are marked by *, at 5% level of significance. Employment trend coefficient is positive and significant only in ball clay among all considering minerals. Bajari also has a positive coefficient but it is not significant. Employment in gypsum, have negative employment coefficient. So employment status is not satisfactory in mineral sector in Bikaner.

Minerals	Least Square Trend Equations
Ball clay 't' value	$Y = 807.0 + 37.9393t$ -.908
Gypsum 't' value	$Y = 454.4 - 33.0818t$ 2.693*
Kankar-Bajari 't' value	$Y = 801.2 - 23.1272t$.516
Lignite 't' value	$Y = 149.6 + 0.2181t$ -.385
*, significant at 5% level of significance	

The least square trend values are calculated in Table 5 to Table 8. These trend values are based on the estimated equations depicted in the Table 4 and their graphical presentation are shown in Figure 3 to Figure 6.

Year	Employment	$a + bt = Y_c$
2011-12	645	434.2525
2012-13	650	420.7075
2013-14	700	407.1625
2014-15	700	393.6175
2015-16	700	380.0725
2016-17	700	366.5275
2017-18	1200	352.9825
2018-19	1200	339.4375
2019-20	780	325.8925
2020-21	795	312.3475

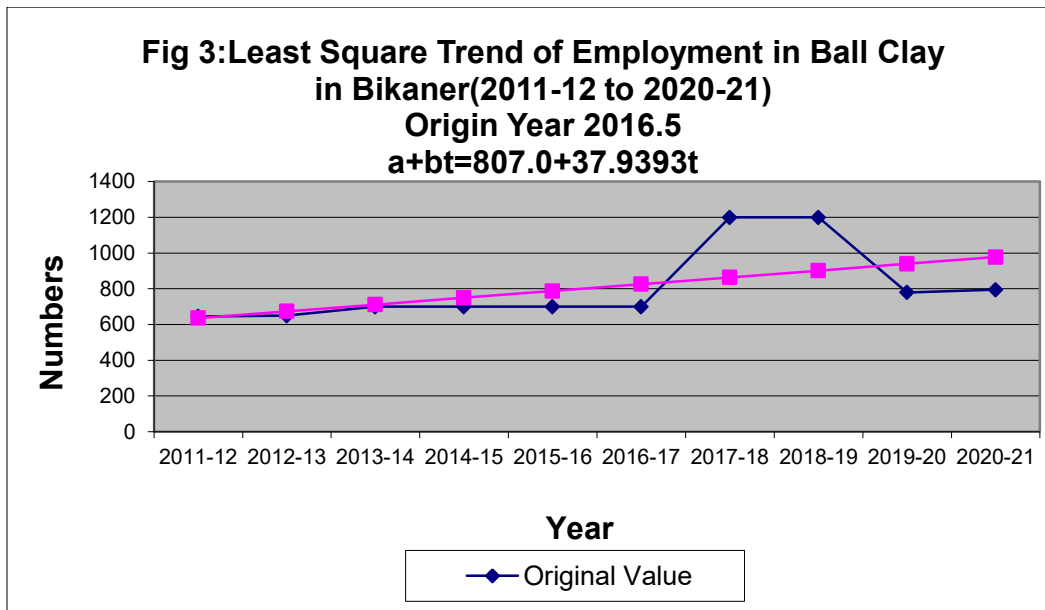


Table 6:LeastSquare Trend($Y=454.4-33.0818t$)of Employment in Gypsum in Bikaner(2011-12 to 2020-21)

Year	Employment	$a+bt = Yc$
2011-12	650	-66.235
2012-13	450	-10.205
2013-14	500	45.825
2014-15	500	101.855
2015-16	500	157.885
2016-17	500	213.915
2017-18	500	269.945
2018-19	500	325.975
2019-20	222	382.005
2020-21	222	438.035

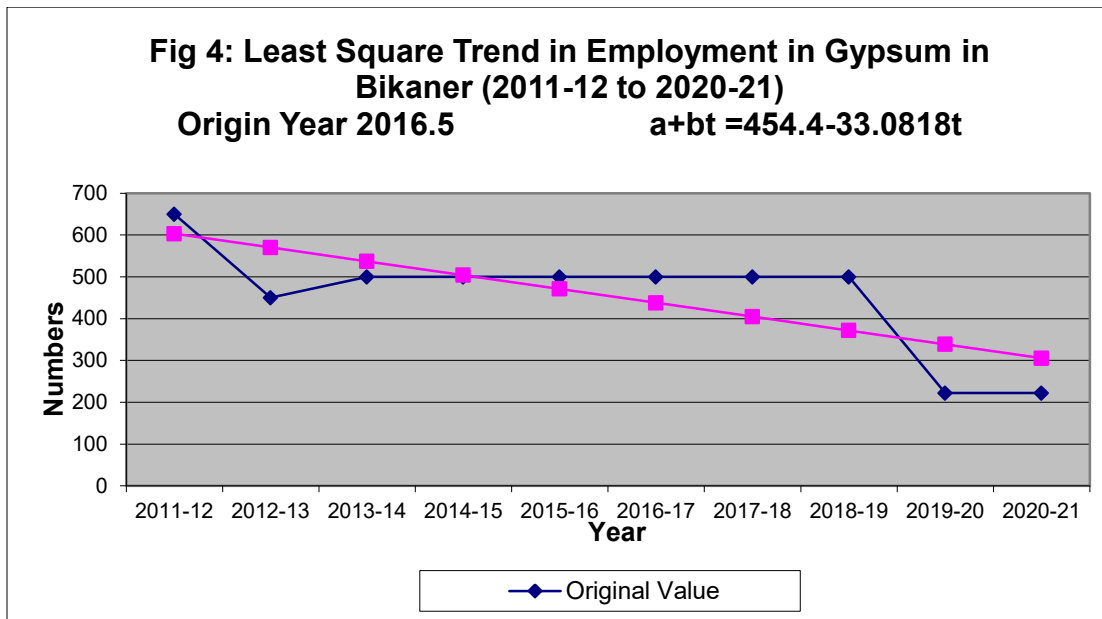


Table 7: Least Square Trend ($Y=801.2-23.1272t$) of Employment in Kankar-Bajari in Bikaner (2011-12 to 2020-21)

Year	Employment	$a+bt = Yc$
2011-12	850	1105.025
2012-13	900	1138.175
2013-14	950	1171.325
2014-15	800	1204.475
2015-16	800	1237.625
2016-17	800	1270.775
2017-18	800	1303.925
2018-19	800	1337.075
2019-20	462	1370.225
2020-21	850	1403.375

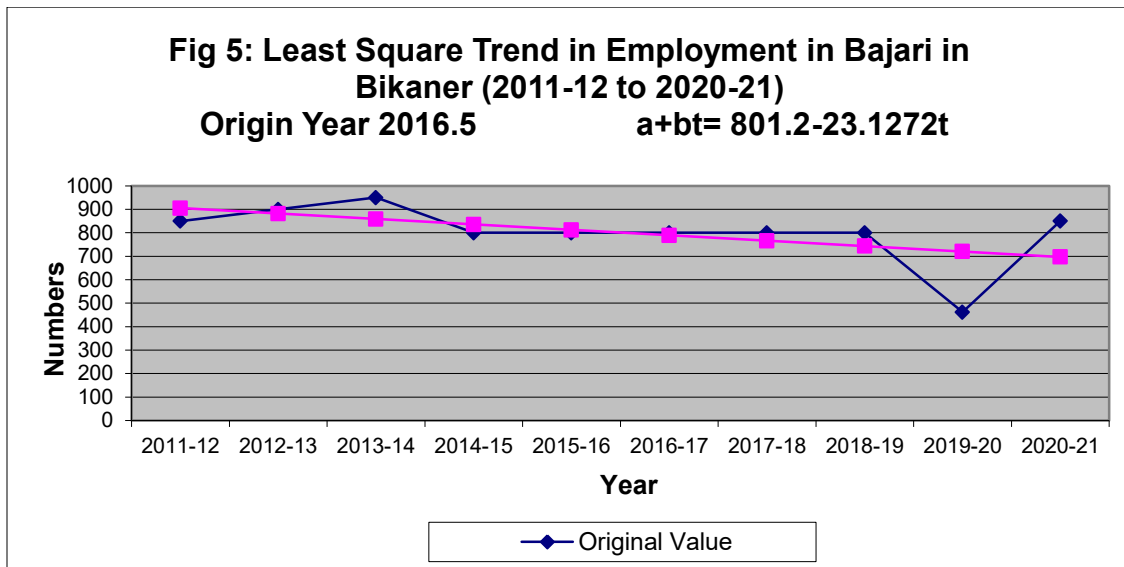
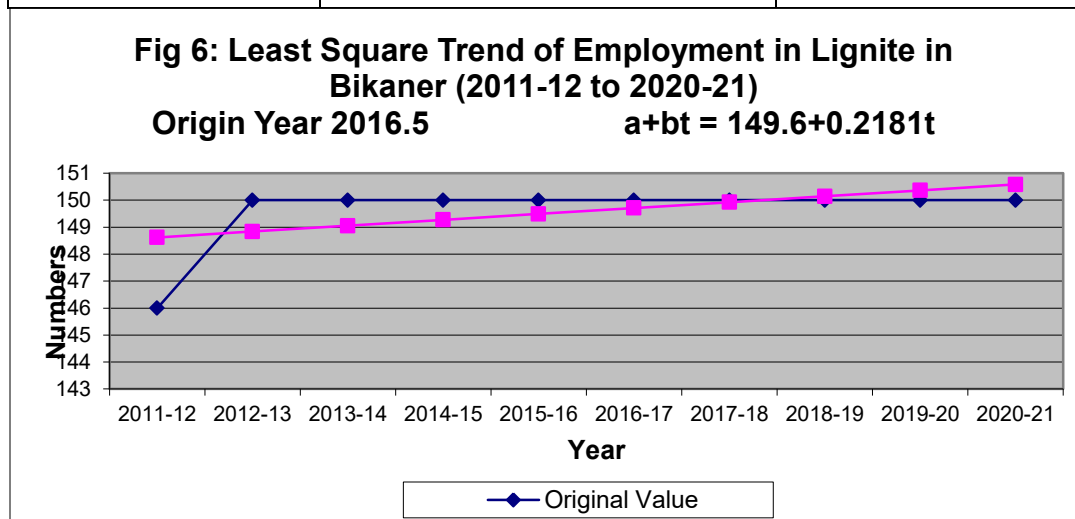


Table 8: Least Square Trend ($Y=149.6+0.2181t$) of Employment in Lignite in Bikaner (2011-12 to 2020-21)

Year	Employment	$a+bt = Yc$
2011-12	146	62.1472
2012-13	150	57.6256
2013-14	150	53.104
2014-15	150	48.5824
2015-16	150	44.0608
2016-17	150	39.5392
2017-18	150	35.0176
2018-19	150	30.496
2019-20	150	25.9744
2020-21	150	21.4528





Mineral wise, the least square trends in employment in Bikaner are estimated in tables 5 to 8. The estimated trend value of employment in ball clay is increasing at the rate of 37.93 persons annually (Table 5 and Figure 3) which is not significant looking into the scenario of maximum leases and vast clay deposits in the area. The employment in gypsum has an annual declining rate of 33.08 persons (Table 6 and Figure 4). Kankar-bajari has shown an declining trend at the rate of 23.12 persons annually (Table 7 and Figure 5).

The estimated trend value of employment in lignite is increasing at the rate of 0.218 persons (Table 8 and Fig.6). So these trend values indicate that the employment status is very poor in mining sector in Bikaner with Ball Clay being an exception. The factors responsible for the declining trend in employment of major and minor minerals are:

- Ban on bajari mining around the city due to land subsidence and environmental threat.
- Exhausting deposits of sand stone.
- The region has large deposits of lime stone but it is not of the SMS grade.
- Lack of value addition facility in ceramics in Bikaner.
- Lack of R&D facilities in major and minor minerals.
- Lack of skilled man power required by various power plants, ceramic tile industries and gypsum manufacturing board.
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