Review Article

Export - Import performance of coal in India: Trends, challenges and measures for achieving trade balance

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A B S T R A C T

Coal is considered to be the one of the major and crucial natural resources in the world and in our Indian economy. Coal serves as the raw material for generation of the electricity, for the hotel industry and for the other purposes which are highly effective in our economy. Among the coal producers in the world, India is the fourth largest producer of coal and for the requirements of domestic uses India also imports the coal from different countries. In the Indian economy the amount of coal exports has resulted to the trade deficit problems. Although the Indian coal sector has shown a dominant performance, world bank research has shown some serious issues which are faced by the coal industry. Through this paper an attempt has been made to examine the trends, challenges and measures for achieving trade balance through various methods. In accordance to that, existing literature has been gathered with the topics consisting of Coal Exports and Coal Imports to illegal mining, innovative technology and foster ways which improve the quality of coal. The primary objective of this research articles aims in finding out the reasons which focuses for the huge imports and low imports of coal with an objective to achieve trade balance. Thus the conclusion is there are very uncharted areas which can be taken up by the researchers to find the trade balance of coal. For the statistical analysis the tools like Mann Whitney U - Test and Annual Growth Rate has been used using SPSS and the results are provided accordingly.

1. Introduction

The word coal is derived from the Old English word 'col' which refers to the term mineral of fossilized Carbon, it is usually a communized black or the black sedimentary rock occurs in the rock strata and that are called as rock beds. In India coal is found in the Northern plateau and in the North - Eastern states of India. Bihar is most dense state which comprises and produces more coal in India and the mining is done throughout the year. Coal is widely used in India for various purposes and it serves as a basic raw material for an economic activity. Coal is primarily used for the producing the electricity.[1–3] The leading thermal plants in India has reported the highest consumption of coal and the energy sector has shown the highest consumption level. In India the production of Coal. In India the coal is the most demanded product for the country's energy need. At present the installed capacity of 'coal washeries' is ash and 131.24 million - tonnes per annum and it encompasses of both the coking and non - coking coal. The Coal which has been imported to other countries consisting of 10 - 15% of ash and which has been exported is consisting of 45% of ash. Coal India was exploring for export opportunity at the time when pithead coal stock was high as close to 70 Million Tonnes in May 2017. India is the world's third principal producer of coal and it produces around 565.64 million - tons coal in the year 2018 - 2019. Due to poor rail connectivity and availability of rake have been some of

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the major difficulty which led to shortage of coal during the year at 2018 - 2019 to most of the thermal power plants in India.[4–7]

During the year 2018, the coal India which is the largest coal producer hiked the coal price by 10% in January 2018. During the march 2019, the imports of coal inclined to 19.93 Metric Tonnes from 18.02 Metric Tonnes in the corresponding month of 2017 - 2018. Due to the increase in the consumption of non - coking coal, the increase in the coal and coke imports has raised to 12.9%. Thermal coal accounted for 94 per cent of India's domestic coal production, at 683 million tonnes in the same period. Imports declined for a couple of years beginning 2018 – 19, due to government efforts to boost production combined with slowing industrial production growth. Now, India relies on its imports for around its fifth thermal coal consumption. India has imported the smaller volumes of thermal coal from United States, Australia, South Africa, Columbia and Russia.

2. Objectives of the Study

1. To analyze the trend of export - import performance of coal in India.
2. To examine the volume of coal exported - imported to various countries during 2014 - 15 to 2020 - 21.

2.1. Research methodology

In this research article, researcher has used secondary data for this study. The data collected from various sources such as official portal of Coal, DGCIS and other relevant journals. This study is on the basis of theoretical framework of consolidated coal export - import policy (major statistics), ministry of coal, Government of India. In this study, Comprehensive analysis, reasons for selecting India as a hub for the export of coal to various nations.[8–12]

Sources of Information: The statistical data was collected using the secondary sources, the published and unpublished data were collected from various forms like journals, agencies and government organizations.

Statistical Tools and Techniques : In this study, some of the statistical tools like ANOVA and Mann - Whitney (U - Test) has been used for the analysis.

3. Production and Consumption of Coal in India

The production of coal for the period of 2014 - 2015 to 2018 - 2019 in India is given in the Table 1 below:

3.1. Interpretation

From the above Table 1, it is clear that the year wise production and consumption of Coal in India for the period of six years i.e. from 2014 - 2015 to 2020 - 2021. During the year 2018 - 2019 the production and consumption of

Table 1: Production and consumption of coal

Year	Production (in Tons)	Consumption (in Tons)
2014 - 15	452.62	387.54
2015 - 16	407.04	395.27
2016 - 17	430.83	400.40
2017 - 18	457.08	415.94
2018 - 19	492.76	452.22
2019 - 20	512.28	487.36
2020 - 21	524.36	508.17
CAGR	1.71%	6.95%
S.D	31.94	25.65

Source: Coal Ministry, GOI., www.ceicdata.com

coal has reported the highest values 492.76 (Tons) and 452.22 Tons respectively. There is a stagnant growth in the consumption of coal is seen during the year 2015 - 16 to 2018 - 19. The CAGR (Compound Annual Growth Rate) could be seen as 1.71% for the production of Coal, and the CAGR for the consumption of coal is 6.95%. Hence, it is reported that there is a positive trend at consumption of coal. The standard deviation for the production of coal is 31.94 and the Standard Deviation for the consumption of Coal stood at 25.65.[13]

3.2. Mann - whitney U test

For the given data in the Table 1, the below are the necessary results,

Result 1 - U-value - The U-value is 3. The critical value of U at $p < .05$ is 2. Therefore, the result is not significant at $p < .05$.

Result 2 - Z-ratio - The Z-Score is 1.88004. The p-value is .0601. The result is not significant at $p < .05.0$

The U-value is 3. The critical value of U at $p < .05$ is 2. Therefore, the result is not significant at $p < .05$. The z-score is 1.88004. The p-value is .0601. The result is not significant at $p < .05$. According the results, the consumption is increasing at the higher rate than that of the production of coal in India.

4. Export Performance of Coal

The below Table 2, represents the exports and the growth rate of Coal in India.

4.1. Interpretation

During the study period 2014 to 2021, From the above Table 2, it is represented year wise exports and growth rate of Coal in India for the period of four years. The data for the exports of coal from 2014 - 2018 has shown the year wise progress. There is no decline in the export of coal from India and there is gradual increase in the exports of Coal in India. During the year 2014 - 15 the coal exports stood at 3903.50 millions and during 2018 - 19, the coal exports has shown

Table 2: Exports and growth rate of coal in India

Year	Exports (in Millions)	Growth Rate (in %)
2014 - 15	3903.50	106.76
2015 - 16	3656.00	102.17
2016 - 17	3578.20	94.73
2017 - 18	3776.90	88.79
2018 - 19	4253.30	112.63
2019 - 20	4625.20	116.32
2020 - 21	4821.33	119.54
CAGR	-68.92	-58.66
S.D	488.37	11.35

Source: Statistics, Production and Supplies, Ministry of Coal, GOI.

tremendous increase to 4253.30 millions.

The Growth rate of the coal exports has reported at least percentile during 2014 - 15 at 106.76%, and during 2018 - 19 at the highest percentile at 112.63. The exports growth percentage has not shown a stagnant increase for the consequent number of years, and there is a fluctuation in the growth rate of the Coal. The Standard Deviation stood at 488.37 and 11.35, where as the annual growth rate stood at -68.92% and -58.66 which reveals that there is a pessimistic growth rate of coal in India.

4.2. Linear regression

The statistical method (*Linear Regression*) has been applied in this paper to come-up with better results and it is derived below:-

Sum of X = 19167.90
Sum of Y = 505.08
Mean X = 3833.58
Mean Y = 101.016
Sum of squares (SSX) = 281019.908
Sum of products (SP) = 7369.6096
Regression Equation = $\hat{y} = bX + a$
$b = SP/SSX = 7369.61/281019.91 = 0.02622$
$a = MY - bMX = 101.02 - (0.03*3833.58) = 0.48224$
$\hat{y} = 0.02622X + 0.48224$

5. Country- Wise Export Performance of Coal

The below Table 3 represents the Export performance of Coal country-wise. During the Study period 2014 - 2021, the export data for the coal has been taken for the analysis. The CAGR and the Standard Deviation has been used for the analysis of data for the study.

During the study period 2014 - 2021, the export performance of coal has been analyzed with respect to various destinations across the world. During the year 2014 - 15, Australia has shown the export performance of 6.92 Tonnes and Columbia has shown the lowest export performance of 0.012 Tonnes. The Standard Deviation is 2.32. During the year 2015 - 2016, the highest export

performance was shown by Australia i.e. 7.84 Tonnes and the lowest level of export was done by Finland 0.01 Tonnes. The standard deviation could be seen at 2.57. During the year 2016 - 2017.

6. Import Performance of Coal

The below Table 4 represents the Imports and the growth rate of Coal in India.

6.1. Interpretatio

During the study period 2014 - 2021, the imports of the coal in India stood at 235.24 (millions) and the growth rate was seen at the highest at 112.94 %. The CAGR of imports of Coal stood at 1.56% and the Standard Deviation was at 16.53 and the standard deviation of growth rate stood at 7.28. During the period of study 2014 - 2021, the imports and growth rate of the coal has shown the fluctuating values.

7. Two sets of Null Hypothesis

Set-1: H_0: There is no significant difference in the value of imports made by India for the coal during the study period i.e. from 2014 - 2015 to 2020 - 2021.

Set-2: H_1: There is no significant difference in the value of the import of coal and its growth rate during the different years from 2014 - 2015 to 2020 - 2021.

8. Result

Set-1: H_0: The critical value of 'F' at the 5% level of significance (2.1641) is less than the calculated value of 'F'(13.497), hence the null hypothesis is rejected. Therefore there is a significant difference in the value of the import of coal in India.

Set-2: H_1: The calculated value of 'F' at the 5% level of significance (0.9463) is less than the critical value of 'F' (2.3806), Thus the null hypothesis is accepted and there is no significant difference in the value of imports of coal in India years from 2014-15 to 2020-21.

9. Country Wise Import Performance of Coal

The below Table 6 represents the Country - wise import performance of Coal in India. The data for the consequent number of years have been analyzed in the below table.

During the study period 2014 - 2019, the country wise import performance of coal has been seen at the highest during 2018 - 2019 from Australia i.e. 9.30 Tonnes. During 2016 - 2017 India imported 8.69 Tonnes of coal from Australia. During 2015 - 2016 India has imported minimal level of coal from Finland i.e. 0.01 Ton and from Vietnam during 0.03 Ton. The Standard Deviation has shown highest during 2018 - 2019 i.e. 3.10 Ton. The lowest level of import was done by Finland 0.01 Tonnes. The standard deviation stood at 2.57. During the year 2016 - 2017. The standard

Table 3: Export performance of coal country– Wise (in Tonnes)

Year Countries	2014 -15	2015 - 16	2016 - 17	2017 - 18	2018 - 19	2019-20	2020-21
Australia	6.94	7.84	8.69	8.77	9.30	10.25	11.25
Indonesia	4.84	5.37	5.74	5.84	6.90	7.36	9.25
South Africa	2.47	2.12	2.35	2.88	3.00	2.87	3.11
US	2.33	1.58	1.74	1.98	2.10	2.22	2.89
Canada	1.87	0.47	0.56	0.74	0.86	0.89	0.89
Mozambique	1.62	0.65	0.71	0.82	0.81	0.84	0.84
Russia	1.61	0.32	0.41	0.52	0.59	0.63	0.63
Singapore	1.23	0.34	0.48	0.51	0.52	0.56	0.56
Colombia	1.11	0.027	0.038	0.04	0.05	0.04	0.04
Vietnam	0.87	0.019	0.021	0.03	0.04	0.05	0.05
Finland	0.67	0.01	0.02	0.023	0.04	0.06	0.06
S.D	1.91	2.57	2.81	2.84	3.10	3.16	3.27

Source: Computed, DGCIS.

Table 4: Imports and growth rate of coal in India

Years	Imports (in Million s)	Growth Rate (in %)
2014 - 15	217.78	106.78
2015 - 16	203.95	106.89
2016 - 17	190.95	93.62
2017 - 18	208.27	109.07
2018 - 19	235.24	112.94
2019 - 20	247.32	118.54
2020 - 21	283.21	120.22
CAGR	1.56	1.13
S.D	16.53	7.28

Source: Statistics, production and supplies, ministry of coal, GOI.

Table 5: ANOVA - average stage length

	Sum of Square	Degrees of freedom	Mean Square	F-Ratio	P-value	F crit
Between column	33247	3	10812	13.497	5.2801	2.1641
Within Row	9648	2	20444	0.9463	0.0412	2.3806
Residual	19856	11				
Total	62751	16				

Sources: Computed using SPSS * Significant at the 5 % level

Table 6: Country - wise import performance of coal (in Tons)

Year Countries	2014 -2015	2015 - 2016	2016 - 2017	2017 - 2018	2018 - 2019	2019-2020	2020-2021
Australia	6.94	7.84	8.69	8.77	9.30	8.66	9.30
Indonesia	4.84	5.37	5.74	5.84	6.90	5.45	6.90
South Africa	2.47	2.12	2.35	2.88	3.00	2.52	3.00
US	2.33	1.58	1.74	1.98	2.10	1.68	2.10
Canada	1.87	0.47	0.56	0.74	0.86	0.67	0.86
Mozambique	1.62	0.65	0.71	0.82	0.81	0.74	0.81
Russia	1.61	0.32	0.41	0.52	0.59	0.42	0.59
Singapore	1.23	0.34	0.48	0.51	0.52	0.31	0.52
Colombia	1.11	0.027	0.038	0.04	0.05	0.02	0.05
Vietnam	0.87	0.019	0.021	0.03	0.04	0.01	0.04
Finland	0.67	0.01	0.02	0.023	0.04	0.021	0.04
S.D	1.91	2.57	2.81	2.84	3.10	2.77	3.10

Source: Coal Statistics, Computed.

deviation was at the highest during 2018 - 2019 i.e. 3.10. From this it could be analyzed that during 2018 - 2019 maximum import has been taken place. The imports of coal from Russia during the study period 2014 - 2019 is seen fluctuating.

10. Challenges and Measures for the Export & Import of Coal

1. The financial performance of coal industry is increasingly affected by rising costs and due to longer delays in the logistics and that is because increase in the demand due to passenger traffic and other essential commodities.
2. The export coal if it is done through rail transport, a distance of 200 - 300 km and the cost that is incurred also makes a big deal for the exporters.

11. Conclusion

In this research paper an effort has been made to examine the developments and difficulties in India's foreign coal trade. With an emphasis on cleaner coal technology, the literature on the global trade of coal has been analyzed by separating out existing studies on various factors. In conclusion, it can noted that because it has so many still-unexplored or underexplored elements, the field of international commerce of Indian coal presents excellent opportunities for future research. Owing to massive imports of coal and rising consumption, it is crucial to comprehend and analyze the most recent developments in the global trade of coal and identify strategies to decrease coal imports into India while also increasing coal exports so that we can achieve self-sufficiency.

12. Source of Funding

None.

13. Conflict of Interest

None.

References

1. Available from: Https://economictimes.indiatimes.com/news/economy/foreign-trade/indias-coal-import-.
2. Available from: https://iced.niti.gov.in/energy/fuel-sources/coal/import.
3. Available from: https://www.livemint.com/budget/news/what-the-union-budget-can-do-to-re-energize-india-sstagnant-exports-11580151799789.html.
4. 2020. Available from: https://www.india.gov.in/spotlight/union-budget-.
5. William C, Wnuk K, Watson D. The Potential for India in the World Coal Export Market. *J Ener Develop*. 1997;22(1):45–65.
6. Kashif MD, Ansari S. International Trade of Coal In India: Trends, Challenges And Measures For Achieving Trade Balance. *Int J Res Granthlayah*. 2016;4(1):189–97.
7. Cornot-Gandolphe S. Indian steam coal imports: the great equation; 2016.
8. Chandra A, Chandra H. Impact of Indian and imported coal on Indian thermal power plants. *J Sci Indus Res*. 2004;63(2):156–62.
9. Sharma K. Factors determining India's export performance. *J Asian Econ*. 2003;14(3):135–446.
10. Dhinakaran DP, Kesavan N. Exports and Imports Stagnation in India During Covid-19- A Review. *GIS Business*. 2020;15(4):1158–62.
11. Kant R. Promoting Efficiency in Power Generation in India: The Role of Imported Coal-Based Plants, ORF, Issue - 568; 2022. Available from: https://www.orfonline.org/research/promoting-efficiency-in-power-generation-in-india-the-role-of-imported-coal-based-plants#:~:text=Reviving%20imported%2Dcoal%2Dbased%20plants,sectors%20will%20mitigate%20the%20pressure..
12. Tendulkar S. Indian Export And Economic Growth Performance In Asian Perspective, Indian Council For Research On International Economic Relations.
13. Bhavani TA, Suresh D. Determinants of firm-level export performance: a case study of Indian textile garments and apparel industry. *The J Int Trade Econ Develop*. 2000;10(1):65–92.

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