EVALUATION OF PRODUCTIVITY OF GONDEGAON OPEN CAST MINE

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Abstract— **This paper looks at the Comprehensive Production of Gondegaon Open cast Mines in detail to develop a better understanding of the factors that contribute to long-term productivity growth; and to assess the impacts of the movement on mining production and other developments in the economy as a whole and the growth of living standards.**

Product measurement challenges in mines differ in many important ways from those in other sectors. Understanding the nature of mining, and especially the type of investment, is one key to understanding the factors that determine mining 'profile' productivity.

I. INTRODUCTION

The coal mining industry has long been an important and fundamental sector leading to the growth and stability of the Indian economy. In order to continue that tradition and meet the huge demand for energy, the country has embarked on a rapid growth in the sector.

The state-owned company Coal India Limited has grown to become the world's largest coal producer, and has continued to use new technological advances in its mining operations to improve its production.

Such improvements include the use of open mining equipment, new mining concepts, satellite surveillance and awareness of the quality of coal produced. The company has sought and adopted the best mining methods that have had a positive impact on its production and production as well.

In order to maintain global competitiveness over coal prices, modern mining methods will be used to reduce mining costs and increase "PRODUCTIVITY", a further way to improve the profitability of Indian coal mining projects.

II. METHEDOLOGY FOR PRODUCTION AND PRODUCTIVITY CALCULATION OF GONDEGAON MINE

A. PRODUCTION :

Economics is about producing and distributing wealth. Production is any process or process designed to transform a set of inputs such as men, goods, money (money), Knowledge and power into a Specified set of outputs such as finished

Production & Dispatch of Gondegaon Mine			
Years	**Coal (Te)**	**OBR (M³)**	**Coal Despatch (Te)**
2010-2011	1403610	5018116	1323081.55
2011-2012	1521042	3508852	1153317.80
2012-2013	1708009	4501930	1516980.17
2013-2014	1822016	5411077	2161462.01
2014-2015	1859137	5886621	2240609.86
2015-2016	2129304	4254284	2124576.45
2016-2017	2153354	5105904	1935267.90
2017-2018	3163883	11672509	2755114.76
2018-2019	3499786	12218312	4023530.60
2019-2020	3500000	12526182	3533475.96
2020-2021	3500000	9714920	3392003.31

goods, fair value and Quality, thus achieving the objectives of the organization. the products produced must be produced in a sustainable manner due to its significant impact on the economy, environment and society.However, due to the many different sides involved and their often conflicting motives, this is often not the case. This paper is a review of the literature describing the drivers of the transition to sustainable production with different perspectives on current literature analysis.

B. PODUCTIVITY :

Productivity is the ratio between output and input. Output means the amount produced or the amount of goods produced and the inputs are the various resources used, eg, land and building, equipment and machinery, material work, money etc.

To calculate total production growth, a non-parametric index numerical method is used in India's coal sector. Efforts to calculate production growth began in the 1980s in India. This analysis helps the entire coal sector to compare and achieve growth and smaller investments

Formulas for productivity calculation

$$\text{Total Productivity Index} = \frac{\text{Product} + \text{Service}}{\text{Labour} + \text{Material} + \text{Energy} + \text{Capital}}$$

$$\text{Labour Productivity Index} = \frac{\text{Labour hours used in measured period}}{\text{Labour hours used in base period}}$$

$$\text{Machine Productivity Index} = \frac{\text{Total Output}}{\text{Machine hours used}}$$

$$\text{Capital Productivity Index} = \frac{\text{Total Output}}{\text{Total Capital Used}}$$

$$\text{Raw Material Productivity Index} = \frac{\text{Total Output}}{\text{Total Raw material Used}}$$

$$\text{Direct Labour Cost Productivity Index} = \frac{\text{Total Output}}{\text{Total Direct Labour Cost}}$$

III. GENERAL INFORMATION ABOUT GONDEGAON MINE

Gondegaon Open Cast Mine is situated in Nagpur District of Maharashtra State. The mine is at a distance of about 32 K.M from Nagpur and National Highway No 7, linking Nagpur and Jabalpur, passes about 4 Km East of the Mine.The nearest Railway Station is Kanhan Junction of South Eastern Railway on the Mumbai -Howrah Main Line located about 9Km from the Mine.Koradi Thermal Power Station is located at an aerial distance of about 10 KM from this block.

The coal bearing strata are over-lapped by capped formation (24m to 30m) which is overlain by black cotton soil of average thickness of 20m – 28m. Five coal seams which are characteristic of the KampteeCoalfields are present in the Gondegaon block also. The seams are numbered from bottom to top. The bottom most is Seam-I and Top most is Seam-V. Seam-I with thickness of 0.90 m occurs about 10m below the Seam-II and is unworkable. The general strike of the formation is NW-SE from one end of the block to the other. Dip is generally towards South West with dip angle varying from 11° to 15°.

GEO-MINING PARAMETERS OF MINE :

1. Area of Quarry : a) 277.13 HA on surface

 b) 182.78HA on floor

2. Minimum Depth : 35 m

3. Maximum Depth : 176 m

4. Gradient of Seam : 1 in 3.5 to 1 in 5.

5. Maximum width : a) 1010m.on surface

 b) 750m on floor

6. Net Mineable (1.04.2017) : 24.947 Million Te.

7. Average stripping ratio : 1:4.483M3/Te

8. Balance Life of Project(as on 1.04.21) : 5 Year

A. TARGET PRODUCTION OF MINE :

Target	2021-22	Achivedupto june21
Coal	35L.Te	7.29L.Te
OB	97L.Te	12.66L.Te

IV. ANALYSIS AND CALCULATION

A. PERFORMANCE AT GLANCE :

Item	2019-20	2020-21
Total output [coal+OB]	6608090	5627110
Avaibility of Machine Hrs	311598	292336
Machine working Hrs	89140	87142
Direct labourHrs	138131	130752
Direct labour cost (Rs)	1022601928	756002228.5
Explosive cost (Rs)	213110902.5	163973985.4
Energy used (Kw)	1743810	2540041
Raw Material used	4166334664	3057771574
Total daily rated wages (Rs/T)	154.75	134.35
Diesel cost (Rs/T)	255.04	215.61
Explosive cost (Rs/T)	32.25	29.14
Total spare & store cost (Rs/T)	343.20	298.65
Total cost (Rs/T)	2352	1191

B. COMPARISON OF PRODUCTIVITY INDEX :

Productivity Index	2019-20	2020-21
Machine Hours Availability index	21.17	19.37
Total machine working hour	74.60	64.99
Labour Productivity Index	47.7526	64.99
Direct Labour Cost Productivity Index	6.45×10^{-3}	7.49×10^{-3}
Explosive Productivity Index	0.0309	0.0345
Diesel Productivity Index	3.91×10^{-3}	4.66×10^{-3}
Energy Productivity Index	3.78	2.22
Raw Material Productivity Index	1.58×10^{-3}	1.85×10^{-3}
Total Cost Productivity Index	7.94×10^{-5}	1.32×10^{-3}

C. PRODUCTIVITY INDEX W.R.T. PREVIOUS YEAR :

1) MACHINE PRODUCTIVITY INDEX for year 2020-21 w.r.t. year 2019-20.

    Total M/c hours availability index

$$= \frac{7022614/362496}{6352064/300068} \times 100$$

$$= 91.52\,\%$$

Total M/c working hour's productivity index

$$= \frac{7022614/108056}{6352064/85140} \times 100$$

$$= 87.11\%$$

2) LABOUR PRODUCTIVITY INDEX for year 2020-21 w.r.t. year 2019-20.

$$= \frac{7022614/162132}{6352064/133020} \times 100$$

$$= 90.70\%$$

3) DIRECT LABOUR COST PRODUCTIVITY INDEX for year 2020-21 w.r.t. year 2019-20.

$$= \frac{7022614/937442763}{6352064/984765657} \times 100$$

$$= 116.14\,\%$$

4) EXPLOSIVE PRODUCTIVITY INDEX for year 2020-21 w.r.t. year 2019-20.

$$= \frac{7022614/203327742}{6352064/205225799} \times 100$$

$$= 111.58\,\%$$

5) DIESEL PRODUCTIVITY INDEX for year 2020-21 w.r.t. year 2019-20.

$$= \frac{7022614/1504443871}{6352064/1622970164} \times 100$$

$$= \quad 119.26 \ \%$$

6) ENERGY PRODUCTIVITY INDEX for year 2020-21 w.r.t. year 2019-20.

$$= \frac{7022614/3149650}{6352064/1679289} \times 100$$

$$= \quad 58.94 \ \%$$

7) RAW MATERIAL INDEX for year 2020-21 w.r.t. year 2019-20.

It includes, explosive + detonator + diesel + lubricants + total spares & stores.

$$= \frac{7022614/3791636756}{6352064/4012180282} \times 100$$

$$= \quad 116.98 \ \%$$

8) TOTAL COST PRODUCTIVITY INDEX for year 2020-21 w.r.t. year 2019-20.

$$= \frac{7022614/5.3 \times 10^{10}}{6352064/8.32 \times 10^{10}} \times 100$$

$$= \quad 173.55 \ \%$$

V. SCOPE FOR THE PRODUCTIVITY IMPROVEMENT

Calculated data shows that the total cost productivity index in the year of 2020-21 is increased by 66.24 % in comparison to the year of 2019-20.

• Reasons for increase in Total Cost Productivity Index are as under.

1. The Total Cost per tonne of output in the base year 2019-20 was Rs 2352 per tonne in comparison to Rs 1191 per tonne for the year 2020-21 resulting in improvement of Total cost productivity index for 2020-21 in comparison with the base year 2019-20 under consideration.
2. Using of high capacity equipment.
3. Arranging the training programs and giving proper information about new techniques and safety to the workers.
4. A proper inventory control system adopted.

5. Increasing the working efficiency of the workers &equipmentsby providing dust free atmosphere & maintenance respectively.
6. Improving Human relations
7. By providing the social & welfare facilities to boost the morale of miners.
8. By proper design of blast resulting in less consumption of explosives there by achieving good performance of the loading & excavating machines.
9. Increase in the quality of coal.
10. Timely maintenance of the equipments and availability of the spare parts.
11. Due to up throw of the fault less amount of over burden is to be extracted out.
12. Proper planning for avoiding the spontaneous heating when the coal is in the stock yard.

VI. CONCLUSION

Productivity is the average measure. Producing an output rate of what is needed to produce (revenue, labor, land, energy, building materials, etc.). Production rate is defined as the total output per unit of total input. We see that as a production measure it is often difficult to define it properly. The term productivity index which is used in this project is basically a concept to measure performance of any system (here Gondegaon o/c mines in our case) with the base year (here 2019-20). Productivity index is a relative parameter which provides basis for comparison of performance. The total cost Productivity index as seen from calculations have

shown remarkable improvement with the base year for the reasons mentioned below,

i. Both loading as well as transportation capacity as shown improvement over the base year.

ii. In the current year under consideration workings was mainly concentrated in up-throw fault area, thereby reducing the overall o/b to be removed and improving production.

iii. Since new loading and transportation systems were installed, maintenance cost was reduced.

iv. Total cost of mining coal per tonne was reduced by Rs.1161 in the current year (i.e.2021)

VII. LIMITATIONS OF THE STUDY

There are the some limitations of the study of the production & Productivity of the GONDEGAON Open Cast mine are as follows.

➢ The deflation factor for the year 2020-21 is not considered while calculating the productivity index.

➢ Some productivity index has not been calculated due to non-availability of the data like depreciation.

➢ All comparisons are made by taking 2019-20 as a base year.

➢ Strict comparison between two years i.e. 2019-20 & 2020-21 is not possible as every year. Because the target for over burden removal and annual production is dynamic.

➢ Changes in mining conditions (planned & unplanned) are not considered.

It is recommended to check any incident or anywhere only after describing the business, something under review is part of it. Therefore, Manufacturing cannot be evaluated as an independent entity but is required to identify the business part of it. Such a business is defined as the Production process and its ability to generate revenue.

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