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*Labour Productivity
In Coal Mining Sector
In India: With Special
To Major Coal Mining
States*

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Abstract

Coal is one of the Primary sources of Energy accounting for about 67% of total energy consumption in India. The production of Coal has increased from 35 million tons in 1951 to 409.3 million tons in 2004. At the same time, the Average Daily Employment (ADE) has increased from 352 thousand in 1951 to 405 thousand in 2004. However, the journey of Coal sector was not uniform throughout the five decades. It is shown in recent time that the productivity of labour in coal mines in Tamil Nadu and Orissa is very high in comparison with other major coal producing states, like, West Bengal and Jharkhand. However, the coal mining in Tamil Nadu and Orissa is mostly and increasingly depends on Open-cast mining. The paper is wanted to show that the labour productivity in coal mine are the boom in productivity in Orissa and Tamil Nadu is only due to the weighted average of different types of productivities. But, the coals at open-cast and below ground are not same. They are different in quality. So, we simply cannot add (although we are taking the weighted average) the two different quality things. That is why we are getting the problem of Addition.

Keywords: Coal, Productivity of Labour, Average Daily Employment (ADE), Open-cast Mining, Inter-states comparison, India

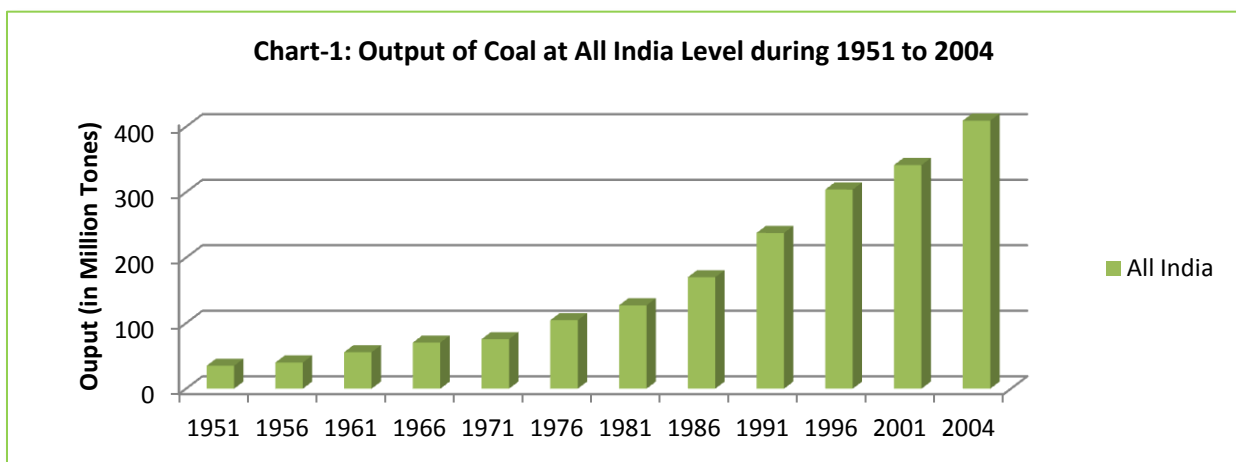
1. Introduction

Coal is one of the Primary sources of Energy accounting for about 67% of total energy consumption in India. Although the share of labour force engaged in Coal sector is small (0.7% in 1999-00) and it is remain stagnant since 1951, but the absolute number is not negligible, it is 405000 (Average Daily Employment) in 2001. The production of Coal has increased from 35 million tons in 1951 to 409.3 million tons in 2004 (*"Statistics of Mines in India" vol.-I (coal) of different years*). At the same time, the Average Daily Employment (ADE) has increased from 352 thousand in 1951 to 405 thousand in 2004. However, the journey of Coal sector was not uniform throughout the five decades.

1.1. Production Of Coal In India

The Production of coal in different year in India is shown in Table no.-1. In 1951, coal production was 35 million tones. It increased moderately until 1971 (75.6 million tons). After that, the production has increased steadily. It is 409.3 million tons in 2004.

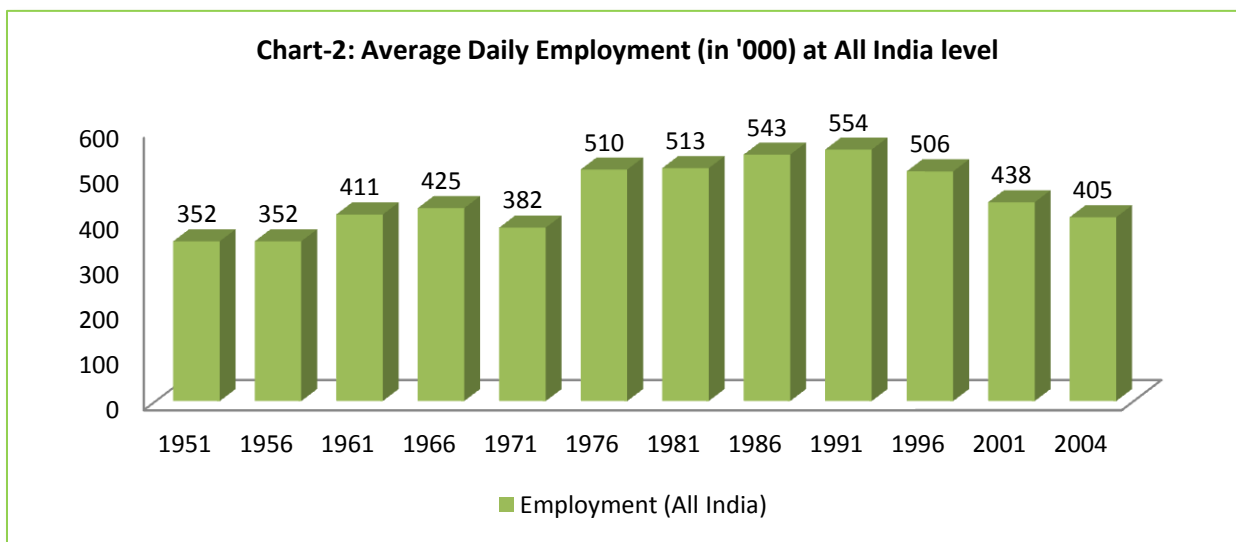
The increasing trend of production of Coal in India (i.e. the All India level) since 1951 can also be visualized easily through the figure given below.



1.2. Employment In Coal Sector In India

Employment is measured in term of “Average Daily Employment”. This terminology is used in ‘Statistics of Mines in India’ by Directorate-General of Mines Safety, Ministry of Labour and Employment, Govt. of India. Average Daily Employment (ADE) of a mine is the ratio of total number of Manshift worked to the total no. of working days during the year. Average Daily Employment of a State is the sum total of the same of all mines belonging to that State.

The Table-2 below is showing the Trend in Average Daily Employment (ADE) in Coal Sector in India since 1951. The Chart-2 is also showing the same things. In 1951, employment in coal sector was 352 Thousand ADE and it increased until 1971. In 1966 it was 425 Thousand ADE. The figure came down to 382 Thousand ADE in 1971. It may be due to political crisis and labour movement in 1971, mainly in West Bengal and Jharkhand. After that employment is increased upto 1991 when the figure of ADE was at its maximum level at 554 Thousand ADE. Since 1991 the trend of figure is falling. It came down to 405 Thousand ADE in 2004.



If we look at the yearly growth rate of employment (ADE) in Table-2 above, we see that the growth rates are mixed in nature. We can easily see from Table-2, that the growth rates of ADE over the year. It was positive during 1956-61, and then started to fall. In fact during 1966-71 the growth rate was negative. After that it reached its highest level at 6.7% during 1971-76. After that it declined drastically until 1981. In addition, after 1991 the Average annual growth rate of ADE is still falling and became negative growth.

2. Research Questions

- Why does the Trend in Labour Employment decrease after 1991?
- What is the All India Trend in Labour Productivity in Coal Mining Sector?
- What is the Scenario of Labour Productivity in Coal Mining Sectors across the States?
- Why do the States behave differently in labour productivity in Coal mining Sectors?

3. Database

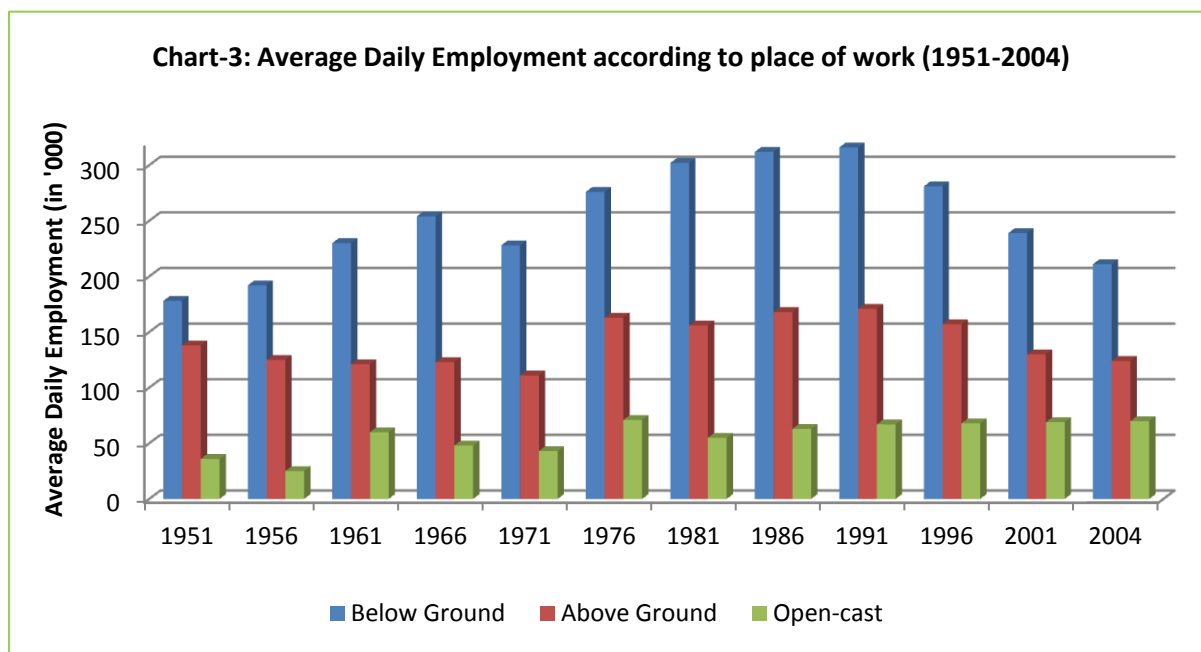
All the Data are collected from “Statistics of Mines in India” Vol.-1 (Coal) of various years. It is published by ‘Directorate-General of Mines Safety’, ‘Ministry of Labour and Employment’, Government of India.

4. Data Analysis/ Findings

4.1. The Reason Behind The Decline In Labour Employment After 1991

We have already seen in Table-2 that the Average Daily Employment (ADE) decreased after 1991. It may have so many economic reasons. In 1991, India had opened her economy to the world. New capital-intensive technology could come to this sector. More Capital formation or investment could be the other reason. However, no such data is available for Capital formation or investment in ‘Statistics of Mines in India’. Such data from other sources may not be comparable. In case of Technology, various types of Machineries are there in ‘Statistics of Mines in India’. However, they are all in disaggregating form. Their horizontal sum might bring the problem of addition. Therefore, to give the explanation of decline in employment in post reform period, we are trying to explain in indirect method.

The Table-3 shows the Trend in Average Daily Employment as classified according to the ‘Place of Work’. Coal is extracted from three types of places; below ground, Open-cast and above ground. From the Table-3 and the Chart-3, it shows that employment in below ground is much more than that of Open-cast and Above Ground. And since 1991 employment in Open-cast is more or less stagnant, in above ground it is declining and in below ground the Declining is more than above ground.



Therefore, the overall picture is that the declining in employment is mainly due to declining employment in below ground and not for the open-cast.

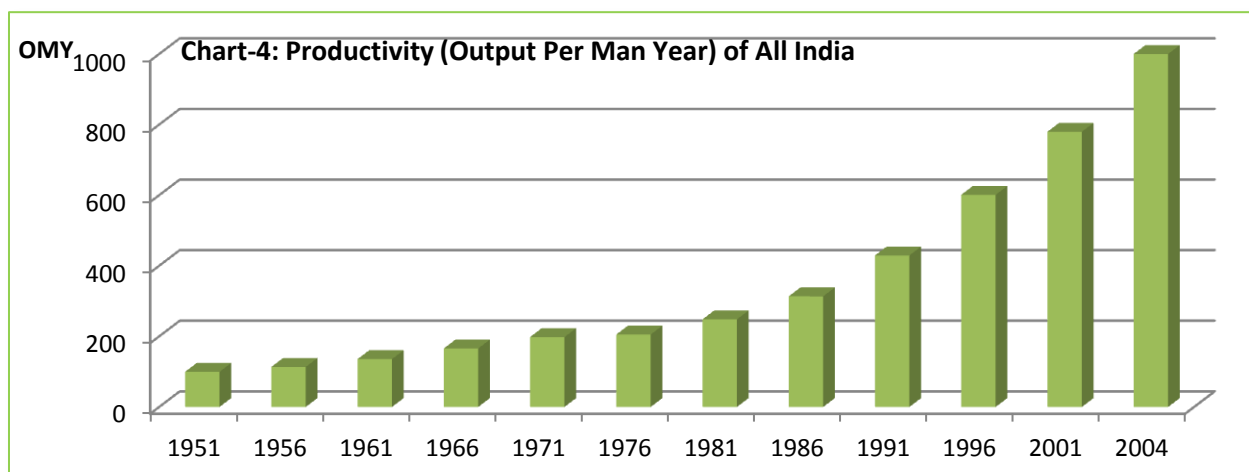
In the Chart, just below the Table-6, show that the States like Jharkhand and West Bengal employed a large number of labour forces earlier, now their ADE is decreasing drastically. The production of coal was large in these two states. The data in ‘Statistics of Mines in India’ also shows that their production in below ground was huge compare to the Open-cast. And in below ground employed much more labour compare to Open-cast. The production in Open-cast is fully mechanized in recent year (After 1991, according to “Statistics in Mines in India”) and it is increasing. In Below ground, production is mainly by manual and their production is declining. So, as a whole, In Below ground Employment was Large, but now Employment is declining due to the decline in production. And in contrast in Open-cast the production in increasing drastically without any increase in Employment, since in Open-cast the production is fully mechanized now. That is why the Average Daily Employment (ADE) is declining since 1991. However, one can go further to find the more economic reason of it with much more data.

4.2. All India Trend In Labour Productivity In Coal Mining Sector

In Calculating the Productivity of Labour in Coal Mining Sector, the Directorate-General of Mines Safety, Ministry of Labour and Employment uses two types of Concepts; Output per Man Year (OMY) and Output per man shift (OMS). **OMS** is defined as the Ratio of total amount of Coal Raised during the reference year to the total no. of Manshift worked during the same year. And **OMY** is defined as the ratio of total amount of Coal raised during the reference year to the Average Daily Employment (ADE) during the same year, i.e.

$$OMY = \frac{\text{Total amount of Coal rose during the reference year}}{\text{Average Daily Employment (ADE) during the same Year}}$$

In this term paper we are using the OMY (Output per man Year) as the measures of Productivity of labour in Coal Mining Sector. In Table-4 and in the Chart-4, we see that the Productivity of Labour in Coal Mining Sector at all India level is increasing since 1951. It was just 99.4 tones per man year and it increased to 1010.6 tones per man year in 2004. So, it is a huge increase in productivity of labour in Coal mining sector in India during the last five decades.

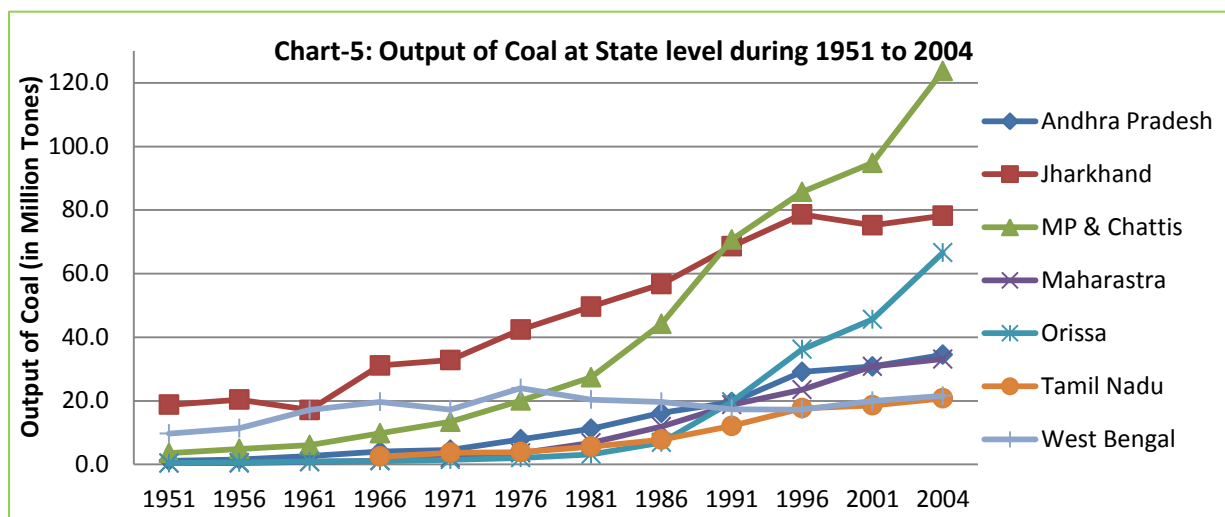


Moreover, the interesting thing is that the increase in Productivity of labour was moderate till 1991. But after that the rate of increase is much high. Now the question may arise why the productivity is increasing since 1991 at a much higher rate than the past period. It may be due to the openness of economy new technology and more capital may come to the coal sector. But the literature is not there on this topic and the data is not available to go the deep.

The picture we see, it is an All India picture. To go to the root of it we should go for more disaggregated manner. So, in the next section we want to look the productivity of labour States wise.

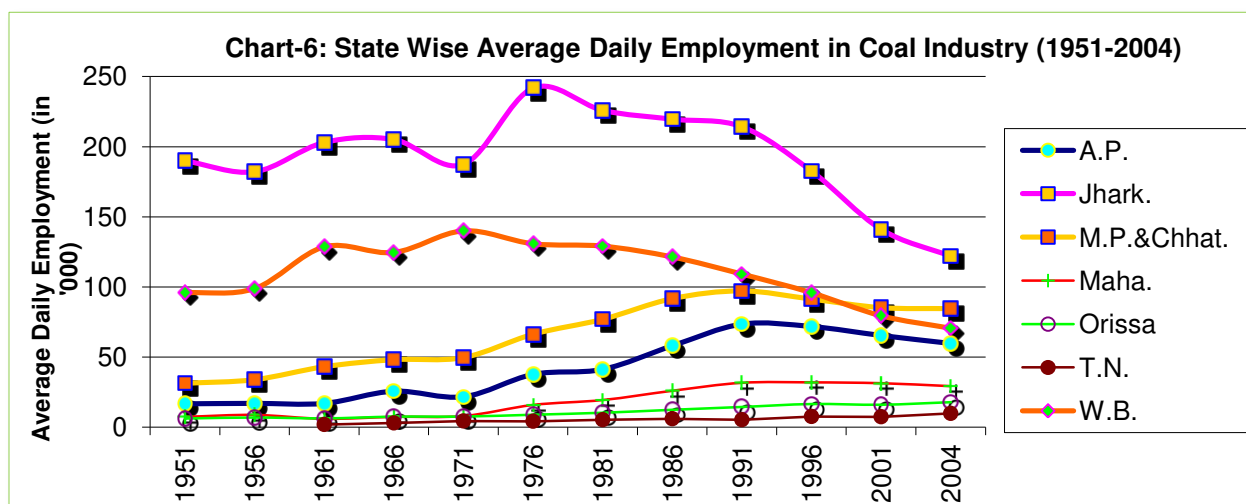
4.3. Scenario Of Labour Productivity Across States

We have taken only the major coal producing States like Jharkhand, West Bengal (WB), Andhra Pradesh (AP), Maharashtra (Maha), Orissa, Madhya Pradesh and Chhattisgarh (MP&Chhat.) and Tamil Nadu (TN).



After bifurcation of Bihar, all the coalfields came under the new State, Jharkhand. Now, in Bihar no coalfield is there. So, we have taken all the figure of Bihar as for the Jharkhand. It is also applied in “Statistics of Mines in India”. In case of Madhya Pradesh, after creation of new State, Chhattisgarh, some coalfields are gone to Chhattisgarh. So, for the purpose of inter-temporal comparison we are taking the figures of both the states together. We see from the above Chart and the Table-5 that production of Coal in Jharkhand is much higher than that of other states. The Production of coal in MP and Chhattisgarh has increased rapidly since 1981 and at an increasing rate. Now a day MP and Chhattisgarh is the largest producer of Coal. The production of coal in Orissa has increased rapidly since 1991. The production of other states had increased but, after 1991 it is stagnant more or less.

The State-wise Average Daily Employment (ADE) is shown in the Table-6 and the subsequent Chart of it on the next page. In the Chart we see that the employment had declined rapidly in two states, Jharkhand and West Bengal which are the largest employer.

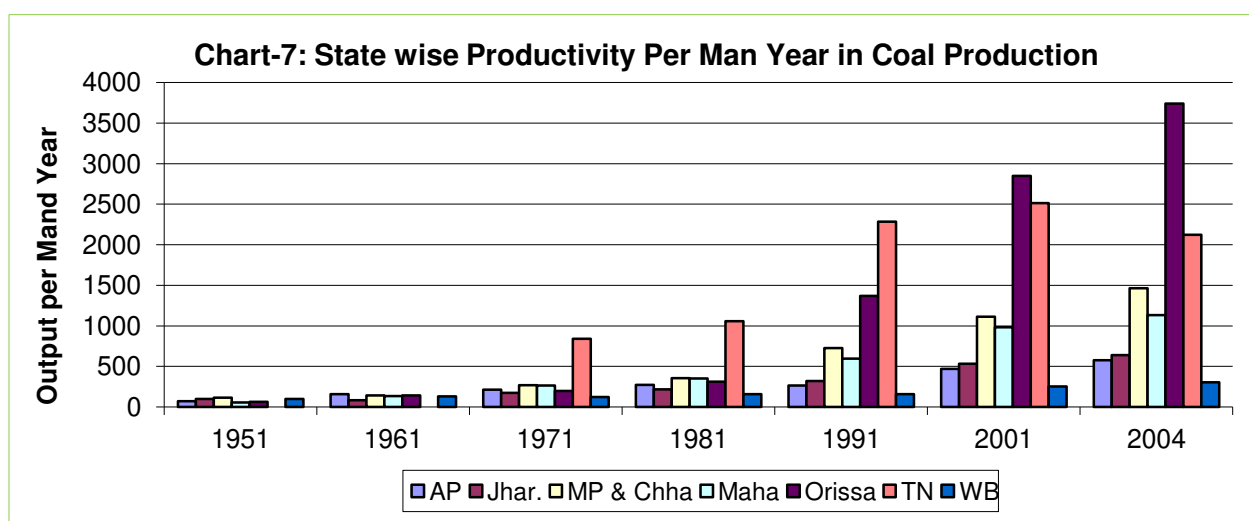


The employment in MP & Chhattisgarh and Andhra Pradesh were increased till 1991, but then they were more or less stagnant. The employment in other states is much low compare to the States mention above.

Now we see the Pictures of Productivity of labour in coal sector across the major coal producing States. The Productivity is calculated by Output per man year (OMY) as defined in "Statistics of Mines in India". OMY of labour in coal sector for a single State is;

$$\text{OMY for a single State} = \frac{\text{Total amount of Coal rose during the Reference year in that State}}{\text{Average Daily Employment (ADE) of that State during the same year}}$$

The productivity of labour in major coal producing states is shown in the Table-7 and the Chart-7.



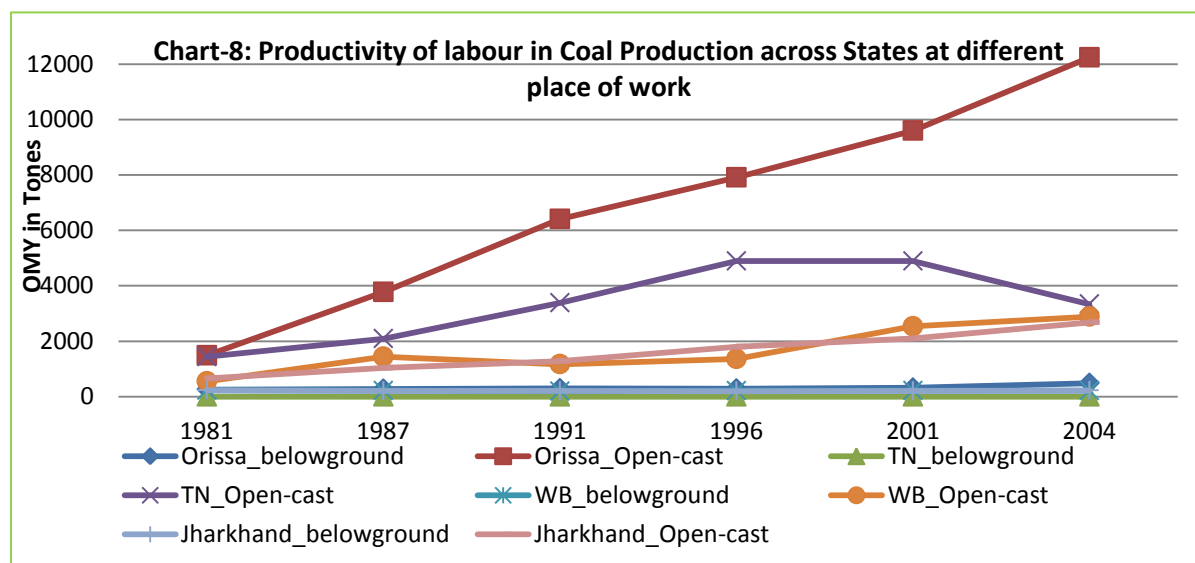
From the Table-7 and Chart-7, we can see that almost all the States showing an increasing trend of labour productivity measured by OMY. The productivity in Andhra Pradesh, Jharkhand, Madhya Pradesh & Chhattisgarh and Maharashtra are increasing, but that are much lower than the Other States.

In Case of Tamil Nadu, it is increasing steadily since 1971 and productivity is much higher than the other states, except Orissa. But in recent year productivity had declined in Tamil Nadu in 2004, but still it is much higher. In case of Orissa, it was moderate and was same as the other states till 1981. But after 1991, the productivity is increasing rapidly in Orissa. And in present situation Orissa has the highest productivity of Labour in Coal mining sector. West Bengal has the least Productivity in coal mining sector since 1961 compare to that of other states. Although, the productivity is increasing, as shown in the above Chart, it is much low. Now the question arises why the States behave differently. Now, we would try to find out the reason of it in the next section in the next page.

4.4 The Reason Behind Differential Behaviour Of States In Labour Productivity

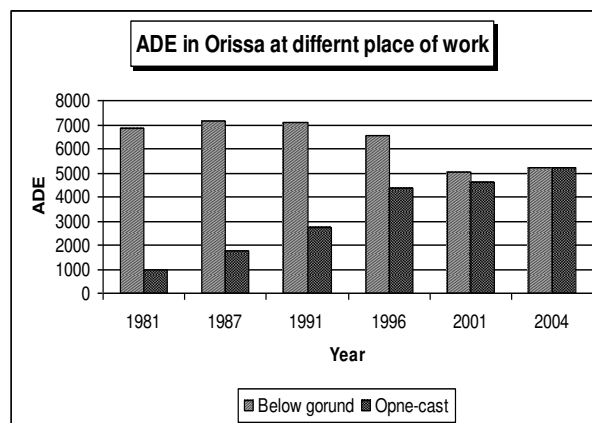
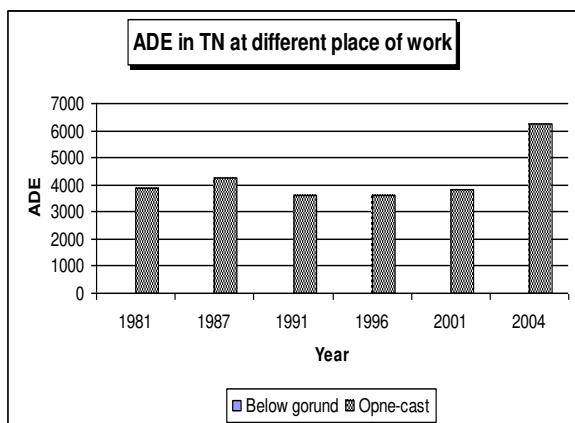
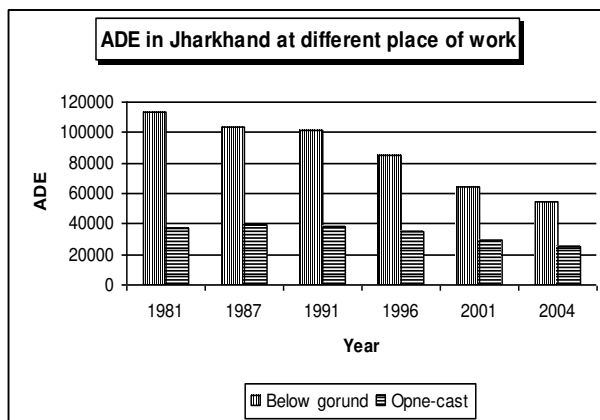
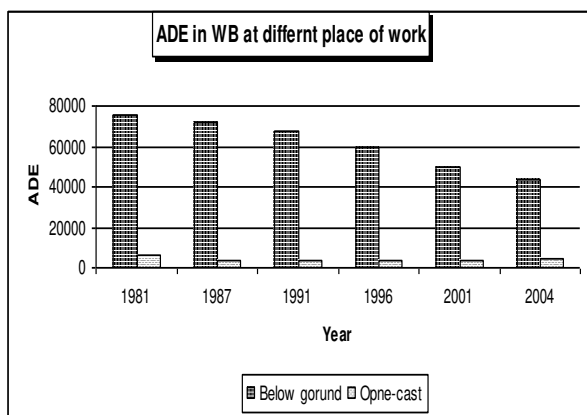
The Coal can found in India are of Four types; Peat, Lignite and Bituminous and Anthracite. Peat is very low quality coal and Lignite is also low quality. These two types of Coal are found in Open-cast and above ground. Bituminous and Anthracite are the high quality coal and are found in below ground.

In the above section we have seen that three states behave abnormally in this respect. These states are West Bengal, Tamil Nadu and Orissa. That is why we are taking these three states for analysis in this section. Tamil Nadu and Orissa have much higher productivity and West Bengal Has the least productivity. And we are taking Jharkhand with these tree states. Jharkhand also has very low productivity of labour. Lignite is found in Tamil Nadu almost 95% of total lignite found in India. In Jharkhand, West Bengal and Orissa we found Bituminous and Anthracite types of coal.



In the above Chart-8, we see that in all the four States the productivity at Open-cast is much more higher than that of at below ground. And productivity at open-cast in Orissa and Tamil Nadu are much higher than that of West Bengal and Jharkhand.

When the overall productivity is calculated from the productivity at different places of work, the weighted average is taken of all the productivity. And to do that the level of employment at different place of work are taken as weights.



From the above Charts, we can see that in **West Bengal** employment in belowground is higher than that of open cast. And the Productivity in below ground is much lower than that of Open-cast in West Bengal. So, the weighted Average of the Productivity at different place of work is much low with considering the employment as weights. In case of **Jharkhand**, it is more likely to the case of West Bengal. We have seen that the productivity at below ground is lower than that of an open-cast in Jharkhand. Moreover, the employment at below ground is much higher. Therefore the weighted average of Productivities would be low. In case of **Tamil Nadu**, there is no coalfield which operates below ground extraction of coal. All the coalfields are Open-cast and few are in above ground operation. So, the productivity of labour in coal sector in Tamil Nadu is nothing but the productivity of Open-cast only. That is why the productivity of labour is so high in Tamil Nadu. In Case of **Orissa**, the picture is very interesting. The employment at below ground was high and decreasing. And the employment at Open-cast was low and increasing. In more resent time the employment at both the work of place are converging and more or less equal. In Contrast, we saw in the Chart (the first chart of this section), that the productivity at different place of work is diverging very rapidly. And, the productivity at Open-casting is much higher than that of an open-cast. So, the weights (i.e. employment) are same more or less but the productivity is higher at open-cast. So, the influence of productivity at open-cast is much higher than that of at below ground.

From the above discussion, we see that the boom in productivity in Orissa and Tamil Nadu is only due to the weighted average of different types of productivities. But, the coals at open-cast and below ground are not same. They are different in quality. So, we simply cannot add (although we are taking the weighted average) the two different quality things. That is why we are getting the problem of Addition.

5. Conclusion

We have seen that the productivity boom in Tamil Nadu and Orissa is mainly due to the weighted average of different types of productivity at different place of work and of different quality of coal. We cannot take the average of lignite and bituminous. The boom in productivity is mainly due to the open-cast high productivity. Open-cast productivity is much high because, in open-cast coal is extracted by fully mechanized process.

No doubt, the productivity of labour in coal mining sector is increases since 1951. However, the productivity boom of labour in coal mining sector at all India level is only due to productivity boom at open-cast in Orissa and Tamil Nadu. The increasing trend can be explained with more economic data (if available). One can go further in details in it to search the reason for increasing trend in productivity of labour in coal mining sector in India. But, the Productivity boom as we saw is mainly due the Productivity boom at open-cast of low quality coal in Orissa and Tamil Nadu. But the problem of addition of different quality of coal is still remaining. One can go further with the Monetary Values of different types of coal when s/he would try to calculate the productivity.

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7. Tables And Figures

Table 1: Production of Coal in India (in Million Tones)

Year	1951	1956	1961	1966	1971	1976	1981	1986	1991	1996	2001	2004
All India	35	39.9	55.7	70.4	75.6	105	127.3	170.2	237.8	304.1	341.5	409.3

Sources: - "Statistics of Mines in India", Vol.-1 (Coal) of different years.

Table 2: Trend in Average Daily Employment in Coal Sector in India (1951) in thousand or '000

Year	1951	1956	1961	1966	1971	1976	1981	1986	1991	1996	2001	2004
Employment (All India)	352	352	411	425	382	510	513	543	554	506	438	405
Growth rate (yearly) (%)	NA	0	3.35	0.68	-2.02	6.7	0.12	1.17	0.41	-1.73	-2.69	-2.51

Sources: - "Statistics of Mines in India", Vol.-1 (Coal) of different years.

Table 3: Trend in Average Daily Employment (1951-2004) (in thousand)

Year	All India	Place of Work		
		Below Ground	Open-cast	Above Ground
1951	351	178	36	138
1956	352	192	25	125
1961	411	230	60	121
1966	425	254	48	123
1971	382	228	43	111
1976	510	276	71	163
1981	513	302	55	156
1986	543	312	63	168
1991	554	316	67	171
1996	506	281	68	157
2001	438	239	69	130
2004	405	211	70	124

Sources: - "Statistics of Mines in India", Vol.-1 (Coal) of different years

Year	Output in million tones	Output in '000 tones	ADE in '000	Productivity per man year (OMY)
1951	35.0	35000.0	352	99.4
1956	39.9	39900.0	352	113.4
1961	55.7	55700.0	411	135.5
1966	70.4	70400.0	425	165.6
1971	75.6	75600.0	382	197.9
1976	104.6	104600.0	510	205.1
1981	127.3	127300.0	513	248.1
1986	170.2	170200.0	543	313.4
1991	237.8	237800.0	554	429.2
1996	304.1	304100.0	506	601.0
2001	341.5	341500.0	438	779.7
2004	409.3	409300.0	405	1010.6

Sources: - "Statistics of Mines in India", Vol.-1 (Coal) of different years

Year	AP	Jharkhand	M.P. & Chhat.	Maharashtra	Orissa	TN	WB
1951	1.2	18.8	3.6	0.4	0.4	NA	9.7
1956	1.6	20.4	4.9	0.4	0.6	NA	11.4
1961	2.7	17.1	6.1	0.8	0.9	NA	17.1
1966	4.1	31.1	9.8	1.2	1.1	2.5	19.7
1971	4.6	32.8	13.4	2.1	1.5	3.7	17.3
1976	7.9	42.4	20.1	3.6	2.1	3.9	24.0
1981	11.2	49.6	27.4	6.8	3.2	5.6	20.4
1986	16.2	56.7	44.2	11.9	6.9	7.8	19.7
1991	19.6	68.6	70.7	18.8	19.7	12.1	17.4
1996	29.1	78.6	85.7	23.5	36.2	17.7	17.3
2001	30.8	75.2	94.8	30.8	45.6	18.6	20.0
2004	34.5	78.2	123.7	33.1	66.6	20.8	21.6

Sources: - "Statistics of Mines in India", Vol.-1 (Coal) of different year

Table 6: Trends in Average Daily Employment in Indian Coal Sector (1951-2004) (in thousand or '000)

Year	AP	Jharkhand	MP + Chhatt.	Maharastra	Orissa	TN	WB
1951	17	190	31	7	6		96
1956	17	182	34	9	7		99
1961	17	203	43	6	6	2	129
1966	26	205	48	7	8	3	125
1971	22	187	50	8	8	4	140
1976	38	242	66	16	9	4	131
1981	41	226	77	19	10	5	129
1986	58	220	92	26	12	6	121
1991	74	214	97	32	14	5	109
1996	72	183	91	32	17	8	96
2001	65	141	85	31	16	7	80
2004	60	122	85	29	18	10	71

Sources: - "Statistics of Mines in India", Vol.-1 (Coal) of different year

Table 7: Productivity of Labour, Output per man year (OMY) across States in tones per man year

Year	AP	Jharkhand	MP&Chhat.	Mahar.	Orissa	TN	WB
1951	72.3	99.0	114.6	54.8	64.5	NA	101.3
1961	159.8	84.2	141.2	135.6	142.9	NA	133.0
1971	213.0	175.0	269.6	265.8	197.4	840.9	123.6
1981	271.8	219.6	356.3	352.3	310.7	1056.6	158.0
1991	266.7	320.3	728.1	594.9	1368.1	2283.0	159.3
2001	470.9	533.0	1112.7	984.0	2850.0	2513.5	251.6
2004	577.9	641.5	1463.9	1133.6	3741.6	2122.4	305.9

Sources: - "Statistics of Mines in India", Vol.-1 (Coal) of different year