

***IMPACT OF COAL MINING AND TRADING ON
THE ECONOMY OF MEGHALAYA:
A CASE STUDY OF JAINTIA HILLS DISTRICT***

PhD Dissertation
Under the supervision of
Dr Utpal Kumar De
Reader, Department of Economics

By

Lambodar Rout

Department of Economics

North-Eastern Hill University

Shillong, 793022

December 2006

ACKNOWLEDGEMENT

I take this opportunity to express my heart-felt gratitude to my supervisor, Dr Utpal kumar De for his sincere guidance and painstaking correction of my thesis. I am also grateful to his better-half, Maumita Bhattacharjee, for her constant co-operation and sacrifice of valuable family time. I would be failing in my duty if I did not mention Dr Gurudas Das, who helped me by providing valuable advice and ideas in the initial stages of my research work. I am also thankful to my better-half, Swarnaprava Puan, who stood by me through thick and thin to complete my study. I am also grateful to the various Government departments like Directorate of Mineral Resources, Government of Meghalaya, Directorate of Economics and Statistics, Government of Meghalaya, Office of the Commissioner of Central Excise, Government of India, Shillong, Office of the Commissioner Custom, Government of India, shillong, Land Custom Station, Dawki, Geological Survey of India, Shillong, Office of the Commissioner of Transport, Government of Meghalaya, etc which permitted me to use the materials provided by them freely. My special thanks to all Governing Body members of Nongtalang College for granting me leave for my study. I am also thankful to Bah Godfre for helping me in computer work. I am also grateful to my friends and colleagues for their constant inspiration for the completion of my thesis. Last but not least, I am also indebted to all the Faculties of the department of Economics for their sincere co-operation. I trust that I shall be forgiven if for unforeseen all-too-human oversight some of these contributions have not been properly acknowledged in the text.

LIST OF TABLES

Table No.	Title of the Table	Page No.
1.1	State-wise Reserves of Indian Coal	
1.2	Coal Reserves by States in the North-Eastern Region	
4.1	Coal Reserves Across Different Coalfields of Meghalaya	
4.2	Spatial Distribution of Coal Reserve in Meghalaya	
4.3	Estimated Coal Reserves in different Coalfields of Three Hills Regions of Meghalaya	
4.4	Spatio-Temporal Variation in Production of Coal in Meghalaya	
4.5	Quantity of Cement Production and Utilisation of Coal in different Cement Factories of Meghalaya in 2004	
5.1	Coal Extraction and Total Export to Bangladesh	
5.2	Coal Export as Percentage to Total Export from Meghalaya to Bangladesh	
6.1	Sectoral Composition of NSDP of Meghalaya during 1980-81 to 2002-03 (at 1993-94 Prices)	
6.2	Sub-Sectoral Estimates of NSDP at Constant (1993-94 Prices)	
6.3	Contribution of Mining and Quarrying to NSDP of Meghalaya	
6.4	Contribution of Coalmining and Quarrying to NSDP of Meghalaya	
6.5	Coal Royalty and Revenue Receipts of the Government of Meghalaya	
6.6	Extraction of Coal and Income Earned by Coalmine Labourers	
6.7	Extraction of Coal and Income Earned by Coalmine Owners	
6.8	Coal Trade and Profit Earned by International Exporters and Inter-State Traders	
6.9	Coal Trade and Profit Earned by Middleman Trader	

- 6.10 Transportation of Coal and Income Earned by Truck Owners
- 6.11 Transportation of Coal and Earnings of the Loaders
- 6.12 Coal Business and Earnings of the Depot Managers
- 6.13 Trade of Coal and Earning of the Managers and Assistant Managers of International and Intra-national Traders
- 6.14 Transportation of Coal and Earnings of the Drivers and Handymen
- 6.15 Overtime Extraction of Coal and Growth of Cement Production in Meghalaya
- 6.16 Extraction of coal and Employment for Coalmine Labourers
- 6.17 Extraction of Coal and Employment for Coalmine Owner over the Years
- 6.18 Transportation of Coal and Employment for Drivers and Handymen
- 6.19 Despatch of coal and Employment of Loaders
- 6.20 Coal Depots and Employment Opportunity for Depot Managers in Meghalaya
- 6.21 Coal Trade and Employment of Middleman Traders generated over time in Meghalaya
- 6.22 Coal Trade and Employment Opportunity for Traders in Meghalaya
- 6.23 Coal Business and Employment Opportunity for Managers and Assistant Managers in Meghalaya
- 6.24 Coal Extraction and Direct Employment
- 7.1 Over-Time Inter-District Variation in Contribution of Mining and Quarrying to NSDP in Meghalaya

- 7.2 Contribution of Mining and Quarrying to N.D.D.P. of Jaintia Hills
- 7.3 Distribution of Coalmine Owners According to their Annual Earnings
- 7.4 Distribution of Exporters according to Annual Earnings in Jaintia Hills
- 7.5 Distribution of Non-Coalmine Owners According to Annual Income Earnings
- 7.6 Distribution of Sample Coalmine Labourers and Non-Coalmine Labourers according to their Monthly Income Range in Jaintia Hills
- 7.7 Distribution of Sample Non-Coalmine Owner Families according to the Source of Major Income
- 7.8 Distribution of Mine Labourers according to the Place of Origin
- 7.9 Distribution of Houses of Coalmine Owners and Non-Coalmine Owners according to the Holding of Tangible Assets
- 7.10 Distribution of Coalmine Owners and Non-Coalmine Owners According to Vehicle Ownership
- 7.11 Growth of Registered Vehicles in Jaintia Hills during 1990-91 to 2004-05
- 7.12 Distribution of Coalmine Owners and Non-Coalmine Owners according to Monthly Expenditure on Children's Education
- 7.13 District-wise Overtime Deposits and Credits in Scheduled Commercial Banks

LIST OF DIAGRAMS

Diagram No.	Title	Page No.
4.1	Extraction of Coal in Meghalaya during 1978-79 to 2005-06	57
4.2	Cumulative Extraction of Coal in Meghalaya during 1978-79 to 2005-06	58
5.1	Extraction and Export of Coal to Bangladesh Over Time in Meghalaya	83
5.2	Percentage of Output Exported to Bangladesh Over Time from Meghalaya	84
6.1	Changes in N.S.D.P. and Output of Mining and Quarrying of Meghalaya at 1993-94 Prices during 1980-81 to 2002-03	101
6.2	Percentage Contribution of Coal to Total N.S.D.P. of Meghalaya during 1980-81 to 2002-03	104
6.3	Extraction of Coal and Employment Generated directly through that Activity in Meghalaya during 1978-79 to 2005-06	133

LIST OF ABBREVIATIONS

BSF:	Border Security Force
DMR:	Directorate of Mineral Resources
GSI:	Geological Survey of India
LCS:	Land Custom Station
MT:	Metric Tonne
MCCL:	Mawmluh Cherra Cement Limited
MMDC:	Meghalaya Mineral Development Corporation
MITA:	Meghalaya International Traders Association
MEP:	Minimum Export Price
NSDP:	Net State Domestic Product
NDDP:	Net District Domestic Product

CONTENTS

Title	Page No.
ACKNOWLEDGEMENTS	i
LIST OF TABLES	ii-iv
LIST OF DIAGRAMS	V
LIST OF ABBREVIATIONS	vi
Chapter -1 BACKGROUND	1-11
1.1 Introduction	
1.2 Coal Resource in India	
1.3 The Coal Reserve of North-East India	
1.4 Objectives of the Study	
1.5 Hypotheses	
1.6 Chapterisation	
Chapter-2 REVIEW OF LITERATURE	12-25
2.1 Extraction of Non-Renewable Resources	
2.2 Coal Trade in Meghalaya	
2.3 Impact of Extraction of Coal and its Trade in Meghalaya	
Chapter-3 METHODOLOGY AND COLLECTION OF DATA	26-39
3.1 Spatio-Temporal Variation in Availability and Extraction of Coal in Meghalaya	
3.2 The Pattern of Coal Trade in Meghalaya and Its Temporal Variations	
3.3 Impact of Extraction of Coal on the Income and Employment in Meghalaya	
3.4 Impact of Extraction of Coal on the Local Economy of Jaintia Hills	
3.5 Collection of Data	
3.6 Limitations of Data	
Chapter-4 AVAILABILITY AND UTILISATION OF COAL IN MEGHALAYA	40-69
4.1 Background	
4.2 Review of Earlier Studies	
4.3 Availability of Coal in Meghalaya	
4.4 Techniques/Methods of Coal Mining in Meghalaya and Ownership Pattern	
4.5.1 Spatial Distribution of Coal Deposits in Meghalaya	
4.5.2 Coal Reserves across Different Coalfields of Three Hills Regions in Meghalaya	
4.6.1 Production of Coal in Meghalaya	
4.6.2 Spatio-Temporal Variation in Production of Coal in Meghalaya	
4.6.3 Nature of Coal Extraction in Meghalaya	
4.7 Utilisation of Coal in Meghalaya	

- 4.8 Utilisation of Coal Produced in Meghalaya by Other States of India
- 4.9 Utilisation of Coal Produced in Meghalaya by Bangladesh
- 4.10 Conclusion

Chapter-5 COAL TRADE IN MEGHALAYA 70-95

- 5.1 Introduction
- 5.2 Coal Trade Between Meghalaya and Bangladesh: A Historical Background
- 5.3 Export Procedure
- 5.4 Nature of Coal Market
 - 5.4.1 Local Coal Trade in Meghalaya
 - 5.4.2 Inter-State Coal Trade and Its Modus Operandi
 - 5.4.3 International Coal Trade of Meghalaya/Meghalaya's Coal Trade with Bangladesh
 - 5.4.4 Export of Coal from Meghalaya to Bangladesh
 - 5.4.5 Temporal Growth in the Value of Coal Exported to Bangladesh
 - 5.4.6 Coal Trade with Bangladesh through Different Border Points
- 5.5.1 Coal Export: A Case Study of Dawki Trade Route
- 5.5.2 Modus Operandi of Trade of Coal through Dawki
- 5.5.3 Estimation of Volume of Unofficial Coal Trade through Dawki Land Custom Station
- 5.5.4 Trade Facilitation Bottlenecks in Meghalaya
- 5.6 Conclusion

Chapter-6 IMPACT OF COAL MINING AND TRADING ON THE ECONOMY OF MEGHALAYA 96-136

- 6.1 Introduction
- 6.2 Generation of Income from the Extraction and Trading of Coal in Meghalaya
 - 6.2.1 Impact of Coal Extraction on the Net State Domestic Product of Meghalaya
 - 6.2.2 Contribution of Coal Mining and Quarrying to the Revenue of the Government of Meghalaya
 - 6.2.3 Extraction of Coal and Income Generation by the Individual Mine Workers
 - 6.2.3.1 Earning of the Coalmine Labourers
 - 6.2.3.2 Earning of the Coalmine Owners
 - 6.2.3.3 Earning of the International Exporters and Inter-State Traders
 - 6.2.3.4 Earning of the Middleman Traders
 - 6.2.3.5 Earning of the Truck Owners
 - 6.2.3.6 Earning of the Loaders
 - 6.2.3.7 Earning of the Depot Managers
 - 6.2.3.8 Earning of the Managers and Assistant Managers at Trading Points of Coal
 - 6.2.3.9 Earning of the Drivers and Handymen
 - 6.3 Extraction of Coal and Growth of Cement Industries in

- Meghalaya
- 6.4 Extraction of Coal and Its Impact on Employment
 - 6.4.1 Coalmine Labourers
 - 6.4.2 Coalmine Owners
 - 6.4.3 Transportation of Coal and Employment Opportunity for Local People
 - 6.4.4 Loaders in Coal Depots
 - 6.4.5 Depot Managers
 - 6.4.6 Middleman Traders
 - 6.4.7 International Exporters and Inter-State Traders
 - 6.4.8 Managers and Assistant Managers of Exporters
- 6.5 Extraction of Coal and Indirect Employment Generated in Meghalaya
 - Employment in Motor Repairing Workshops within
 - 6.5.1 Coal Mining and Trading Areas of Jaintia Hills of Meghalaya
 - 6.5.2 Motor Parts Shops
 - 6.5.3 Tea Stalls in Mining Area and in Trading Points
 - 6.5.4 Tea Stalls at International Border Point
- 6.6 Conclusion

Chapter-7 IMPACT OF COAL MINING AND TRADING ON THE LOCAL ECONOMY OF JAINTIA HILLS 137-162

- 7.1 Introduction
- 7.2 Some Earlier Studies
- 7.3 Extraction of Coal and Contribution of Coal Mining and Quarrying to N.D.D.P. of Jaintia Hills District
- 7.4 Impact of Extraction of Coal on the Earning of People in Jaintia Hills
- 7.5 Extraction of Coal and Composition of Mine Labourers in Jaintia Hills
- 7.6 Impact of Coal Mining and Trading on Asset Holding
- 7.7 Impact of Coal Mining on Vehicle Ownership by Coalmine Owners in Jaintia Hills
- 7.8 Expenditure on Children's Education by Coalmine Owners and Non-Coalmine Owners
- 7.9 Cross-Border Trade of Coal and Its Impact on the Local Economy of Jaintia Hills
- 7.10 Nature of Growth in the Local Economy of Jaintia Hills
- 7.11 Conclusion

Chapter-8 CONCLUSION AND POLICY IMPLICATION 163-174

- 8.1 Summary of Findings
- 8.2 Conclusion and Policy Implications
- 8.3 The Scope for Further Study

BILIOGRAPHY 175-181

CHAPTER-1

BACKGROUND

1.1 Introduction

The pattern of economic activities in a particular area is largely determined by the nature of endowments available therein and their economic viability. This resource and activity linkages lead to variations in economic structures over the geographical space. Even this interaction between endowments and agents often leads to the evolution of the activity-pattern as well as economic structure in a particular area over a long period of time depending upon the nature of exercise of the “free will” of the agents concerned.

Agents and endowments interaction in a mineral-based economy may lead to two diametrically opposed alternative situations:

- i) Sustainable growth in the long-run through diversification of investment in other sectors of the economy concerned, given the fact that market demand does not pose any barrier.
- ii) Non-sustainable growth because of flight of capital from the local economy due to inadequate scopes for diversified investment primarily due to limitations of the market.

In case of situation (ii), the temporal domain of growth will depend primarily on the quantum of reserves of the resources (mineral) concerned. In the absence of development of alternative sectors, the local mineral based economy would collapse with the exhaustion of deposit. The growth generating impact of mining, instead of strengthening the local economy, would be felt elsewhere. Mining of mineral resources in such a case will tantamount to resource drain.

iii) Apart from these two extreme situations [(i) and (ii)], a part of the gains from mining may find its way to some selected sectors of the local economy in the long-run.

The present study seeks to investigate as to which one of these alternative situations conform to the coal mining and trading experience of Meghalaya in general and Jaintia Hills in particular.

Right from the early 19th century coal has been the major source of energy and the input for the manufacturing of iron and steel. The coal as a source of energy played a prominent role in the industrial revolution of the 19th century and made Great Britain a dominant industrial power. Until First World War the main coal producing countries were the major players in the global industrial development. But, after Second World War, coal started losing its importance as a source of primary energy due to the overwhelming substitution of oil as a major source of fuel (Chadwick *et al.*, 1987). However, in the 1970, the coal consumption grew steadily in both absolute and relative terms. The oil price shocks caused consumers to substitute more economical and secure supplies of coal for petroleum products, especially for power generation. Now, again it has added a new dimension to the problem of energy sources and people have started thinking to switch over to suitable alternatives because of the rising pollution problem due to the consumption of coal across the world.

1.2 Coal Resource in India

Coal is one of the fossil fuels, which dominate the energy scenario in India especially in the field of power, metallurgy and other industries. Coal meets about 55 per cent of our total energy demands. The latest estimated coal reserves in India are placed at 221 billion tonnes. India now ranks third amongst the coal

producing countries in the world, next to China and USA. The total production of coal in India has increased from 73 million tonnes in 1970-71 to 313.4 million tonnes in 2000-01 (Reliance Review of Energy Markets, 2002). Geographically, the Indian coalfields having commercial viability are distributed in the states of Jharkhand, Orissa, Chhatisgarh, West Bengal, Madhya Pradesh, Andhra Pradesh, Maharashtra, Uttar Pradesh, Meghalaya, Assam, Bihar, Arunachal Pradesh and Nagaland (Geological Survey of India Report, 2001).

Coal is required both as a fuel and as a material input vital for the petro-chemical industries. This is also a depleting or non-renewable resource. Now-a-days, special emphasis is being made on expanding the production and use of coal to reduce the dependence on the fast depleting oil resources. So the demand for coal is increasing day-by-day in the resource market of the economy (Ali, 1979).

Perhaps, the first scientific attempt to examine the coal deposits of the country (India) was made by D.H. Williams, an officer of the British Geological Survey of the East India Company in 1845. He identified a number of potential coal deposits in Raniganj, Jharia and Karampura coalfields in the Damodar valley belt and this paved the way for Geological Survey of India (GSI) to take up comprehensive geological survey of coal-bearing areas after it was set up in 1851. The coal production, which was 50,000 tonnes in 1857, 30 million tonnes at the time of Independence and 73 million tonnes before nationalisation of coalmines in 1971-72; rose to 270 million tonnes in 1995-96. Economically, exploitable Indian coals are broadly restricted to two geological ages – Gondwana and Tertiary. More than 99 per cent of the known reserves are contained in the Gondwana coalfields.

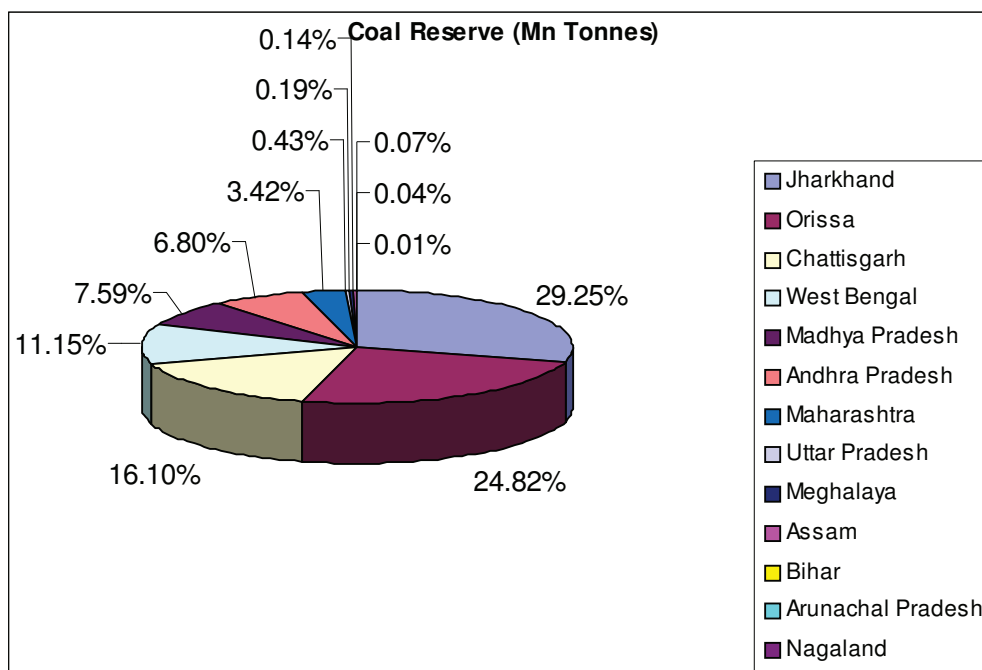
Geographically, the Indian coalfields having commercial viability are distributed in the states of Jharkhand, Orissa, Chhatisgarh, West Bengal, Madhya

Pradesh, Andhra Pradesh, Maharashtra, Uttar Pradesh, Meghalaya, Assam, Bihar, Arunachal and Nagaland. The Table-1.1 illustrates the percentage of coal reserves in different states of India.

Table 1.1: State-wise Reserves of Indian Coal

State	Reserve (Million tonnes)	Percentage
Jharkhand	71864.27	29.25
Orissa	60987.02	24.82
Chattisgarh	39544.91	16.10
West Bengal	27393.90	11.15
Madhya Pradesh	18659.74	7.59
Andhra Pradesh	16697.26	6.80
Maharashtra	8413.78	3.42
Uttar Pradesh	1061.80	0.43
Meghalaya	459.43	0.19
Assam	340.14	0.14
Bihar	160.00	0.07
Arunachal Pradesh	90.23	0.04
Nagaland	19.94	0.01
Total	245692.42	100.00

Source: Geological Survey of India, Central Mine Planning and Design Institute.



The current consumption of coal in India is about 335 million tonnes per year. More than two-third of the coal consumption in India is towards power sector, with

the remaining accounted for by the production of steel, cement, tea, brick kiln etc. Coal production in the late 1960s and the early 1970s was turning out to be inadequate to meet the growing demand. The government's view was that adequate capital investment was not forthcoming from the private coalmine owners and it was concerned with unscientific mining practices adopted by some of the private coalminers (Reliance Energy Review, 2002). On account of these reasons, the Central Government took a decision to nationalise the private coalmines. The nationalisation was done in two phases; the first with the coking coalmines 1971-72 and then with the non-coking coalmines in 1973.

The Tertiary Coals in India is, in a sense better than Gondwana Coals and characterised in general by high moisture, low ash and high sulphur content. These have lower ash content in the range of 8 to 10 per cent on air-dried basis. Total sulphur content generally varies between 2 to 7 per cent of which 40 to 90 per cent is organic in nature. Coals from some areas (Makum coalfield of Assam) have strong coking properties. Almost all coals available in the North-Eastern States of India are high-sulphur tertiary coals.

Coal production, however, received its filling with the introduction of railways propelled by steam-driven locomotives. The first railroad connecting Bombay with Thane in 1854 had however started on imported coal only. Indian coal was used in the railway for the first time in 1855, when the section between Howrah and Raniganj, a distance of about 209 km., was opened. During that time the Raniganj field was practically the only producer of coal. With the expansion of the railways and concomitant establishment of industries, there was increased demand for coal. To cope up with this requirement other fields were opened up.

1.3 The Coal Reserve of North-East India

North-East India is endowed with huge mineral resources including coal, limestone, gypsum, fine clay, sillimanite, kaolin, oil and natural gas and even uranium. It is evident from GSI documents that the coal reserve in the North-Eastern region is around 900 million tonnes, out of which, 55 per cent belongs to Meghalaya and 35 per cent to Assam. The rest belongs to Arunachal Pradesh and Nagaland. Inconsistent seam structure, high inclination, weak strata, poor slope stability and prolonged rainfall are some of the major constraints of mining activities in this region.

The history of coal mining in North-Eastern region is more than a century old. According to the official document of the Union Ministry of Coal, of the total reserves of 909 million tonnes in the entire North-Eastern region, 431 million tonnes are under proved category, 109 million tonnes under indicated category and 369 million tonnes under inferred category. If we look at the depth-wise reserve of coal in this region, we find that maximum coal reserves are found within the depth of 0 – 300 metres under the Earth's crust. Of the total coal reserves in the four states of the North-Eastern region, Meghalaya top the list followed by Assam, Arunachal Pradesh and Nagaland.

Table 1.2
Coal Reserves by States in the North-Eastern Region (million tonne)

State	Proved	Indicated	Inferred	Total
Meghalaya	117	41	301	459 (50.40)
Assam	279	27	34	340 (38.40)
Arunachal Pradesh	31	40	19	90 (9.90)
Nagaland	4	1	15	20 (2.20)
N.E. Region	431	109	369	909 (100.00)
All India	90085	112613	38050	240748

Source: Geological Survey of India, Shillong.

From Table-1.2, it is evident that Meghalaya has the highest percentage of total coal reserves among the North-Eastern states and Nagaland has the lowest coal reserves, i.e., 2.2 per cent of the total North-Eastern coal reserves of North-East India.

The quality of coal available in the North-East is otherwise good except for high sulphur contents. It is due to the presence of sulphur, the coal from North-East cannot be used directly for the metallurgical purposes. However, coal of North-East India can be of good use in numerous industries like fertilizer, cement, textile, paper, brick burning, and pottery as well as in power generation and making smokeless coke. Out of 459.53 Million tonnes of total reserves estimated by the Geological Survey of India, only around 118 million tonnes are proved reserves, 40.89 and 300.71 million tonnes are indicated and inferred reserves.

The mining of coal started in Meghalaya in early 40s of the 19th century. It was, then, limited only to Cherra and Lakadong areas (Oldhan, 1854). Geological Survey of India carried out the preliminary investigation on coal deposit in Jaintia Hills in 1962. Mining of coal, started at a limited scale there and in early 1970s following repeated investigations huge coal was found in the surrounding area (Lamin, 1995). The mining activities assumed momentum when Shillong-Jowai-Badarpur road was elevated to National Highway 44 in 1978. During 2005-06, the total production of coal in Meghalaya reached 5565.715 thousand metric tonnes. During the same year Jaintia Hills alone produced 3879.73 thousand metric tonnes, which is about 69.71 per cent of total coal production in the state.

Coal being an exhaustible mineral resource has a definite life at any given rate of extraction. The higher the rate of extraction, the shorter is the life span given the amount of reserve and vice-versa. The rising extraction has thus raised doubt about how long the local economy that is highly dependent on local coal mining activities for employment and income, would continue to grow unless the alternative sectors grow sufficiently to absorb people who would be unemployed if the coal is exhausted. Hence, coal mining and trading per se can hardly provide sustainability to the growth

of a mining-based economy unless alternative sectors come up. It is thus pertinent to study the exact impact of coal mining and trading on the structure of the local economy. Here, the impact is studied by accounting the fact as to how much of the surplus generated in the process of mining and trading is being invested in other sectors of the economy that can carry forward the momentum of growth in the long run even if the reserve of the mineral is exhausted some day. For sustainable growth, the mining economy has to transform itself into manufacturing economy.

Unlike other areas of the country, in Meghalaya coal is not nationalised. It is owned by the private individuals though land is primarily owned by the communities. There are a large number of petty coalmines spreads all over Meghalaya and most of the activities have been concentrated in the Jaintia Hills district as shown above. The owners of coalmine and international exporters are mostly from local areas that also earn a lot every year. So there is the possibility of investing such revenues for the development of alternative sectors from where the present day owners or exporters can generate income in future along with the maintenance of employment and income prospects of the others in the local economy.¹ Moreover, the royalty earned by the state government can be reinvested for the sustainable progress of the state economy.

Out of total coal extracted in Meghalaya very less quantity is used in different sectors of the state. Very limited growth of coal-based industries has been observed in Meghalaya. Cement is the major industry that uses coal as major input along with limestone. But still now, only nine cement manufacturing have come up in Meghalaya with annual production capacity of 775 thousand tonnes. The utilisation of coal in cement manufacturing is about 178 thousand M.T. Also there are a few brick kilns, iron re-rolling, tea gardens where coal is used along with insignificant domestic uses.

¹ However, most of the inter-state exporters are non-locals and thus they transfer their net earnings to their home soil that along with the maintenance of their families generates capital there and not in Meghalaya.

Yet very little portion of total coal production in Meghalaya is used in such industries. The extraction of coal is led by the export demand in Bangladesh and other states where there is dearth of coal. So extraction of coal in Meghalaya is not significantly associated with local industrial development, rather the extraction here is mainly to meet the demand in the industries of Bangladesh and other states of India. During 2005-06, the total amount of export of coal from Meghalaya to Bangladesh reached a level of over 1103 thousand M.T. and export through Dawki alone in that year was around 292 thousand M.T., which was about 26.49 per cent of total exports from Jaintia Hills. During 2005-06, the state government has earned a sum of Rs.91.83 crores as royalty from the despatch of coal of which, Jaintia Hills alone contributed 64.01 crores i.e., about 70 per cent of total coal royalty earned by the state.

The indicators of production, royalty and export etc. convincingly point out the fact that Jaintia Hills is the centre of coalmining and trading activities in Meghalaya. Due to its pristine position in the coalmine activities (production and trade) in the state a special stress is given to the Jaintia Hills in the present study. Instead of its positive impact on income and employment through the extraction and industrial activities, coal mining also adversely affect the income and employment through its adverse effect on health of the miners and neighbouring others, local spring water (that damage fisheries, drinking water), agricultural productivity of the neighbouring soils and the forest resources. But in the present study, due to the limitations of time and lack of information these aspects have not been addressed.

1.4 Objectives of the Study:

The specific objectives of the study are to:

- i) explain the spatio-temporal variations in coal reserve and nature of its extraction in Meghalaya;

- ii) analyse the effect of coalmining and its related activities on the income and employment in Meghalaya;
- iii) assess the impact of coalmining activities on the local economy of Jaintia Hills.
- iv) describe the nature and spatio-temporal variations in internal and external trade of coal in the state of Meghalaya;
- v) investigate the nature of industrial development in relation to availability and extraction of coal.

1.5 Hypotheses:

The following hypotheses have been tested in the present study:

- i) Extraction of coal in Meghalaya has been increasing at the optimum rate.
- ii) Employment generated due to coalmining has increased significantly over time in Meghalaya.
- iii) Export of coal to Bangladesh has significantly boosted-up coalmining in Jaintia Hills.
- iv) Extraction of coal has significantly boosted-up cement production in Meghalaya, which is the major user of coal in Meghalaya.

Apart from these, some hypotheses have also been examined logically:

- i) Coalmining has widened the gap of income between owner and non-owner of coalmine in Jaintia hills region.
- ii) Pattern of industrial development is insufficient to absorb the people who would be withdrawn from coal sector once coal is exhausted.
- iii) Coalmining has significant impact on the indirect employment generated in the Jaintia hills region.

1.6 Chapterisation

The whole study is divided into eight chapters. Besides the chapter of introduction, review of literature and methodology of the study, Chapter-4 elaborately describes the availability, extraction and utilisation of coal in Meghalaya. Nature and variation in coal trade in Meghalaya has been discussed in Chapter-5. Chapter-6 is devoted to the analysis of impact of coalmining and trading on the economy of Meghalaya. A special analysis on the impact of coalmining on the local economy of Jaintia Hills is incorporated in Chapter-7. Chapter-8 deals with the summary of observations and policy conclusions emanated from the whole study.

References:

- Ali, S. A. (1979), *Resource for Future Economic Growth*, Vikas Publishing House, New Delhi, pp. 10-11.
- Chadwick, M. J. Highton N. H. and Lindman, N. (1987), *Environmental Impacts of Coal Mining and Utilization*, Pergamon Press, pp. 1-27.
- Geological Survey of India, (2001), *Proceedings of National Seminar on Recent Advances in Geology of Coal and Lignite Basins of India*, Special publication, 54, Kolkata.
- Lamin, H. (1995), *Economy and Society in Meghalaya*, Har-Anand Publication, New Delhi, pp. 109-129.
- Oldhan, T. (1854), *Geology, Meteorology and Economy of Meghalaya*, Mittal Publications, New Delhi, pp.53-77.
- Reliance Review of Energy Markets* (2002), compiled and edited by the Research Group, Reliance Industries Ltd.

CHAPTER – 2

REVIEW OF LITERATURE

2.1 Extraction of Non-Renewable Resources

Broadly speaking, literatures on the impact of coalmining and trading on the economy of Meghalaya is not available. Hardly there is any study that deals with the nature of extraction of coal in Meghalaya and its socio-economic impact on the local people. A few studies however are there those try to analyse the adverse impact of coalmining on the neighbouring forest resources, local land resources, mineral spring water etc. (Pandey, 1993; Sahu & Goel, 2004; Rai, 2002 etc.). Also sometimes, reports come in the newspaper on several problems of mining especially of coalmining along with limestone and uranium mining in Meghalaya. Pandey (1993) has given an over all socio-economic condition of the coalmining in Meghalaya. But the impact of coalmining specifically on income and employment of different agents, future prospects of an economy including trade has not been highlighted there.

However, there are some studies relating to the problem of extraction and utilisation of non-renewable resources that may be tenable to the analysis of extraction and economy of coal in Meghalaya. A series of path-breaking works were completed in 1960s and 1970s, where the economists systematically investigated the efficient and optimal depletion of resources, both renewable and non-renewable. However the original works on optimal depletion of exhaustible resources dates back to Gray (1914) and the classic paper by Hotelling (1931), which provided a foundation upon which the later resource economists like Dasgupta and Heal (1974),

Heal (1978), Solow (1974a and 1974b, 1986) and Hartwick (1977) developed their more general and extended structure of analysis.

Hotelling (1931) presented a comprehensive study on principles of extraction of exhaustible resources under both competitive and monopolistic market situations. According to him a competitive resource owner does not find any difference if he receives for a unit of his product a price P_0 now or a price $P_0 e^{rt}$ after a period of t years. In other words, equilibrium price of extracted exhaustible resource must grow at a rate equal to the long term market rate of interest if extraction is done efficiently and under competitive condition. It indicates that the present discounted value of unit extraction will be the same for all the periods. The nature of demand function for the concerned resources over time has an important role to play for the extraction of resources especially for a monopolist. The variation in difficulties of extraction also affects the exploratory effort and thus the decision of extraction under different market conditions. Also the distance from the extraction site to the end use has serious impact on the price of resources and thus rate of extraction. In Meghalaya, as the coal is available very near the Earth's surface, there is very little change in exploratory effort and hence the production decision. But distance and difficulties of transport matters much in the differences of rate of extraction across the hill regions. Also, because of inaccessibility or difficulty to access and thus the comparatively higher cost to reach the mining product (coal in this case) to the export point with respect to the price of the same some of the potential mines still remained unutilised.

Krutilla (1969) has highlighted problem of allocation of resources for the present and future with unspoiled natural environments, for which the market fails to make adequate provision. He has mentioned that a private resource owner would consider the discounted net income from the alternative uses and select the use, which would hold prospects for the highest present value. The private resource owner would

not be able to receive appropriate value of resources when he will extract resource used in compatible with preserving natural state. He explained that open pit mines may be refilled and surroundings rehabilitated in a way to approximate the original conditions, but even here the undertaking cannot be accomplished without the co-operation of nature.

Ross (1980) has addressed the issue of natural resource scarcity across the countries. In this context he has highlighted the problems raised by Meadows and others in their *The Limits to Growth*. He has raised the issue of sustainable growth of output in the face of scarcity of exhaustible resources. In his opinion, lack of accurate knowledge on most of the world's resources is the greatest problem to estimate the nature of resource scarcity. He also highlighted the importance of carrying capacity and environmental limits beyond which there would be many problems for the existence of mankind.

Johanson and Lafgren (1985) have investigated and concluded that the objective of each resource owner is to maximise the present value of income from extraction of non-renewable resources. For measuring the present value of the income from extraction of an exhaustible resource over time he has used equation $P_r = \int_0^{\alpha} P(t) h(t) e^{-rt} dt$, where $h(t)$ is the quantity extracted at time t and r is the interest rate with $r > 0$.

It is generally observed that the competitive industry initially exploits the resource at a higher rate, and also exhausts the resource more rapidly than a monopolist. On the other hand, the monopolist restricts production so as to maintain a higher price and earn reasonably high profit for a long period of time (Conrad and Clark, 1989). If there is no cost of extraction, a monopolist would set optimal rate of

extraction by maximising $\pi = \int_0^{T_m} P(q^{(t)}) q^{(t)} e^{-\delta t} dt$, where $P(q^{(t)})$ is the inverse demand function and δ is the social rate of discount. In equilibrium however the marginal revenue from the extraction of mineral must rise at the rate of interest. The socially optimum rate of extraction will be obtained under perfect competition by maximising

$$\int_0^T \left[U \left(\sum_{i=1}^n q_i(t) \right) - \sum_{i=1}^N C_i(q_i(t)) \right] e^{-\delta t} dt$$

Subject to $R_i = -q_i(t)$, $R_i(o) = R_i$ and $R_i(t) \geq 0$.

Here R_i is the rate of extraction or depletion of stock and C_i is the cost of extraction. In equilibrium, the extraction will be done at a rate for which price increase at the social rate of discount δ . The result will be similar whether resource owners are of equal size or not.

Chadwick *et al.* (1987) however explained through the empirical observations that there has been a rapid decline in the ratio of energy consumption to industrial output in the seven largest OECD countries in response to oil price rises. In spite of substitution of coal in different sectors, coal would have been extensively used in the power sector and heat requirements in other energy-intensive industries of those countries such as chemicals, paper manufacture, building materials and petroleum refining would have raised scope for the additional utilisation of coal in place of oil and gas. During last few decades we also observe a similar trend for the rising demand for thermal power to maintain the industrial development of those countries. However, because of rising concern about the pollution generated due to excessive consumption of coal, a gradual shift has been taking place towards other form of energy in those countries.

Kula (1992) has discussed the views of Malthus, Ricardo, Mills, Jevon and Pigou on natural resource scarcity and explained how changes in interest rate,

extraction cost as well as taxation affect the optimal rate of extraction of exhaustible resources in the same way.

Lamin (1995) has made an attempt to describe the nature of commercial exploitation of coals in Bapung area (in Jaintia Hills of Meghalaya). A large number of people in Bapung area are engaged directly or indirectly in coal business for several years. He found that the mining sector is paying very high wages to the labourers compared to other agricultural activities, which is the main reason why more labourers are attracted to the mining area from different places of the state and outside the state¹.

Gale (2000) made an attempt to explain the utilisation of coal in different sectors like power, cement, iron and steel and fertiliser in India. He also presented an account on expected future coal demand in different industrial sector. Utilisation of coal was expected to be more and more due to expanding construction activities and more requirement of electricity where utilisation of coal is very extensive in India².

Khanna (2001) has argued that non-renewable resources not only have a fixed stock, they are also in limited supply relative to the demand for them. In her opinion, coal may be considered as renewable since vast stock is remaining in the world. But in Meghalaya the stock of coal is not so vast (118 million M.T. of proved reserve), which would be exhausted within 2 decades if the current rate of extraction continues. Hence coal cannot be considered as renewable resource in Meghalaya from that point of view (Rout, De and Das; 2005).

Bhattacharya (2001) has presented a comprehensive account on the principle of extraction of exhaustible resources. He has mentioned that optimal rate of

¹ A field survey by the researcher during April 2005 in Bapung coal mine areas also found that the daily wage of miners was around Rs 275, whereas the daily wage of agricultural labourer at that time was about Rs.120 – Rs.150.

² The substitution of coal by other energy resources in India will take a long time as still now very little energy is being generated from non-conventional sources and nuclear sources except the water resources. Hence, to meet the rising energy requirement, coal is still an important option.

extraction of exhaustible resource is guided by the marginal cost of extraction and its user cost. It is optimal for a competitive resource owner to extract the resource in each period to that point where the marginal cost of extraction plus the user cost equals the market price. He has highlighted that the current extraction rate by a private owner of a natural resource depends not only on the current price, as in the standard theory, but also on an expectation about future prices. Following “Hotelling Rule” (1931, *op. cit.*) if a competitive supplier expects future price to be sufficiently low compared to the current price, he may extract and sell intensively in the current period and vice versa.

Devaranjan and Fisher (2001) analysed the “Hotelling Rule” which states that the price of an exhaustible resource must grow at a rate equal to the rate of interest both along an efficient extraction path and in a competitive, resource industry equilibrium. They highlighted the role of cumulative production and uncertainty in case of extraction of exhaustible resources.

Chakrabarti and Majumdar (2004) have outlined the quantity and quality of the coal reserves of North-East India. The production of coal in Meghalaya is generally controlled by a huge number of cottage mining units. They also highlighted the possibility of utilisation of coal produced in North-Eastern states for the development of industries like fertilizer, cement, textile, paper, brick burning and pottery as well as in power generation. They have also mentioned some of the demerits like slaughter mining, lack of conservation and unscientific methods, which are found in the coal mining of the region.

2.2 Coal Trade in Meghalaya

Very few studies are available so far that deal with the trade of coal in Meghalaya. Though there are some studies that investigate the evolution and nature of coal trade with Bangladesh as such there is no study specifically on the inter-state coal

trade that takes place mainly through the Guwahati and its impact on the economy. The available studies provide a brief idea about the trade of Meghalaya with other regions especially with Bangladesh. The beginning of the coal trade with Bangladesh from Meghalaya can be traced back to the 1842, when Colonel Lister excavated and dispatched 44350 maunds (1 maund = 37.3 kg. at that time) of coal to Chattuc (Oldham, 1854).

Syiemlieh (1989) has tried to provide an account of Britishers' mercantile interest in Khasi-Jaintia Hills. He has described how the trade in mineral resources in the hills used to contribute to the revenue of the then British Government in India.

Agnihotri (1993) has tried to explain the mode of operation of coal trade between Meghalaya and Bangladesh, where earlier Meghalaya Mineral Development Corporation Ltd. (MMDC) used to work as commission agent. But the mining and supply of coal used to be maintained by the private people. Now total export activities related to coal is totally controlled by the private individuals and there are quite a few number of coal exporters. Madan (1996) also furnished an account of historical development of Indo-Bangladesh economic relations and also highlighted the importance of Joint Economic Commission for the acceleration of trade whose primary component is mineral.

Dutta (2000) has tried to present an account on coal export from Meghalaya to Bangladesh. He has explained the nature of coal trade and the export procedure followed in Borsora (a place in Maghalaya). However, though coal extraction generates huge income and employment in Meghalaya, there is no concrete evidence of investment of export earnings in any other productive sectors of the local economy besides expanding mining and trading operations. While describing the commodity structure of Indo-Bangladesh border trade, Sarma and Goswami (2000) also mentioned about the prime position of coal exported from North -East, especially

from Meghalaya, to Bangladesh. They have also informed how trade with Bangladesh is taking place through different border points of Meghalaya like Dawki and Borsora.

Over the years, coal and limestone together have become the major component of export and after the beginning of new economic policy at all-India level, since 1992 export of coal from Meghalaya has been deregulated and left open to the private exporters (Mero, 2000).

2.3 Impact of Extraction of Coal and its Trade in Meghalaya

Studies on economic impact of coal mining are very few. Only a few studies are there that deal with the environmental impact of coal mining in Jaintia Hills of Meghalaya i.e., those studies basically addressed the adverse impacts of coal mining in the region.

Lamin (1995) has described that coalmining in Jaintia Hills has brought about so many changes like steady flow of labourers from outside as well as from different parts of the state itself to the mining areas of the State. He observed that there is sometimes conflict between the outside labourers and local labourers. He has also mentioned that paddy fields are left fallow as their owners had no time to cultivate due to their preoccupations with mining activity. According to him, the emergence of Ladrymbai market (located in the mining site of Jaintia Hills) is entirely due to coalmining activity. But from the economic point of view it may be mentioned that the coalmining provides an option of easy earning compared to the cultivation for those who coal. Or the profit per unit of investment is more in coal mining and hence it is quite normal that the owners will prefer coalmining. But it is also to be mentioned that the owners themselves internalise the adverse impact of mining on their land productivity. However, if the case be that because of mining of one owner the agriculture or fishery of other person is affected then it is not incorporated in the

decision making of mining and the actual profit enjoyed by the owner is not the true benefit accrued to the society. In that case the decision of the other (farmer, fisher) is affected by the activity of the mining owner (Hanley, Shogren, White, 1997).

Dasgupta *et al.* (2002) have made an attempt to analyse the adverse impact of coalmining on the soil characteristics. Through the testing of soil (nutrients of coalmine areas of different ages) they have shown that the nutritional content declines with the age of mine or with the rising extraction of coal. Also the moisture content, sand, etc. have been increasing over time with the continuous mining activities. According to them, these soil changes make it less suitable for the growth and development of plants.

Rai (2002) has explained the impact of coalmining on environment of Jaintia Hills. He gave a description of how coalmining activity in Jaintia Hills has adversely affected the local environment; exhibited through the shortage of potable water, deforestation, water pollution, increase in wasteland, land subsidence and dust pollution. He also investigated and assigned the adverse environmental consequences to the unscientific primitive techniques and small-scale coalmining operations.

Singh and Swer (2004) have outlined the fact that underground coal production has serious adverse effect on water resources. According to them, unscientific coal mining practised in Jaintia Hills is the primary cause of deterioration of water quality. They also observed that the influx of acid mine drainage into the rivers and streams of the area are mainly responsible for degradation of water quality leading to degradation of aquatic habitat. They also highlighted the acid mine drainage contamination that has adversely affected the various uses of water including agriculture and domestic water supplies.

Sahu and Goel (2004) have assessed the social implications of coalmining in Jaintia Hills. By using the chi-square test they observed that the local labourers and

the local inhabitants did have positive attitude towards the influx of labourers from outside for the purpose of mining activities. They also found that there have been a spur of wine shops and spur of anti social activities due to coalmining activities in Jaintia Hills.

References:

- Agnihotri, S. K. (1993), "Border Trade with Bangladesh", *Journal of North-East India Council for Social Science Research*, Vol. 17, No. 2, October, Pp. 29-36.
- Bhattacharyya, S. (2004), *The Making of a Hill Leader*, Deo Gratias DTP, p-47.
- Bhattacharya, R. N. (2001), "Economics of Natural Resources" in R. N. Bhattacharya (ed.), *Environmental Economics: An Indian Perspective*, Oxford University Press, Chapter. 2.
- Chadwick, M. J. Highton N. H. and Lindman, N. (1987), *Environmental Impacts of Coal Mining and Utilization*, Pergamon Press, pp. 1-27.
- Chakrabarti, S. and Majumdar, S. (2004), "The Coal Reserves of North-East India" in Z. Hussain and S. K. Barik (eds.), *Development and Environment*, Regency Publication, New Delhi, pp. 221-228.
- Conrad, J. M. and Clark, W. C. (1989), *Natural Resource Economics: Notes and Problems*, Cambridge University Press, Chapter-3.
- Dasgupta, P. and Heal, G. (1974), "The Optimal Depletion of Exhaustible Resources", *The Review of Economic Studies*: Symposium on the Economics of Exhaustible Resources, pp. 3-28.
- Dasgupta, S., Tiwari, B.K. and Tripathi, R.S. (2002), "Coal Mining in Jaintia Hills, Meghalaya: An Ecological Perspective" in P.M. Passah and S. Sarma (eds.), *Jaintia Hills: Its Environment, Land and People*, Reliance Publishing House, New Delhi.

- Devaranjan, S. and Fisher, A. C. (2001), Hotelling's "Economics of Exhaustible Resources": Fifty Years Later in U. Sankar (ed.), *Environmental Economics*, Oxford University Press, pp. 86-123.
- Dutta, R. (2000), "Coal Export from Meghalaya to Bangladesh: A Case Study of Borsora Trade Route" in G. Das and R.K. Purkayastha (eds.), *Border Trade: North-East India and Neighbouring Countries*, Akansha Publishing House, New Delhi, Pp. 200-208.
- Gale, J. J. (2000), "Coal and Energy for the Twenty-First Century in India" in P. Audinet, R. R. Shukla and F. Grare (eds.), *India's Energy: Essays on Sustainable Development*, Manohar Publication, New Delhi.
- Goswami, P. J. (2004), "Coal Production in North-East India: Its Impact on Environment and Economy" in Z. Husain and S. K. Barik (eds.), *Development and Environment*, Regency Publication, New Delhi, pp. 290-294.
- Gray, L. (1914), "Rent under the Assumption of exhaustibility", *Quarterly Journal of Economics*, Vol. 28, Pp. 466-489.
- Hanley, N., Shogren, J. F. and White, B. (1997), *Environmental Economics in Theory and Practice*, Macmillan India Ltd.
- Hartwick, J. M. (1977), "Intergenerational Equity and the Investing of Rents from Exhaustible Resource", *American Economic Review*, Vol. 67, pp. 972-974.
- Heal, G. (1978), "Resource Prices and Resource Scarcity", In: *Proceedings of the Wisconsin Seminar on Natural Resource Policies in Relation to Economic Development and International Co-operation*, Vol. 1, Madison: Institute for Environmental Studies, University of Wisconsin.
- Hotelling, H. (1931), "The Economics of Exhaustible Resources", *Journal of Political Economy*, Vol. 39, Pp. 137-73.

- Howe, C .W. (1978), *Natural Resource Economics: Issues, Analysis and Policy*, John Wiley and Sons, New York.
- Johanson, P. and Lofgren, K. (1985), *The Economics of Forestry and Natural Resources*, Basic Blackwell, New York, pp. 23-44.
- Khanna, N. (2001), “On the Economics of Non-renewable Resources”, Invited contribution to *Encyclopaedia of Life and Social Sciences*, UNESCO.
- Kula, E. (1992), *Economics of Natural Resources and the Environment*, Chapman and Hall, London, Chapter-1, Chapter-4.
- Krutilla, J. V. (1967), “Conservation Reconsidered”, *The American Economic Review*, Vol. 57, No. 4, Sept., pp. 777-786.
- Lamin, Henry (1905), *Economy and Society in Meghalaya*, Har-Anand Publications, New Delhi.
- Madan, D. K. (1996), *Indo-Bangladesh Economic Relations and SAARC*, Deep and Deep Publications, New Delhi.
- Maiti, A. and Chakrabarti, S. (2004), “Underground Resources of the North-East: Some Issues and Questions in Z. Husain and S. Barik (eds.), *Development and Environment*, Regency Publications, New Delhi, Pp. 211-219.
- Mero, M. K. (2000), “Exports from North-Eastern Region: Potential and Problems” in G. Das and R. K. Purkayashta (eds.), *Border Trade: North-East India and Neighbouring Countries*, Akansha Pub. House, New Delhi.
- Meadows, D. H., Meadows, D. L., Randers, J. and Behrens, W. (1972), *The Limits to Growth*, Pan Books, London.
- Oldham, T. (1854), *Geology Meteorology and Economy of Meghalaya*, Mittal Publications, Delhi, P. 60.

- Pandey, H. N. (1993), *Studies on Environmental Impact of Coalmining in Jaintia Hills District*, Final Technical Report of the project, sponsored by Meghalaya State Pollution Control Board, North Eastern Hill University, Shillong.
- Rai, R. K. (2002), "Implication of Coal Mining on Environment in Jaintia Hills," Meghalaya in P.M. Passah and S. Sarma (eds.), *Jaintia Hills: Its Environment, Land and People*, Reliance Publishing House, New Delhi.
- Rout, L., De, U. K. and Das, G. (2005), "Dynamics of Coal Extraction in Meghalaya and Its Implication" paper presented in the National Seminar on North East India's Natural Resource Management with Special reference to Meghalaya on 5th June 2005, organised by NEICSSR at Shillong.
- Ross, J. E. (1980), "Natural Limits to Natural Resources" in Peter Dorner and Mohmoud A. El-Shafie (eds.), *Resource and Development*, The University of Wisconsin Press, London, Chapter-3.
- Sahu, B.P. and Goel, N.P. (2004), "Social and Environmental Impact Assessment of Opencast Mining in Meghalaya: A Case Study of Jaintia Hills," in Zahid Husain and S.K. Barik (eds.), *Development and Environment*, Regency Publications, New Delhi.
- Sarma, B. K. and Goswami S. N. (2000), "Border Trade in North-East India: An Overview" in G. Das and R.K. Purkayastha (eds.), *Border Trade: North-East India and Neighbouring Countries*, Akansha Publishing House, New Delhi, Pp. 93-99.
- Singh, O.P. and Swer S. (2004), "Diminishing Life-Sustaining Role of Water in Jaintia Hills of Meghalaya due to Coal Mining", in Z. Husain and S.K. Barik (eds.), *Development and Environment*, Regency Publications, New Delhi.
- Solow, R. (1974a), "On the Intergenerational Allocation of Resources" *Review of Economic Studies* (Symposium), Pp. 29-45.

Solow, R. (1974b), "The Economics of Resources or the Resources of Economics",
American Economic Review, Vol. 64, pp. 1-14.

Solow, R. (1986), "On the Intertemporal Allocation of Natural Resources",
Scandinavian Journal of Economics, Vol. 88, Pp. 141-149.

Syiemlieh, D. (1989), *British and Administration in Meghalaya: Policy and Pattern*,
Heritage Publishers, New Delhi.

CHAPTER-3

METHODOLOGY AND COLLECTION OF DATA

Inquiry about the impacts of coal mining and trading on the economy of Meghalaya with a special emphasis on Jaintia Hills district has been made in four major parts. First of all, spatio-temporal variation in availability, nature of extraction and utilisation of coal are explained. Thereafter, the pattern of coal trade (international and intra-national) in Meghalaya and its changes over time have been described. Then, the impact of extraction of coal and its related activities as well as trade on the income and employment of the state have been examined rigorously. Finally, the impact of extraction of coal on the local economy of Jaintia Hills has been analysed with the help of a sample survey.

3.1 Spatio-Temporal Variation in Availability and Extraction of Coal in Meghalaya

First of all, the spatial distribution of coal deposits and the spatio-temporal variation in production of coal across three hill regions of Meghalaya is explained by tabular method in chapter-4. As data on extraction are available only for few years for all the regions, regression analysis is not possible to have an idea about the inter-regional pattern of growth in extraction. However, for the state as a whole, data on extraction are available since 1960-61 to 2005-06. But the data reveals that before 1978-79 the quantity of extraction was very less and there was a declining trend of it. The production plummeted at 10 M.T. only in 1977-78. At that time, production was

mainly carried out for the local domestic use. After the development of *National Highway* and commercialisation of extraction process we observe over time increasing rate of extraction especially in the Jaintia Hill Region since 1978-79. Hence a regression of the form $\ln Y_t = \alpha + \beta.t$ (where Y_t is the cumulative extraction of coal at time t since 1978-79; t represents time in years and α , β are the two parameters and β represents annual exponential rate of growth of Y_t) is run to find out the over time rate of growth of cumulative extraction of coal in Meghalaya since 1978-79. Here semi-log linear equation is fitted after the careful examination of the scatted diagram of the actual times series data. After estimating the parameters of the equation by the ordinary least square method values of the parameters are substituted in the equation $Y_t = Y_0 e^{\beta t}$ and estimated Y is also substituted by the proved stock, i.e., 118 million tonnes. Solving equation $Y_t = Y_0 e^{\beta t}$ for t (time) we get the estimated number of years after which the estimated stock would be exhausted if the current trend of extraction is maintained and there is no further addition to the existing stock of coal in Meghalaya, i.e., no further new discoveries of coal mine that would be economically exploited. Then the growth in price of coal over the years is estimated and compared it with the existing long term interest rate presuming it to be the representative of the social rate of time preference. This is done to have an idea about the preferences of coalmine owners between present and future stock of coal. Though the data on price was not available directly from the secondary sources, it is calculated from the information collected from the field and compound rate of growth has been calculated. The comparison has been done to know whether the rate of extraction has been going on at the optimal rate in accordance with the Hotelling Rule of resource extraction (Hotelling, 1931).

Thereafter, the pattern of uses of Meghalaya coal is described. As cement is the major industries, utilisation of coal in different cement factories of Meghalaya has

been estimated by using the capacity of production and the technological relationship between the output of cement and input of coal. Similarly, the utilisation of coal in brick kiln and iron re-rolling has been estimated. Total utilisation of coal in the major industries in Meghalaya over time has been described by tabular method. Then, utilisation of Meghalaya coal by the other states of India as well as neighbouring Bangladesh is also estimated from the balance of total output and total estimated internal use in Meghalaya.

3.2 Pattern of Coal Trade in Meghalaya and its Temporal Variation

The nature of coal trade in Meghalaya is analysed in chapter-5. First of all, a historical evolution of coal trade between Meghalaya and Bangladesh has been highlighted. Thereafter, over time changes of export of coal to Bangladesh has been analysed. Also the nature of the local market and temporal variation in export to other regions of the country has been elaborated. As local industries are very limited, internal use of coal would also be very small. Moreover, the pace of coal based industrialisation in Meghalaya has also been very slow. Therefore, the rise in extraction of coal in Meghalaya is presumed to be primarily due to the significant rise in export. Hence, emphasis is given to the analysis of export and its impact on the extraction of coal in the state.

Annual average exponential growth of export to Bangladesh both in percentage terms and in value terms have been explained by fitting semi-log linear equations of the form $\ln M_t = a + b \cdot t$, where M_t is export or percentage of export in the year t . Here b represents the annual exponential rate of growth of export. The effect of export on the rate of extraction has been examined by running log-linear regression of the form $\ln E_t = k + s \cdot \ln M_t$, where E_t represents the extraction of coal at time t . Here s indicates the elasticity of extraction with respect to export of coal.

Before running such regression, the stationarity of the two time series processes E_t and M_t are examined by using the famous Dickey-Fuller test (Dickey and Fuller, 1981). Moreover, over time variation in contribution of export to total export of Meghalaya to Bangladesh during the last decade (for which data are available) has been examined by the similar regression method as used for the estimation of exponential growth of export to Bangladesh. Also, over time growth of coal export through different border points has been explained by the tabular method to know the changes in locational pattern of coal export. Due to non-availability of continuous data regression method is inapplicable in this case. Also a description of Dawki trade route and its modus operandi are described. The volume of unofficial coal trade through Dawki Land Custom Station has been estimated and explained by using both the primary and secondary information. Then trade facilitation bottlenecks which are found at Dawki Land Custom Station have been enumerated.

3.3 Impact of Extraction of Coal and its Trade on the Income and Employment in Meghalaya

Generation of income from the extraction of coal and its trade has been analysed in chapter-6. At first, sectoral and sub-sectoral composition of NSDP has been explained by using tabular method to have an idea about the relative contribution and temporal variation in contribution of mining and quarrying in total and coalmining in particular to the NSDP of Meghalaya. Then over time growth of contribution of coal mining and quarrying to the net state domestic product of Meghalaya and also the variation in royalty collected from coal despatched from the region in absolute term and in terms of percentage to the total revenue earnings of the government of Meghalaya has been described. Also, the contribution of coal mining and quarrying to the net district domestic product of Jaintia Hills region have been

explained by the same method as followed in case of over time growth of coal export to Bangladesh. This is specifically done because Jaintia Hills is the major contributor to total coal production of Meghalaya.

Both income and employment is generated by the coalmining directly and indirectly. Secondary information on income generated in coal mining and its allied activities is not available. Therefore, primary information has been used to estimate the income generated in the coal mining and its related activities. For the purpose of analysis, primary information on different aspects like extraction of coal and income generated by different agents from it and its related activities, employment, transportation expenditure are collected from Bapung, Ladrymbai and Khliehriat coal mining areas and also from the Bapung, Ladrymbai, Khliehriat and Dawki trade centres of Jaintia Hills district of Meghalaya during April-May, 2005. Jaintia Hills region is chosen purposively for the survey as it is the major contributor to the total production and business of coal in Meghalaya (about 70 percent of coal in Meghalaya is extracted from Jaintia Hills region). The areas of Bapung, Ladrymbai and Khliehriat are the main extraction areas of Jaintia hills district. Along with those areas Dawki is the main international trade centre of coal. As the method of extraction is almost similar all over Meghalaya and coal is available at similar depth in all places of Meghalaya having similar other conditions (technology of extraction, wage, ownership pattern, quality etc); cost, revenue, income etc are estimated for the whole Meghalaya on the basis of observations from the samples of Jaintia Hills District.

Experience from the field shows that coal is generally extracted on contract basis and the average cost of extraction per tonne of coal was Rs 800 in 2005. The cost of extraction during the earlier years have been collected from the experienced coal mine owners who have been in mining activity for more than 25 years. Multiplying the cost of unit extraction, which is paid to the labourers with the total

production of coal of the respective year, total income generated by the coal mine labourers is estimated.

The income of the coalmine owners has been estimated on the basis of the difference between the total extraction cost plus other expenditure like (i) the payment to the depot managers (ii) transportation cost for fetching coal from the mining site to the main road depot; and the selling price of the coal at the depot. The variations in the cost of extraction and the selling price have also been considered though it is not significant across different places. The average net income per tonne of coal has been multiplied by the total production of coal of the respective year, to have an estimate of the total income received by the coal mine owners in total. Similarly, loading charge per tonne of coal which was Rs 40 in 2005 has been multiplied by the total amount of coal despatched from Meghalaya in 2005-06, to find out the approximate total income of the loaders. The loading charge which was prevailing in the past years has also been collected from the experienced traders to approximate income of the loaders in the past years. The income of the depot managers has been estimated taking into account the total number of depot managers and their annual income. The salary paid to the depot managers has been collected from the coalmine owners and has also been crosschecked with the information obtained from the depot managers. The total numbers of coal depots are calculated on the basis of total number of coal depots owned by the coal mine owners and others in Jaintia Hills.

The revenue generated by the international exporters and inter-state traders, has been estimated on the basis of the average net profit of the exporters per tonne of coal. Then, the total amount of coal despatched from Meghalaya has been multiplied by the net income per tonne of coal to approximate the income of the traders. The income of the truck owners has also been estimated on the basis of the average net income generated from the transport of one metric tonne of coal and relating it to the

total despatch of coal from Meghalaya. The total income of the managers and assistant managers of the traders has been estimated on the basis of per individual annual income and the total number of employment. The total number of managers and assistant managers has been approximated on the basis of total number of traders (exporters plus inter-state traders)¹. The income of the drivers and handyman has been estimated taking into consideration their annual income and their total number of employment. The total number of trucks used for both the mining and trading purposes gives an idea of the total employment of drivers and handymen. The information relating to the past income of the different units has been collected from those respondents who have worked in coal mining and its related activities for more than 25 years. But it is to be noted that the efficiency of the individuals may change over time and hence the input output coefficients in trade, transport etc and thus the employment and income may not change linearly with the rise in extraction or trade. Hence the estimated past incomes may involve little error. However in the absence of sufficient information, that is the best possible way to do so.

A comparative analysis of trend rate of extraction of coal and the growth of cement production in Meghalaya has been examined by running regression of the form $\ln Y_t = \alpha + \beta.t$ (where Y_t represents either the extraction of coal or production of cement and t represents time and α , β are the two parameters and β represents the rate of growth of Y_t). Also an equation of the type $\ln (Y/E)_t = \alpha + \beta.t$ is fitted to get the differences in trend rate of growth of cement production and extraction of coal, which is measured by the coefficient β .

¹ It may however be noted that the number of managers, assistant managers and traders may change due to the variation in capacity of each of them. Therefore, in the present analysis the capacities or efficiencies of the managers, traders etc have been considered to be the same and thus there might be some bias in the estimation. This is also because of the over time improvement in efficiency, transport facility and other practices. However, in the absence of any other suitable method and information this is the best possible estimation of all such categories.

The impact of coal mining and its related activities on the generation of employment has also been examined. Secondary data on employment separately for the coal mining and its allied activities is not available. Therefore, primary information has been used in the estimation of employment generated by the coal mining and its related activities over the years. The study of 50 coalmine owners reveals the fact that 25 per cent of them have been working for more than 25 years, 20 per cent of them have been working for more than 20 years and 55 per cent of them have been working for more than 15 years. Hence, it is evident that the number of coalmine owners has not been increasing for nearly last 15 years. The survey data on production by coalmine owners also reveals that on an average a coalmine owner annually extracts about 4660 M.T. of coal. Dividing the total extraction of coal in 2005-06, i.e., 5565.71 thousand tonnes by the average quantity of coal extraction by a coalmine owner, the estimated total number of coalmine owners is obtained, 55 per cent of whom have been working for 15 years and 20 per cent for more than 20 years and the rest have been in such activity for more than 25 years. This pattern of changes in number of owners along with the extraction figures over time is used to estimate the number of owners at different years, where the percentage distribution of experience of owners is assumed to be the same over time, which may however change in reality. But in absence of other information in this regard this is the best possible method of estimation.

Regarding coalmine labourers, it is found that generally three man-days are required for the extraction of one tonne of coal. Given the same technology or technique of production, the ratio between labour and output has remained almost constant over the years. Hence, the number of coalmine labourer or man-days generated over the years has increased in proportion to the rise in extraction of coal. But the total number of working days is only 210 days since coal extraction takes

place only for 7 months (from October to April and due to rainy season the extraction work remain suspended during the other months of the year). Therefore, per day coal extraction is estimated by dividing the total annual extraction of coal by 210. Then per day coal extraction figure is multiplied by 3 to get an idea of the total number of coalmine labourers engaged in the field of extraction in that particular year. By using that relationship and the quantity of extraction of different years, estimated employment of miners over the years are estimated.²

In case of loaders, they normally work in a group and 6 loaders constitute a particular group. It is observed that a group of 6 loaders usually load 2 trucks in a day. For them, the total number of working days is 300 since on Sunday no work is done in most of the places of Meghalaya. If we divide the total figure of despatch of coal of a particular year by 300 and again multiplied by 0.20, we get the average number of loaders getting job throughout that particular year³. By multiplying the average number of loaders with 300 we can estimate the total man-days generated in the form of loader in a year due to the extraction of coal and trade. Therefore, it is clear that over time coal extraction and the number of loaders have a constant positive proportional relation which is used to estimate the year-wise employment of loaders in the coal depots of Meghalaya.

For international exporters, it is found that 10 per cent of them have been working for more than 25 years, 20 per cent of them have been working for more than 15 years, 60 per cent have been working for more than 10 years and 5 per cent have been working for more than 5 years respectively. This shows that the number of

² Over the years technology of extraction remained same and hence the labour requirement per unit of coal extraction also remained the same over the years.

³ The average load of a truck is 15 M.T. and if 6 loaders can load 2 trucks in a day, the loaders day requirement would be $6/30$ i.e., 0.20 labour days.

exporters has not been increasing as per the increase in extraction of coal⁴. But after a gap of some years the number has been increasing with the spread of trade. During 2005, the total number of international exporters was 135 in the Jaintia Hills region. But in case of inter-state traders the total volume of transaction of coal is generally found to be more than three times of international exporters. Using this information along with the pattern of over time changes in percentage of exporters (obtained from their experiences) numbers of international and intra-national traders are estimated for different years.

For middleman trader, it is observed from the field experience that one international exporter normally receives coal from two middleman traders. Hence, the number of middleman traders is always linearly related to the number of international and inter-state traders. The same is the case with manager and assistant manager. In transportation, generally employment depends upon the number of trucks owned either by the coalmine owners and traders. The study of coalmine owners revealed that before 1988 each coalmine owner used to possess one Shaktiman truck; but after 1988 the number of trucks under the possession of each coalmine owner increased to 3 or 4. Most of the coalmine owner own coal depots and it is looked after by a manager. The total number of Depot Managers has a direct link with the number of coalmine owner. On the basis of the above discussed linkages, employment generated in the coal mining sector is estimated and discussed.

The indirect employment generated in coalmining is also estimated by considering employment in the petty business activities in the mining area like motor repairing and parts business, tea stalls, grocery shops, telephone booths etc., whose growth in the mining area is contingent upon the expansion of mining activities. This

⁴ This may be due to the fact that some of the exporters have been increasing their volume of trade over the years and generating more and more personal income.

is only a part of the indirect impact generated by the mining of coal. Extraction of coal also partly contributes to the employment and income generated in the industries like cement firms, brick kilns, steel manufacturing and some other industries where coal enters as an input whether in Meghalaya or in other parts of the country.

3.4 Impact of Extraction of Coal on the Local Economy of Jaintia Hills

The district-wise contribution of mining and quarrying to the NSDP of Meghalaya has been elaborated by using tabular method in chapter-7. Thereafter, the contribution of mining and quarrying as well as of coal mining and quarrying to the NDDP of Jaintia Hills has been described by using the same tabular method. Similarly, the impact of extraction of coal and its trading on the income of mine workers of Jaintia Hills has been explained by tabular method and compared with the income of the non-coalmine owners. Then, the impact of extraction of coal and its trade on the position of asset holding of the local people who own coal and who do not own coal has been examined by the tabular analysis. Similarly, the investment behaviour of the coalmine owners for the generation of further employment and income and their interest in human development like education of their children is illustrated by the tabular analysis. Also, the over time changes in credit-deposit ratios of the commercial banks are examined by tabular method to analyse the potential investment pattern at the district level in Meghalaya.

3.5 Collection of Data

The study is based on both *primary and secondary data*. *Secondary data* on regional pattern of coal deposits, extraction of coal in Meghalaya over time, quantity of export from Meghalaya to Bangladesh over time, growth of major industries (like cement) that use coal as input in Meghalaya and their capacities of production etc are

collected from the Directorate of Mineral Resources, Directorate of Economics and Statistics, Government of Meghalaya, Geological Survey of India, Office of the Commissioner of Custom, Government of India, Shiilong, Dawki Land Custom Station, Office of the Central Excise, Shillong respectively. Though data on local utilisation of coal is not available, it is approximated by the total intake of all the major industries (Cement, Brick Kiln and Iron re-rolling) in Meghalaya. Adding this to the total export to Bangladesh we get a value which is subtracted from the total production of the year to have an idea about the export of coal to other region of the country. One can take the number of coal trucks passed through Meghalaya to reach other parts of the Country and approximate the quantity of coal going to those regions. But there is a difficulty as the toll gates in Meghalaya do not keep any record of trucks carrying various articles separately. Moreover, there is the corruption and thus inconsistencies in the information available in this regard.

To analyse the impact of coal mining and its related activities on income and employment of the local economy, *primary data* have been generated on income, annual extraction of coal, duration of mining operation, asset holding position, vehicle ownership, and income from other sources etc for each selected coal mine owner. Similarly, data on annual export, duration of export operation, price of purchase and sell by the exporters are collected from the sample coal exporters; asset holding position including possession of vehicles of the sample owner and non-owners of coalmine are collected from the sample owners and non-owners. Data on engagement in alternative businesses in the mining area are gathered from the truck owners, people engaged in tea stalls, PCOs, grocery shops, motor repairing and motor parts shops. In addition to that employment and income figures of depot managers, assistant managers etc have been collected from them. Also data on wages of the coalmine labourer, their place of origin, daily extraction of coal by them, daily loading by

loaders and their salaries are obtained from the sample coalmine labourer and coal depots. To find out the difference between the earning of the coalmine owners and non coalmine owners, the source and income of the non-coal mine owners are also enquired from the sample non-coalmine owners.

Primary information relating to employment in coal mining and its related activities had been generated by taking a sample study of 200 coalmine labourers, 20 international exporters and 15 coal mines located in different coalmining areas of Jaintia Hills. 50 coalmine owners studied comprise 20 from Ladrymbai, 20 from Bapung and 10 from Khliehriat. A sample of 20 international exporters is chosen from the Dawki Land Custom Stations. 200 coalmine labourers out of approximately 50,000 miners in Meghalaya were chosen as samples out of which 80 were from Ladrymbai, 80 from Bapung and 40 from Khliehriat respectively. Here the sample units are chosen by simple random sampling without replacement and the numbers of units from the respective areas are chosen in proportion to the extraction activities. The areas of Jaintia Hills are chosen purposively due to the concentration of extraction activities in the region (at present, about 70 per cent of coal production in Meghalaya comes from the Jaintia Hills). Moreover, for the comparison of wage income of the coalmine labourers and non-coalmine workers who are engaged otherwise, a survey of 100 non-coalmine labourers have been done along those 200 coalmine labourers. The sample of non-coalmine labourers has been chosen in the same way as followed in case of coalmine labourers.

Out of nearly 500 coalmine owners in Jaintia Hills region, 50 coal mine owners are selected by using the technique of stratified sampling method. 20 exporters have been chosen out of total 135 international exporters, who have been operating at Dawki Land Custom Station of Jaintia Hills.

3.6 Limitations of Data:

Data on availability of coal in Meghalaya obtained from the Directorate of Mineral Resources (DMR), Government of Meghalaya and Geological Survey of India (GSI), Shillong shows a wide discrepancy in the total deposit. The total reserve of coal available in Meghalaya is around 565 million tonnes in 1998 according to DMR, Government of Meghalaya. While, the total reserve of coal in Meghalaya is around 459 million tonnes in 2004 according to the GSI, Shillong. Data on domestic use of coal in Meghalaya is not available and hence it is estimated by the method mentioned earlier. But due to the non-availability of exact information on the use of coal in all the local industries and its domestic use there might be some error. Similarly, the estimation of employment and income for the previous years may involve some error due to the reasons mentioned above. Moreover, a major portion of coal is exported to the other states of India. However, there is no official record of it and hence it is estimated indirectly as mentioned above. In spite of huge gap in the secondary data and problem in obtaining primary information, suitable methods have been adopted here for the approximations that provide us useful insights about the coal activities and its impact on the economy of Meghalaya.

References:

- Dickey, D. and Fuller, W. (1981), "Likelihood Ratio Tests for Autoregressive Time Series with a Unit Root." *Econometrica*, Vol. 49, pp. 1057-1072.
- Hotelling, H. (1931), "The Economics of Exhaustible Resources", *Journal of Political Economy*, Vol. 39, Pp. 137-73.

CHAPTER-4

AVAILABILITY AND UTILISATION OF COAL IN MEGHALAYA

4.1 Background

Natural resources are the key factors for the nation's economic growth and development. Therefore, the pattern of social and economic development of a region is greatly affected by the availability and utilisation of natural resources in and around that particular region. In other words, the long-run prospects of an economy have been subjected to constraint supply of critical natural resources especially the exhaustible resources. With the growing scarcity and rising prices of some essential natural resources, human being have been trying to switch over to relatively cheaper alternatives and creating newer resources through the development of science and technology over time. But, still now they have to depend on natural resources to a great extent for sustaining their progresses, as there is always a limit beyond which the substitution of essential natural resources by the human or any other resources is not possible. In the beginning of the nineteenth Century, economists like Thomas Malthus (1815) and David Ricardo (1817) had highlighted their concerns about the emerging scarcity of natural resources in the face of rapidly growing population. In India, very fast growth of population was observed in the second half of the 20th Century and demand for resources also grew faster even more than that of the generation of alternatives resources and therefore Meadows *et al.* (1972) in the *Limits to Growth* raised doubt about the sustainability of growth of the economies because of the exhaustibility of critical natural resources. Sustainable harvesting of resources thus

became an important issue for the preservation of scope for future growth of the economy. In spite of continuous effort for long period of time, people have been struggling to find out the optimal rate of extraction of non-renewable natural resources so as to maintain the balance between the future and the present growth of the economy¹. Julian Simon (1981, 1996), Simon and Myers (1994), however argued that the world was not running at the risk of shortage of resources. Growing population in many cases helps economic development and better management of resources through their effort and improving knowledge, innovation etc. Thus human being continuously learns how to overcome the bottlenecks imposed by the nature. Gale Johnson (2000) also tried to prove through evidences that in spite of huge population growth in the last century the scope and level of well-being has not declined, rather it increased manifold. Still the debate on the necessity and level of resource management are going on.

The neoclassical free market economists however gave their counter-arguments against the principle of limits to growth that the rising cost and prices of existing exhaustible resources would lead to the development of the substitutes available at relatively cheaper rate and the growth process would not stop.

But there is an uncertainty about how far the substitutability of those resources will be possible in reality though continuous efforts have been in place across the countries for making the principle of weak sustainability a real one through the continuous improvement of technology and the human resources. The strain of resource has already been felt in respect of oil and the gravity of the problem has been understood from the “energy crisis of 1973”. The United States along with the rest of the industrialised world suffered a major recession as a result of the oil crisis (Howe,

¹ This is primarily because of the uncertainty about the future discoveries of newer mines and realisation of expected or inferred stock of resources. Also it depends on the rate of technological progress and probability of development of alternative substitutes of the concerned resources.

1978). In the past few decades also, the observation of rising pollution level due to the rising consumption of fossil fuels across the countries has become serious concern and drew attention of many researchers and policy makers to find out ways and replaceable environment friendly resources. Population control has also been suggested as alternative ways to reduce the consumption of fossil fuel and other scarce resources. However, critics like J. Simon (*op. cit.*) has shown that price of major non-renewable resources, which have been very important for the development of civilisation, has not really increased and by using simulation technique, he also predicted that with the existing stock of resources; the world economy can continue to grow for nearly 17 million years. In his analysis, he has taken into consideration the pattern of population growth, resource utilisation and other socio-economic variables during the first three quarters of the last century. However, considering the regional imbalances of resource availability, utilisation, population growth, nature of human resources and pollution hazards and degradation of natural resources, one cannot ignore the need of attention towards natural resource management especially of non-renewable resources.

Around 55 per cent of total coal deposit of North East India is available in Meghalaya. In absolute sense total reserve is about 460 million tonnes (Geological Survey of India, 2004). If we look at the extraction of coal, we observe a rapid growth in the production of coal in Meghalaya since 1960 that has been contributing significantly to the local economy. The demand for coal of Meghalaya has also been rising over time due to the growth of brick kiln, cement and some other industries in neighbouring Bangladesh and rising scarcity of coal in other regions of India though there has been very slow growth of related industries in Meghalaya. The rapidly rising extraction of resources has raised doubt about the sustainability of the extraction process and economy of those who depend primarily on coal for their welfare. This

chapter is devoted to analyse the availability, regional distribution and pattern of utilisation of coal over the years in Meghalaya.

4.2 Review of Earlier Studies

There are some studies relating to the problem of extraction and utilisation of non-renewable resources that may be tenable to the analysis of extraction and economy of coal in Meghalaya. A series of path-breaking works were completed in 1960s and 1970s; where the economists systematically investigated the efficient and optimal depletion of resources, both renewable and non-renewable. However the original works on optimal depletion of exhaustible resources dates back to Gray (1914) and the classic paper by Hotelling (1931), which provided a foundation upon which the later resource economists like Dasgupta and Heal (1974), Heal (1978), Solow (1974a and 1974b, 1986) and Hartwick (1977) developed their more general and extended structure of analysis.

Hotelling (1931) presented a comprehensive study on extraction principles of exhaustible resources under competitive and monopoly market situations. According to him, a competitive resource owner does not find any difference if he receives for a unit of his product a price P_0 now or a price $P_0 e^{rt}$ after a period of t years. In other words, equilibrium price of extracted exhaustible resource must grow at the rate equal to the rate of interest if extraction is done efficiently and under competitive condition. It indicates that the present discounted value of unit extraction will be the same for all the periods. However the nature of demand function has an important role to play for the extraction of resources especially for a monopolist. The variation in difficulties of extraction affects the exploratory effort and thus the decision of extraction under different market conditions. Also the distance from the extraction site to the end use has

serious impact on the price and thus rate of extraction. In Meghalaya, as the coal is available very near the Earth's surface, there is very little change in exploratory effort and hence the production decision. But distance and difficulties of transport matters much in the differences of rate of extraction across the hill regions.

According to Chadwick *et al.* (1987), there has been a rapid decline in the ratio of energy consumption to industrial output in the seven largest OECD countries in response to oil price rises. In spite of substitution of coal in different sectors, coal would have been extensively used in the power sector and heat requirements in other energy-intensive industries of those countries such as chemicals, paper manufacture, building materials and petroleum refining would have raised scope for the additional utilisation of coal in place of oil and gas. During last few decades we also observe a similar trend for the rising demand for thermal power to maintain the industrial development of those countries. However, because of rising concern about the pollution generated due to excessive consumption of coal; a gradual shift has been taking place towards other form of energy in those countries.

Krutilla (1969) has highlighted problem of allocation of resources for the present and future with unspoiled natural environments, for which the market fails to make adequate provision. He has mentioned that a private resource owner would consider the discounted net income from the alternative uses and select the use, which would hold prospects for the highest present value. The private resource owner would not be able to receive appropriate value of resources when he will extract resource used in compatible with preserving natural state. He explained that open pit mines may be refilled and surroundings rehabilitated in a way to approximate the original conditions, but even here the undertaking cannot be accomplished without the co-operation of the nature.

Ross (1980) has described the issue of natural resource scarcity. In this context he has highlighted the problems raised by Meadows and others in their book *The Limits to Growth*. He has raised the issue of sustainable growth of output in the face of scarcity of exhaustible resources. In his opinion, lack of accurate knowledge on most of the world's resources is the greatest problem to estimate the nature of resource scarcity. He also highlighted the importance of carrying capacity and environmental limits beyond which there would be many problems for the existence of mankind.

Johanson and Lafgren (1985) have concluded that the objective of each resource owner is to maximise the present value of income from extraction of non-renewable resources. For measuring the present value of the stream of income from extraction of an exhaustible resource over time, he has used equation $P_v = \int_0^{\alpha} P(t) h(t) e^{-rt} dt$, where $h(t)$ is the quantity extracted at time t and r is the interest rate with $r > 0$. $P(t)$ represents that the price of the resource changes with the passage of time along with the changing demand and supply and P_v is the present discounted value of the stream of income.

It is generally observed that the competitive industry initially exploits the resource at a higher rate, and also exhausts the resource more rapidly than a monopolist. On the other hand, the monopolist restricts production so as to maintain a higher price and earn reasonably high profit for a long period of time (Conrad and Clark, 1989). If there is no cost of extraction, a monopolist would set optimal rate of extraction by maximising $\pi = \int_0^{T_m} P(q^{(t)}) q^{(t)} e^{-\delta t} dt$, where $P(q^{(t)})$ is the inverse demand function and δ is the social rate of discount. In equilibrium however the marginal revenue from the extraction of mineral must rise at the rate of interest. The socially

optimum rate of extraction will be obtained under perfect competition by maximising

$$\int_0^T \left[U \left(\sum_{i=1}^n q_i(t) \right) - \sum_{i=1}^N C_i(q_i(t)) \right] e^{-\delta t} dt$$

Subject to $R_i = -q_i(t)$, $R_i(o) = R_i$ and $R_i(t) \geq 0$.

Here R_i is the rate of extraction and C_i is the total cost of extraction.

In equilibrium, the extraction will be done at a rate for which price increases at the social rate of discount δ . The result will be similar whether resource owners are of equal size or not. Kula (1992) has discussed the views of Malthus, Ricardo, Mills, Jevon and Pigou on natural resource scarcity and explained how changes in interest rate, extraction cost as well as taxation affect the optimal rate of extraction of exhaustible resources in the same way.

Lamin (1995) has made an attempt to describe the nature of commercial exploitation of coals in Bapung (in Jaintia Hills). A large number of people in Bapung area are engaged directly or indirectly in coal business for several years. He found that the mining sector is paying very high wages to the labourers compared to other agricultural activities, which is the main reason why more labourers are attracted to the mining area from different places of the state and outside the state².

Gale (2000) has made an attempt to explain the utilisation of coal in different sectors like power, cement, iron and steel and fertiliser in India. He also presented an account on expected future coal demand in different industrial sector. Utilisation of coal was expected to be more and more due to expanding construction activities and more requirement of electricity where utilisation of coal is very extensive in India³.

² A field survey by the researcher during April-May 2005 in Bapung coal mine areas also found that the daily wage of miners was around Rs 275, whereas the daily wage of agricultural labourer at that time was about Rs.120 – Rs.150.

³ The substitution of coal by other energy resources in India will take a long time as still now very little energy is being generated from non-conventional sources and nuclear sources except the water resources. Hence, to meet the rising energy requirement, coal is still an important option.

Khanna (2001) has argued that non-renewable resources not only have a fixed stock, they are also in limited supply relative to the demand for them. In her opinion, coal may be considered as renewable since vast stock is still remaining in the world. But in Meghalaya the stock of coal is not so vast (118 million M.T. of proved reserve) which would be exhausted within 2-3 decades if the current rate of extraction continues. Hence coal cannot be considered as renewable resource in Meghalaya from that point of view.

Bhattacharya (2001) has presented a comprehensive account on the principle of extraction of exhaustible resources. He has mentioned that optimal rate of extraction of exhaustible resource is guided by the marginal cost of extraction and its user cost. It is optimal for a competitive resource owner to extract the resource in each period to that point where the marginal cost of extraction plus the user cost equals the market price. He highlighted that the current extraction rate by a private owner of a natural resource depends not only on the current price, as in the standard theory, but also on an expectation about future prices. Following Hotelling Rule (1931, *op. cit.*) if a competitive supplier expects future price to be sufficiently low compared to the current price, he may extract and sell intensively in the current period and vice versa.

Devaranjan and Fisher (2001) analysed the “Hotelling Rule” which states that the price of an exhaustible resource must grow at a rate equal to the rate of interest both along an efficient extraction path and in competitive resource industry equilibrium. They highlighted the role of cumulative production and uncertainty in case of extraction of exhaustible resources.

Chakrabarti and Majumdar (2004) have outlined the quantity and quality of the coal reserves of North-East India. . The production of coal in Meghalaya is generally controlled by a huge number of cottage mining units. They also highlighted the

possibility of utilisation of coal produced in North-Eastern states for the development of industries like fertilizer, cement, textile, paper, brick burning and pottery as well as in power generation. They have also mentioned some of the demerits like slaughter mining, lack of conservation and unscientific methods, which are found in the coal mining of the region.

4.3 Availability of Coal in Meghalaya

Coal available in Meghalaya, popularly known as “Tertiary Coal” is generally of sub-bituminous composition. It contains low ash, high volatile matter and has a high calorific value. However, it suffers from its high content of sulphur.

The history of discovery of coal in Meghalaya dates back to 1815 when Mr. Stark (an officer of Geological Survey of India under East India Company) reported that he had found some beds of coal in the lower hills of Sylhet, from where he forwarded specimens to the then Government for the examination and consideration for the exploration of the resource. The sample was examined at the Gun Foundry at Cossipore and the favourable report was given for the possibility of extraction of coal. In 1832, Mr. Cracroft brought to the public notice the existence of beds of coal close to the station of Cherrapunjee. But, the extraction of coal was meagre due to the lack of market to sell these extracted coals (Oldham, 1854). In 1971-72, further investigation of coal was done in the adjoining areas of Bapung and Pamura villages of the present day Jaintia Hills District. The coal seam found in these areas ranged from 0.30 to 1.20 metres in thickness and the average thickness was 0.50 metres (Lamin, 1995). The probable reserve of coal was estimated to be 7.6 million tonnes. The availability of coal resources in different coalfields of Meghalaya as obtained from Geological Survey of India (2004) is shown in table-4.1.

Table 4.1
Coal Reserves Across Different Coalfields of Meghalaya (in million tonnes)

Name of the Coalfield	Proved	Indicated	Inferred	Total
Bapung Coalfield	11.01	0.00	22.65	33.66
Other Jaintia Hills Coalfield	0.00	0.00	3.65	3.65
Langrin Coalfield	11.34	7.20	31.46	50.00
Mawlong-Shellia Coalfield	2.17	0.00	3.83	6.00
Other Khasi Hills Coalfield	0.00	0.00	7.09	7.09
West Daranggiri Coalfield	93.31	33.69	0.00	127.00
Balphakram-Pendenguru Coalfield	0.00	0.00	107.03	107.03
Siju Coalfield	0.00	0.00	125.00	125.00
Total	117.83	40.89	300.71	459.53

Source: Geological Survey of India, Shillong.

Table-4.1 shows that approximately 460 million tonnes of estimated coal deposits are available in Meghalaya of which, around 118 million tonnes are proved reserves, 40.89 million tonnes are indicated and 300.71 million tonnes are inferred reserves. Among all the coalfields, West Daranggiri coalfield of Garo Hills region has the highest deposit of over 93 million tonnes of proved reserves, which is followed by Langrin coalfield and Bapung coalfield of Khasi Hills and Jaintia Hills respectively with proved reserves of around 11 million tonnes each.

4.4 Techniques/Methods of Coal Mining in Meghalaya and Ownership Pattern

By and large the extraction of the coal in Meghalaya is privately controlled by small-scale ventures.⁴ The existing mining regulations of Government of India remain inoperative in the state due to the prevailing land tenure and ownership system. Because of its suitability to the geographical condition, still now traditional “Rat-hole method” is widely practised for the extraction of coal in different parts of Meghalaya. The method is so named because literally, the hole has barely one metre opening along which the miners crawl and excavate coal. The coal miners go inside up to 50-100

⁴ Traditional community ownership of the land and forest is prevalent in Meghalaya. But after the discovery and realisation of the commercial importance of coal and other minerals, privatisation of the community land with rich minerals has been observed. Now each small coalmine is under the ownership of private individual.

metres in length from the opening. Therefore, the method adopted by the miners in Meghalaya to extract coal in the opinion of many researchers is unscientific, as the safety and security of miners and workers are not taken into consideration (Rai, 2002). However, till now very few accidents have been reported in the mining sites, which is very unlikely. Rather, for small owners, due to economies of scale of operation and the type of availability and geographical condition does not allow application of modern technology in many cases.

Though coal and other minerals are national property and hence mining in major areas are owned and controlled by the Government agencies, in areas under sixth schedule like Meghalaya people enjoyed the privilege of owning minerals like coal privately. Hence, in Meghalaya, coal is extracted by individual coalmine owners. According to the Sixth Schedule, the State Government is only entitled to collect royalty and it is shared between the State Government and the respective Autonomous District Councils. But in 1985-86, there was a move to have coal mines of Meghalaya nationalised. Late Professor G. G. Swell (ex-Member of the Parliament from Meghalaya) made a great effort to exclude the coalmines of Meghalaya from being nationalised (Lamin, 1995). Since it was considered to be a cottage industry it was exempted and left for the local inhabitants for their utilisation and businesses. So the Government of Meghalaya also gave up the idea of taking over the mines (Lamin, *op. cit.*). However in recent past because of difficulty of operation and lack of capital, the local community owner of the Nangalbibra area of Garo Hills has made an agreement with Coal India Ltd, which has opened sites there and started mining coal since 1990. This is the first such agreement with any such government agency which has just started operating in the area.

4.5.1 Spatial Distribution of Coal Deposits in Meghalaya

Coal reserve is found almost all over Meghalaya extending from Jaintia Hills in the East to East and West Khasi Hills and ending in East Garo Hills District in the West. Generally, the areas of coal deposits are described under three broad heads: (i) Areas of coal deposits in Jaintia Hills; (ii) Areas of coal deposits in Khasi Hills; (iii) Areas of coal deposits in Garo Hills. Table-4.2 illustrates the area-wise distribution of coal reserves in the state of Meghalaya. Though from the record of Geological Survey of India we find about 460 million tonnes of coal reserves including proved, inferred and indicated, the Directorate of Mineral Resources of government of Meghalaya estimated the figure to be around 565.81 million tonnes, as shown in table-4.2. From the table it is observed that Garo Hills has the highest amount of coal deposits with around 63 per cent of total reserve of Meghalaya and Jaintia Hills has the lowest amount with figure stands at merely 7.5 per cent of the total reserves of the state.

Table 4.2

Spatial Distribution of Coal Reserve in Meghalaya

Area/District	Reserve (in million tonnes)
Jaintia Hills	42.31 (7.48)
Khasi Hills	164.50 (29.07)
Garo Hills	359.00 (63.45)
Total	565.81 (100)

Source: Directorate of Mineral Resources, Government of Meghalaya.

Note: Figures in the parentheses represent percentage to total.

4.5.2 Coal Reserves across Different Coalfields of Three Hills Regions of Meghalaya

There are major seven areas in Jaintia Hills where coal is available. Bapung and Khliehriat are the two important coal deposit areas in Jaintia Hills that produce major portion of coal in Meghalaya each year. Out of total estimated reserve of 42.31 million tonnes available in the region Bapung and its adjoining areas have about 80 per cent of the deposit (33.66 million tonnes) as shown in table-4.3.

Table 4.3

Estimated Coal Reserves in different Coalfields of Three Hills Regions of Meghalaya (million tonnes)

Hills	Coalfields	Proved	Indicated	Inferred	Total
Jaintia Hills	Bapung	11.01	-	22.65	33.66
	Khliehriat	-	-	5.00	5.00
	Sutnga	-	-	0.88	0.68
	Lumshnong	-	-	0.20	0.20
	Lakadong	-	-	0.53	0.53
	Jarain-Skentalang	-	-	1.00	1.00
	Loski	-	-	1.24	1.24
	Sub-total	11.01	-	31.30	42.31
Khasi Hills	Laitryngew	-	-	2.74	2.74
	Cherrapunjee	-	-	19.00	19.00
	Laitduh	-	-	31.50	31.50
	Pynursla	-	-	0.40	0.40
	Mawlong-Shella	NA	NA	NA	13.05
	Lumdidom	-	0.20	-	0.20
	Langrin	-	97.61	-	97.61
	Sub-total				164.5
Garo Hills	West Darranggiri	64	-	63.00	127.00
	Siju	-	-	125.00	125.00
	Pendengru-Balphakram	-	107.00	-	107.00
	Selsela	-	-	-	NA
	East Darranggiri	-	-	-	NA
	Sub-total				359.00

Source: Directorate of Mineral Resources, Government of Meghalaya.

Note: NA means not available.

Khasi Hills has been endowed with a huge amount of coal reserves. Langrin, situated in the South-Western part of Khasi Hills, is one of the important coal deposit areas in Khasi Hills region. Table-4.3 shows that the coalfields of Langrin area have estimated deposits of 97.61 million tonnes, which is approximately 60 per cent of the total reserve of the Khasi Hills. Two other important coal reserves within these hills are Cherrapunjee and Laitduh with over 50 million tonnes of total reserve.

Garo Hills are the hosts of major coal reserves in Meghalaya with about 359 million tonnes of estimated total reserve. But over two-third of the total reserve are indicated and inferred. The proved reserve is about 64 million tonnes (about 18 per cent of total deposit). Thus the production in Garo and also Khasi Hills is not in proportion

to the deposit in comparison to the Jaintia Hills⁵. West Darranggiri is the most important coalfield in Garo Hills of Meghalaya with 64 million tonnes proved reserves. Besides this there are Siju and Pendengru-Balphakram where huge amount of coal is available but mostly not proved yet. Selsela and East Darranggiri areas are also expected to have coal deposit that is yet to be estimated.

4.6.1 Production of Coal in Meghalaya

Extraction of coal in Meghalaya dates back to 1815 when Mr. Stark offered to supply any required quantity to the Government (Oldham 1854; p.57). But the production of coal in Meghalaya did not acquire commercial significance due to the difficulty and expense of carriage. So it can be said that use of coal was very limited during the British regime. But coal extraction gained momentum in Meghalaya with the improvement of accessibility and when Shillong-Jowai-Badarpur road was improved to the level of National Highway that made communication of coal from this region to other areas of the country easier. Besides that, the emergence of Bangladesh as an independent country in 1971 boosted up the import demand for meeting the input requirements of different industries there and encouraged production of coal in neighbouring Meghalaya. The table given in the Appendix-4.1 shows the production of coal in Meghalaya over the years.

The systematic data on production of coal in Meghalaya is available from the year 1960 and it shows that the production at that time was at very low scale to mainly meet the domestic needs of the people and some very small-scale industries. Production of coal in Meghalaya was only 122 thousand tonnes in 1978-79; and went up to 521 thousand metric tonnes in 1981 that further steadily rose to 2241 thousand

⁵ Experience shows that some more production of coal have been going on and exported to Bangladesh directly. But those have never been recorded due to corruption and to avoid the royalty payment by the owners and exporters in those areas.

tonnes in 1990-91. The production kept on increasing and by the year 2005-06 production of coal in the state touched 5565.714 thousand tonnes.

4.6.2 Spatio-Temporal Variation in Production of Coal in Meghalaya

Data on region-wise production of coal in Meghalaya were available since 1987-88 that has been presented in table-4.4. From the table, it is evident that the major portion of production of coal in Meghalaya comes from Jaintia Hills. It has always been 70 per cent or more of the total production of coal in Meghalaya since 1987.

Table 4.4
Spatio-Temporal Variation in Production of Coal in Meghalaya
(’000 metric tonnes)

Years	Jaintia Hills	Garo Hills	Khasi Hills	Total
1987-88	1321.00 (91.22)	83.60 (5.79)	43.40 (2.90)	1448.00
1990-91	3059.70 (81.65)	530.80 (14.16)	156.50 (4.17)	3747.00
1994-95	2389.70 (73.21)	752.80 (23.06)	121.50 (3.72)	3264.00
1999-00	2935.90 (72.31)	907.00 (22.33)	217.10 (5.34)	4060.00
2002-03	3089.03 (70.26)	910.70 (20.71)	396.57 (9.02)	4396.30
2005-06	3879.73 (69.70)	1120.53 (20.13)	565.44 (10.15)	5565.70

Source: Directorate of Mineral Resources, Government of Meghalaya.

Note: i) Value in parenthesis represents percentage to total; ii) Production of coal in different hill regions of Meghalaya is presented chronologically in Appendix-4.2

In absolute sense the total production in the state has increased from 1448 thousand M.T. during 1987-88 to 5565.70 thousand M.T. during 2005-2006. Where as, during the same period the production in Jaintia Hills has increased from 1321 thousand M.T. to 3879.73 thousand M.T. However in terms of percentage, the contribution of Jaintia hills to total state level production has declined from 91.22 per cent during 1987-88 to 69.70 per cent during 2005-06, which indicates that rate of growth of production in the other region of the state has been much higher than that of Jaintia hills. This is quite natural as the total reserve of coal in Jaintia hills is much

lower (around 7.5 per cent) than the other hill areas of the state. Though the deposit of coal in the Khasi and Garo hills are comparatively much higher the production in those areas has always been very small compared to that of Jaintia hills. However production in these two hill areas has been increasing over time as is clear from the rise in percentage of production in these areas to total production of the state.

4.6.3 Nature of Coal Extraction in Meghalaya

Coal is one of the important exhaustible resources of the state of Meghalaya. It has an important implication for the development of the state. Though total reserves including indicated one and the inferred amount are 460 million tonnes, total proved stock is only 118 M.T. It is yet to ascertain whether the indicated and inferred amount would be economically exploited or not. As mentioned earlier the extraction was going on a very minor scale since 1960s, which had been very small in quantity and through surface mining or rat-hole mining process with the help of manual labour. Production was primarily for meeting the internal domestic need of the people. Large-scale extraction has been started on an increasing scale since 1978. Though the quality of coal is not of very high standard, due to increase in scarcity in other regions of the country and improvement of communication, coal of Meghalaya is being exported to other regions where it is mixed with the good varieties for industrial use. Most of the mines are owned by the private individuals, where it is normal that they will be guided by the profit maximizing principle and hence utilise the resource judiciously. Whereas we observe over-exploitation of coal, as has normally happened in case of open access common property resources (Hardin, 1968). If the current trend of extraction continues, how long the present estimated stock would last and what would be possible consequences of such extraction is examined in this section.

The data on extraction of coal in Meghalaya, which have been presented in the Appendix-4.1, has been collected from the Directorate of Mineral Resources, Government of Meghalaya. For the purpose of analysis, the extraction of coal in Meghalaya from 1978 has been considered, since when a systematic pattern of extraction over time is observed and extraction started commercially. Then cumulative total extraction over the years has been calculated. Considering the cumulative total extraction over the years from 1978 to 2005 a model of the type $Ln Y_t = \alpha + \beta t$ is fitted.

Where Y_t represents cumulative total extraction up to time t , i.e., $\sum_{k=0}^t Y_k$ and α, β are the two parameters. Here β represents the exponential rate of growth of cumulative extraction of coal over the years. Here semi-log linear equation is fitted after the careful examination of the scatted diagram of the actual times series data. After estimating the parameters of the equation by the ordinary least square method, the values of the parameters are substituted in the equation and estimated y is equated with the proved stock, i.e., 118 million tonnes. Solving the equation $Y_t = Y_0 e^{\beta t}$ for t , we get estimated time period, which indicates the number of years after which the estimated stock is expected to exhaust if the current trend of extraction is maintained and there is no further addition to the existing stock of coal in Meghalaya, i.e., no further new discoveries of exploitable coalmine and the coalmine extractors have the incentive to do so.

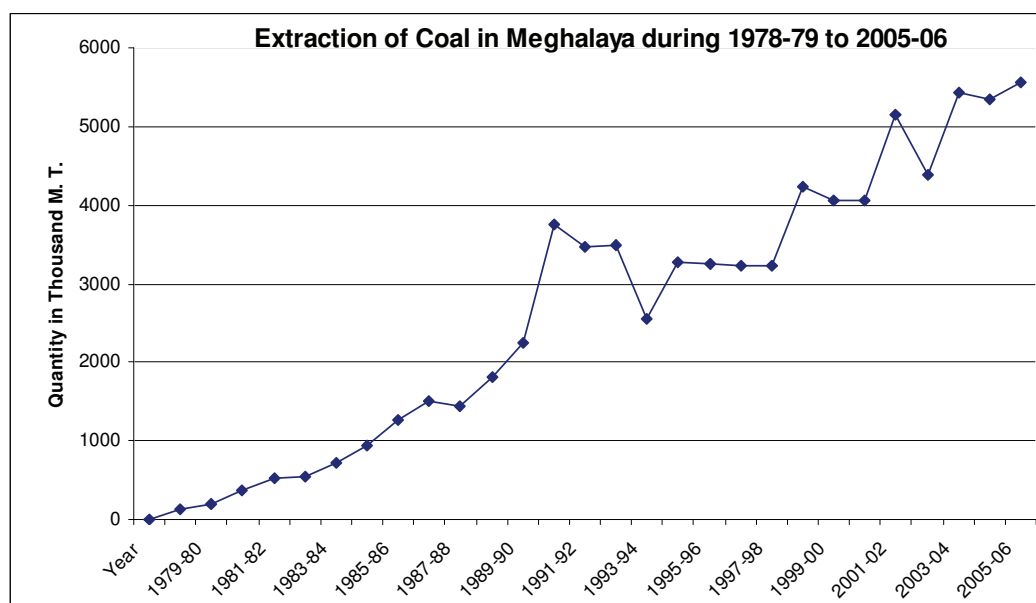
Thereafter the growth of coal price over the years is considered and compared with the existing interest rate presuming it to be the representative of the social rate of time preference. This is done to know whether the coalmine owners give much importance to the future or in what way they value the future stock i.e. to know whether the extraction has been going on according to the principle of Hotelling rule. Though

the systematic data on price was not available directly, we have calculated the price taking information from the field and compound growth rate has been calculated accordingly⁶.

Observation

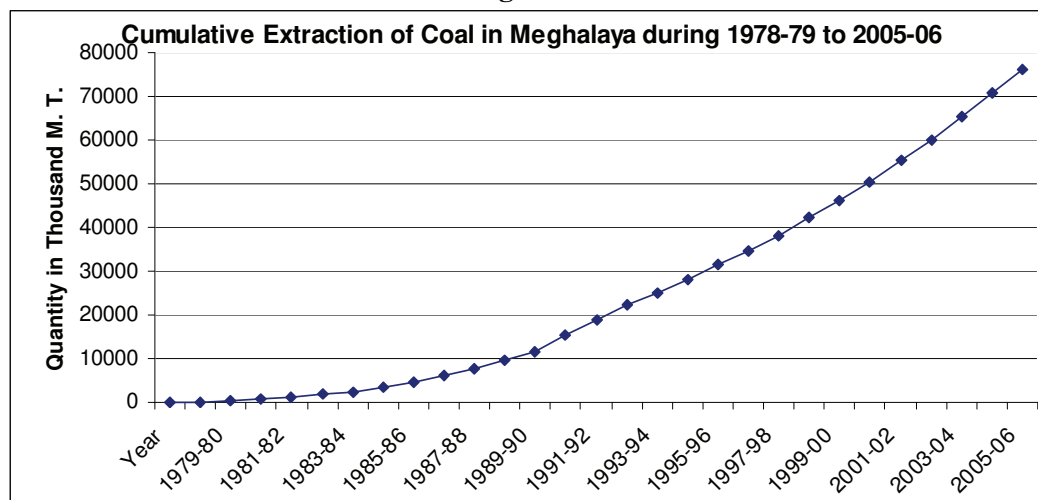
Data presented in Appendix-4.1 shows that the rate of extraction of coal in Meghalaya was at much lower scale before 1977-78. Moreover, the extraction was declining over the years and in 1977-78 it was only 10 thousand tonnes, which may be due to the social disturbances and non-availability of mine workers at that time. Since 1978-79, there has been increasing rate of growth of coal extraction in the state. Over time extraction and cumulative extraction of coal in Meghalaya since 1978-79 has been shown in the diagram-4.1 and diagram-4.2 respectively.

Diagram-4.1



⁶ The cost of extraction has not increased with the extraction of coal; though technology of extraction has not changed significantly in Meghalaya. As most of the deposits are near the Earth's surface between 100-300 metres, even if extraction is carried out manually labour cost in physical terms remain more or less identical, only cost may rise proportionally to the changing money wage rate over time.

Diagram-4.2



After using Ordinary Least Square (OLS) method we observe that the annual exponential rate of growth of cumulative extraction is 21.1357 per cent, which is highly significant. The estimated equation is

$$L_n Y_t = 6.43 + 0.1994t \quad R^2 = 0.8843 \quad \dots\dots\dots (4.1)$$

(0.014),

The term in the bracket indicates the standard error of the coefficient β . Putting estimated Y equals to 118000 thousand tonnes, and solving the equation we get the value of t as 34.48 i.e., around 35 years. Even if we assume that some amount had already been extracted before 1978 and we deduct it from the estimated 118000 thousand tonnes available stock and equate with the cumulative stock, we get the result as t equals to around 34 years. There is not much difference in the result, because, the cumulative total extraction up to 1978 was very small in quantity with respect to the available resources.⁷ If the total inferred and indicated reserves are materialised then the stock would exhaust in around 43 years. As 27 years have already been elapsed it would last another 15 years.

⁷ Here it should be noted that the estimated value of $L_n Y_0$ is not considered, rather the actual value of Y_0 and the estimated figure of growth rate has been taken into consideration

Data on price of coal is not available for a long period of times as well as for continuous years. Hence regression method is not applied to estimate the trend rate of growth. Whatever data is available from 1994-2002 is used to find out annual average compound rate of growth. Annual average compound growth of that price is calculated to be around six per cent from 1994 to 2002. This was much lower than the long-term interest rate (though declining) in the commercial banks existing during that period. This was an indication of lower time preference of the coalmine owners for the future than what it would have been. That means they are not much concerned about the preservation for the future and they value their present welfare more than the future. This is because the long-term interest rate has been higher than the rate of growth of price of coal (in spite of removal of administrative control over the price of coal since 1998). Therefore extracting coal and investing in secured bank deposit the coal owners can earn more than if they preserve and extract in future. Moreover there is uncertainty in future as (i) quality of coal in Meghalaya is not very high. Hence the export demand in Bangladesh may not increase if price is increased as they can import from other country (Australia) good quality coal at reasonably lower rate, (ii) the land tenure system may change and there is always a fear of losing ownership right due to unforeseen nationalisation movement of coal, (iii) if alternatives of this type of coal is available in future, it would remain unutilised and demand may reduce drastically in the market. Therefore, in economic sense the present owners are rationale in their behaviour regarding the pattern of extraction of coal in Meghalaya.

From the overall analysis, it becomes clear that if the current trend of exploitation of coal in Meghalaya is continued then it will not last for a long period of time. Even if we assume that a considerable portion of indicated and inferred stock will be available it will not take much time to exhaust the deposit of coal under earth surface

of Meghalaya, unless judicious approach is adopted to utilise the same. Though in many countries technologies have been changing to find alternative of coal, in India coal is still being extensively used for domestic purposes, in iron and steel, cement and other industries and also in thermal power projects. India will have to go a long way to obtain economically full-scale substitutes of coal either on its own or from the advanced countries. Therefore, a judicious approach is well warranted in the utilisation of coal.

Secondly, 15 years is not long enough. Even though we assume that it would not be possible to maintain this rising trend of extraction after some years and it would last a few more years, that will not be long enough which can allow the next generation of those mine owners to survive only on the naturally supplied stock of coal without searching for and investing in alternative opportunities. It is also not a healthy symptom for the economy of the region.

Thirdly, it is apparent that there are a few owners of the total coal reserves of Meghalaya and they must be operating like a cartel. But here the situation is not like so because the experience says that these few owners are enmeshed in competition among themselves to exploit as much as possible quickly and becoming rich overnight and also to maintain a luxurious lifestyle. So they give more importance on their present consumption needs than the future. So it is a case of competition among the few who are moving along the conflict locus of Stackleberg's oligopolistic model. All of them are trying to produce more and making more revenue whatever be its implication on price and per unit royalty, which may be one of the reasons of slow rise in price of coal compared to the social discount rate.

Fourthly, a few of them may be interested in investing money in the bank for earning interest income or invest in real estate around Shillong or other places to raise

rental later and sustain on that. But these efforts would not help in the development of alternatives to coal that would help continuous progress of industries and thus economies. Moreover, there is the possibility of loss of job opportunities in such mining and related activities.

Finally, though we could not say much about what would be optimal rate of extraction for which we need the concrete data on prices for a considerable period of coal extraction and its substitutes and the development in the substitutes of coal and its related industries, transfer rate of alternative technologies from the other countries, trend of new finding in the other regions of the country etc. one can safely argue for the need of deceleration in the extraction rate and investment for the development of employment generating resources in the region.

4.7 Utilisation of Coal in Meghalaya

Though currently around 5 million M.T of coal is extracted in a year in Meghalaya, the local use of the same has been very limited. Here utilisation of coal is very limited due to absence of big industries in the state. The cement factories are the major user of coal in Meghalaya. The first mineral based industry was set up in 1955 in the name of Assam Cement factory at Cherrapunjee that later on renamed as Mawmluh Cherra Cement Limited (MCCL). At present there are only 9 cement factories in Meghalaya with annual production capacity of 775000 M.T. and utilisation capacity of 178175 M.T. of coal (Commissioner of Central excise, Government of India, Shillong). Production of cement and utilisation of coal by the existing cement factories in Meghalaya during 2004 has been presented in table-4.5.

From table-4.5, it is evident that the total consumption of coal by all cement factories together in Meghalaya during 2004 was around 54 thousand M.T., which was

only about 1.05 per cent of the total production of coal in Meghalaya.⁸ Apart from that, there are some brick kiln and small-scale iron re-rolling cottage industries that uses coal but on a very limited scale. Therefore domestic consumption of coal would not be more than 2 per cent of the total coal production of Meghalaya.

Table 4.5
Quantity of Cement Production and Utilisation of Coal in different Cement Factories of Meghalaya in 2004

Name of the Cement Factories	Production of Cement (in M.T.)	Utilisation of Coal (in M.T.)
M-Cherra Cement Limited (MCCL)	93150.00	18630.00
Jaintia Cement	21639.00	4327.00
Virgo Cement	30455.00	6091.00
R.K.B. Cement	3980.00	796.00
A.M.S. Cement	27.350	4.47
Bomber Cement	Nil	Nil
H.M. Cement	74949.00	14989.98
R.N.B. Cement & Chemical Private Ltd.	12136.00	2426.600
C.M.C.L. (Star Cement)	35149.00	7029.800
Total	244085.35	54294.85

Source: Office of the Commissioner, Central Excise, Government of India, Shillong.

4.8 Utilisation of Coal Produced in Meghalaya by other States of India

Coal extracted in Meghalaya is largely used by other states of the country. Nearly, 78 per cent of the total coal extracted in Meghalaya was exported to various parts of India through Assam during 2005-06. This was estimated by deducting the percentage of coal exported to Bangladesh together with the percentage of coal utilised locally in Meghalaya from the total production of coal in Meghalaya. This coal is primarily used in different industries like cement, fertiliser, brick manufacturing and other small-scale industries in other parts of the country. With the depletion of coal reserves in main coal producing areas like Raniganj, Asansol, Jharia and other places, the demand for coal from Meghalaya has been increasing over the years. Approximately, 4 million M.T. of coal is annually exported from Meghalaya to other

⁸ Here the use of coal by the cement industries is estimated by multiplying total production of cement with 0.20, as the requirement of coal is 20 per cent of the cement produced by the industry (Pollution Control Board, Government of Meghalaya).

parts of India. As local industries are very limited and rate of industrial expansion is very slow the major portion of rising extracted coal has been exported to Bangladesh and other parts of the country where industrial growth is relatively faster. Approximately 3632 thousand M.T. of coal was exported to other parts of the country during 1990-91(as estimated by the author). The figure increased to over 4341 thousand M.T. during 2005-06. Now even some portion of coal is blended with good quality coke used in steel manufacturing industry like that of Bokaro, Bihar.

4.9 Utilisation of Coal Produced in Meghalaya by Bangladesh

Internationally, Bangladesh is the only country that imports coal from Meghalaya. According to the available data provided by the Customs Office, Shillong, approximately, 1.1 million M.T. of coal i.e. around 20 per cent of the Meghalaya's total coal production was exported from Meghalaya to Bangladesh during 2005-06. The quantity has been increasing over time, which is explained in detail in chapter-5. This coal is mainly used for the production of bricks. Besides brick factories, Meghalaya coal is also utilised in Chattuc Cement Factory, tea gardens of Bangladesh and other small-scale factories. Because of its poor quality, it is not used in thermal power plant, the demand for which has been covered by the other countries.

4.10 Conclusion

Coal is available in all the hill regions of Meghalaya. But the reserve varies across the region. Out of 565.81 million M.T. of the total reserves of coal, Garo Hills has the highest amount of coal deposits of around 63 per cent and Jaintia Hills region has the least amount (7.5 per cent). In spite of having least amount of coal reserves, Jaintia Hills region has been contributing the highest amount to the total production of

coal in the state though the percentage contribution has been declining from 91.22 per cent in 1987-88 to 69.70 per cent in 2005-06 due to gradual increase in the production of coal in other regions of the state. The highest rate of extraction in the Jaintia Hills region indicates the fact that this region would first experience the exhaustion of coal reserves.

In India coal is abundant and estimated reserves indicate that enough coal is remaining in India to last for many hundreds of years (Encyclopaedia Britannica). However this is not the case with respect to the coal reserves of Meghalaya. From the analysis of available data on extraction of coal in Meghalaya, it is indicated that if the current trend of exploitation of coal in Meghalaya is continued then it will not last for a long period of time unless judicious approach is adopted to utilise the same. However, from the analysis of pattern of extraction over time it is clear that the extraction activities have been going on rationally from the economic point of view, though it raises doubt about the sustainability of the income and progress of the state and of the local people. Even though we assume that it would not be possible to maintain the rising trend of extraction after some years and it would last a few more years, that will not be long enough, which can allow the next generation of those mine owners to survive on the naturally supplied stock of coal without searching for and investing in alternative opportunities.

References

- Bhattacharya, R. N. (2001), "Economics of Natural Resources" in R. N. Bhattacharya (ed.), *Environmental Economics: An Indian Perspective*, Oxford University Press, Chapter. 2.
- Chadwick, M. J. Highton N. H. and Lindman, N. (1987), *Environmental Impacts of Coal Mining and Utilization*, Pergamon Press, pp. 1-27.

- Chakrabarti, S. and Majumdar, S. (2004), "The Coal Reserves of North-East India" in Z. Hussain and S. K. Barik (eds.), *Development and Environment*, Regency Publication, New Delhi, pp. 221-228.
- Conrad, J. M. and Clark, W. C. (1989), *Natural Resource Economics: Notes and Problems*, Cambridge University Press, Chapter-3.
- Dasgupta, P. and Heal, G. (1974), "The Optimal Depletion of Exhaustible Resources", *The Review of Economic Studies*: Symposium on the Economics of Exhaustible Resources, pp. 3-28.
- Devaranjan, S. and Anthony C. F. (2001), Hotelling's "Economics of Exhaustible Resources": Fifty Years Later in U. Sankar (ed.), *Environmental Economics*, Oxford University Press, pp. 86-123.
- Encyclopaedia Britannica*, Vol.19, 15th edition.
- Gale, J. J. (2000), "Coal and Energy for the Twenty-First Century in India" in P. Audinet, R. R. Shukla and F. Grare (eds.), *India's Energy: Essays on Sustainable Development*, Manohar Publication, New Delhi.
- Geological Survey of India (1974), *Geology and Mineral Resources of Meghalaya*, Vol.30, Miscellaneous Publications, Kolkata.
- Geological Survey of India (2004), *New Coal Wing*, Vol.24, No.1, Kolkata.
- Goswami, P. J. (2004), "Coal Production in North-East India: Its Impact on Environment and Economy" in Z. Husain and S. K. Barik (eds.), *Development and Environment*, Regency Publication, New Delhi, pp. 290-294.
- Gray, L. (1914), "Rent under the Assumption of exhaustibility", *Quarterly Journal of Economics*, Vol. 28, Pp. 466-489.
- Hardin, G. (1968), 'The Tragedy of Commons', *Science*, Vol. 162, Pp.1243-1248.

- Hartwick, J. M. (1977), "Intergenerational Equity and the Investing of Rents from Exhaustible Resource", *American Economic Review*, Vol. 67, pp. 972-974.
- Heal, G. (1978), "Resource Prices and Resource Scarcity", In: *Proceedings of the Wisconsin Seminar on Natural Resource Policies in Relation to Economic Development and International Co-operation*, Vol. 1, Madison: Institute for Environmental Studies, University of Wisconsin.
- Hotelling, H. (1931), "The Economics of Exhaustible Resources", *Journal of Political Economy*, Vol. 39, Pp. 137-73.
- Howe, C .W. (1978), *Natural Resource Economics: Issues, Analysis and Policy*, John Wiley and Sons, New York.
- Johnson, D. G. (2000), "Population, Food and Knowledge", *The American Economic Review*, Vol. 90, No. 1, pp. 1-14.
- Johanson, P. and Lofgren, K. (1985), *The Economics of Forestry and Natural Resources*, Basic Blackwell, New York, pp. 23-44.
- Khanna, N. (2001), "On the Economics of Non-renewable Resources", Invited contribution to *Encyclopaedia of Life and Social Sciences*, UNESCO.
- Krutilla, J. V. (1967), "Conservation Reconsidered", *The American Economic Review*, Vol. 57, No. 4, Sept., pp. 777-786.
- Kula, E. (1992), *Economics of Natural Resources and the Environment*, Chapman and Hall, London, Chapter-1, Chapter-4.
- Lamin, H. (1995), *Economy and Society in Meghalaya*, Har-Anand Publication, New Delhi, Pp. 109-129.
- Maiti, A. and Chakrabarti, S. (2004), "Underground Resources of the North-East: Some Issues and Questions in Z. Husain and S. Barik (eds.), *Development and Environment*, Regency Publications, New Delhi, Pp. 211-219.

- Malthus, T. R. (1815), *On the Nature and Progress of Rent*, Lord Baltimore Press, Baltimore.
- Meadows, D. H., Meadows, D. L., Randers, J. and Behrens, W. (1972), *The Limits to Growth*, Pan Books, London.
- Oldham, T. (1854), *Geology, Meteorology and Economy of Meghalaya*, Mittal Publications, New Delhi, pp.53-77.
- Rai, R. K. (2002), “Implications of Coal Mining on Environment in Jaintia Hills, Meghalaya” in P. M. Passah and S. Sarma (eds.), *Jaintia Hills: Its Environment, Land and People*, Reliance Publishing House, New Delhi.
- Ricardo, D. (1817), *Principles of Political Economy and Taxation*, Recent Publication by Pelican Books, 1971, London.
- Ross, J. E. (1980), “Natural Limits to Natural Resources” in Peter Dorner and Mohmoud A. El-Shafie (eds.), *Resource and Development*, The University of Wisconsin Press, London, Chapter-3.
- Simon, J. (1981), *The Ultimate Resource*, Princeton University Press, Princeton, USA.
- Simon, J. (1996), *The Ultimate Resource 2*, 2nd Edition, Princeton University Press, Princeton, USA.
- Simon, J. and N. Myers (1994), *Scarcity or Abundance? A Debate on the Environment*, Norton, New York.
- Solow, R. (1974a), “On the Intergenerational Allocation of Resources” *Review of Economic Studies* (Symposium), Pp. 29-45.
- Solow, R. (1974b), “The Economics of Resources or the Resources of Economics”, *American Economic Review*, Vol. 64, pp. 1-14.
- Solow, R. (1986), “On the Intertemporal Allocation of Natural Resources”, *Scandinavian Journal of Economics*, Vol. 88, Pp. 141-149.

Withagen, C. (1998), “Optimal Extraction of Non-Renewable Resources”, in Jeroen C.J.M. Van den Bergh (ed.), *Handbook of Environmental and Resource Economy*, Edward Elgar.

Appendix-4.1

Quantity of Extraction of Coal in Meghalaya during 1961-62 to 2005-06 (Thousand tonnes)

Year	Extraction of Coal	Year	Extraction of Coal
1961-62	220	1984-85	949.00
1962-63	215	1985-86	1,265.00
1963-64	176	1986-87	1,507.00
1964-65	102	1987-88	1,448.00
1965-66	79	1988-89	1,807.00
1966-67	54	1989-90	2,252.00
1967-68	40	1990-91	3,747.00
1968-69	37	1991-92	3,464.00
1969-70	34	1992-93	3,487.00
1970-71	39	1993-94	2,543.00
1971-72	61	1994-95	3,264.00
1972-73	63	1995-96	3,247.50
1973-74	56	1996-97	3,239.30
1974-75	53	1997-98	3,234.20
1975-76	59	1998-99	4,238.00
1976-77	29.8	1999-00	4,060.00
1977-78	10	2000-01	4,065.00
1978-79	122.00	2001-02	5,149.00
1979-80	196.00	2002-03	4,396.30
1980-81	362.00	2003-04	5,439.10
1981-82	521.00	2004-05	5,345.19
1982-83	548.00	2005-06	5,565.72
1983-84	713.00		

Source: Directorate of Mineral Resources, Government of Meghalaya.

Appendix-4.2

District-wise Production of Coal in Meghalaya (in '000 metric tonnes)

Years	Jaintia Hills	Garro Hills	Khasi Hills	Total
1987-88	1321.00 (91.22)	83.60 (5.79)	43.40 (2.90)	1448.00
1988-89	1558.50 (86.24)	257.40 (14.24)	89.00 (4.92)	1807.00
1989-90	1963.20 (87.17)	340.00 (15.09)	51.20 (2.27)	2252.00
1990-91	3059.70 (81.65)	530.80 (14.16)	156.50 (4.17)	3747.00
1991-92	2787.40 (80.46)	529.90 (15.29)	146.70 (4.23)	3464.00
1992-93	3040.80 (87.20)	303.40 (8.70)	142.80 (4.09)	3487.00
1999-94	2062.20 (81.04)	359.30 (14.12)	121.50 (4.77)	2543.00
1994-95	2389.70 (73.21)	752.80 (23.06)	121.50 (3.72)	3264.00
1995-96	2159.50 (66.49)	899.20 (27.68)	188.80 (5.81)	3247.50
1996-97	2273.60 (70.18)	803.30 (24.79)	162.40 (5.01)	3239.30
1997-98	2414.60 (74.65)	599.40 (18.53)	220.20 (6.80)	3234.20
1998-99	3246.10 (76.59)	807.10 (19.04)	184.80 (4.36)	4238.00
1999-00	2935.90 (72.31)	907.00 (22.33)	217.10 (5.34)	4060.00
2000-01	2839.30 (69.84)	1017.70 (25.03)	208.00 (5.11)	4065.00
2001-02	3889.03 (75.52)	977.50 (18.98)	282.47 (5.48)	5149.00
2002-03	3089.03 (70.26)	910.70 (20.71)	396.57 (9.02)	4396.30
2003-04	3918.60 (72.04)	1058.40 (19.45)	462.10 (8.49)	5439.10
2004-05	3610.60 (67.54)	1101.01 (20.59)	633.59 (11.85)	5345.20
2005-06	3879.73 (69.70)	1120.53 (20.13)	565.44 (10.15)	5565.70

Source: Directorate of Mineral Resources, Meghalaya.

Note: Value in parenthesis represents percentage to total.

CHAPTER-5

COAL TRADE IN MEGHALAYA

5.1 Introduction

Production of commodities (agricultural and industrial) is presumed by many of us to be the primary economic activity through which an economy can acquire wealth especially by generating surplus output. However, apart from production, a state can also generate resources for the welfare of the people through trade and commerce. The Mercantilist argument is that through pure exchange with another country, a country can be richer if it can trade its produced commodities on favourable terms (Mun, 1979). From the Ricardian theory of comparative advantage we also know that if a country has comparative advantage in the production of a commodity, and it needs another commodity for any purpose but any other country has relative advantage in the production of that commodity, then the former or both countries can be benefited if they produce their respective advantageous commodity and exchange one for another (Sraffa and Dobb, 1951-55).

Since coal, limestone and some other minerals are abundant in Meghalaya and those are not available in some other states and neighbouring Bangladesh, the state of Meghalaya has a comparative advantage in the production of such minerals over those areas. Coal is the most important mineral of the state in terms of availability, production; cost of production, export and earning from mineral, which is followed by limestone. Here coal is plenty (though not of very good quality) and mostly occurs near the Earth's surface (within the range of 100 to 300 metre depth). Therefore, till now the extraction in this area is carried out through the age-old technology (either open-cast surface mining

or the well-known rat-hole method). Though coal available in Meghalaya is of medium quality (mostly sub-bituminous and lignite) and there is hardly any change of technology over time¹ and the producers of the state still remain competitive with the producers of coal in the other region of the country because of escalating cost of extraction in those regions (despite the application of modern technology) and with rising difficulty of production as well as limited availability of coal. Though there are industries in some other states of India and Bangladesh where coal is an important input, because of non-availability in those areas Meghalaya always finds an external market for its own coal. Thus the extraction activities are still going on and even expanding, which is clear from the increasing extractions over time despite medium quality of coal, rising wages of labour and slower growth of price of coal with the passage of time. They would be more competitive if they would innovate and utilise the modern technology for the increase in efficiency of workers in the areas of thick seam availability and hence reduce the cost of extraction on the whole. The region has the relative advantage over other regions because of the depleting stock of coal in other parts of India (in spite of medium quality, the coal of Meghalaya is now being used in the Bokaro steel plant after some blending with coke) and also non-availability in the neighbouring country Bangladesh.

Since Meghalaya has large potential for the extraction of coal, the extracted coal has been utilised for internal trade as well as for external trade. But, growth of industries has been very poor in the state of Meghalaya. Now, there are only a few cement factories (nine in total) and some small-scale brick kilns where coal is used as input. Therefore, trade is the primary choice so far as the production and utilisation of coal is concerned.

¹ Here coal is available in different layers that ranges from one to three across the mines with varying depth and seam ranges between one to three feet. Therefore after exhaustion of first or second layer in most cases the mine is abandoned as it is not economical for the contractors to use modern technology and it is very difficult to extract with manual labour.

This chapter is thus devoted to explain the nature and extent of coal trade in Meghalaya and also to analyse the impact of coal trade on the economy of Meghalaya.

Very few studies are available so far that deal with Meghalaya's trade with Bangladesh. These studies provide a brief idea about the trade of Meghalaya with other regions especially with Bangladesh.

Syiemlieh (1989) has tried to provide an account of Britishers' mercantile interest in Khasi-Jaintia Hills. He has described how the trade in mineral resources in the hills used to contribute to the revenue of the then British Government in India.

Agnihotri (1993) has tried to explain the mode of operation of coal trade between Meghalaya and Bangladesh, where earlier Meghalaya Mineral Development Corporation Ltd. (MMDC) used to work as commission agent. But the mining and supply of coal used to be maintained by the private people. Now total export activities related to coal is totally controlled by the private individuals and there are quite a few number of coal exporters. Madan (1996) also furnished an account of historical development of Indo-Bangladesh economic relations and also highlighted the importance of Joint Economic Commission for the acceleration of trade whose primary component is mineral.

Dutta (2000) has tried to present an account of coal export from Meghalaya to Bangladesh. He has explained the nature of coal trade and the export procedure followed in Borsora (a border place in Meghalaya). However, though coal extraction generates huge income and employment in Meghalaya, there is no concrete evidence of investment of export earnings in any other productive sectors of the local economy besides expanding mining and trading operations. While describing the commodity structure of Indo-Bangladesh border trade, Sarma and Goswami (2000) also mentioned about the prime position of coal exported from North -East, especially from Meghalaya, to Bangladesh. They have also informed how trade with Bangladesh is taking place through different border points of Meghalaya like Dawki and Borsora.

Over the years, coal and limestone together have become the major component of export and after the beginning of new economic policy at all-India level, since 1992 export of coal from Meghalaya has been deregulated and left open to the private exporters (Mero, 2000).

5.2 Coal Trade between Meghalaya and Bangladesh: A Historical Background.

Meghalaya's trade relation with present Bangladesh (former East Pakistan or Bengal) is very old. Most of the renowned British writers have mentioned this trade relation. W.W. Hunter in his *statistical Account of Assam* (1879) had noted the external commerce of the Khasi and Jaintia Hills that was chiefly conducted on the southern boundary, through the district of Sylhet. The beginning of the trade in coal with Bangladesh from Meghalaya can be traced back to the 1842, when Colonel Lister excavated and dispatched 44350 maunds (1 maund = 37.3 kg. at that time) of coal to Chattuc (Oldham, 1854). But the trade could not sustain due to lack of cost effectiveness in carriage. However Oldham predicted that the extensive districts of Sylhet, Cachar and Munnipore could not be deprived of the benefit of the coal of Cherrapunjee when communication system would develop in the long run. Today we observe that his anticipation has come true as through all these areas trade relations have been established and flourishing.

The emergence of Bangladesh as an independent country on December 16, 1971 was a landmark development, which introduced a far-reaching character in the trade relations with North-Eastern Region in general, and Meghalaya in particular (Madan, 1996). Systematic export of coal to Bangladesh from Meghalaya has started when the Mineral and Metal Trading Corporation of India (MMTC) started exporting about 3000 tonnes of coal in 1988–89. Having seen the requirement of coal by the brick kilns of Bangladesh, which was almost 100000 tonnes per annum, the state government obtained

a special permission from the government of India in 1989–90 for the export of coal to Bangladesh from Meghalaya by the state owned Meghalaya Mineral Development Corporation Ltd. (MMDC). The MMDC functioned as the commission agent (mentioned earlier) for the mining and supply of coal to the export outlets run by the private parties. The corporation used to process the export documents and collect bills from importers in Bangladesh. In lieu of this service the corporation used to get commission from the exporters (Agnihotri, 1993).

In 1989 John Deng Pohrmen, got the portfolio of Mineral resources. By that time Meghalaya traders started exporting coal to Bangladesh. But they were facing much inconvenience because they had to go to Kolkatta for clearance of transit papers, which was also too expensive and time consuming. After the persuasion by John Deng Pohrmen, the power of providing clearance for such activities has been delegated to the custom office in Dawki (in Meghalaya) for the benefit of the traders. Subsequently, custom offices were opened at Borsora, in West Khasi hills and also at Ghasuapara of South Garo Hills. After the development of facilities for exporting coal to Bangladesh, many traders had become multi-millionaires (Bhattacharyya, 2004). Thus coal has now become black diamond in Meghalaya.

With the passage of time, coal trade with Bangladesh from Meghalaya assumed a new dimension for the newly emerged international exporters. These international exporters have a unique pioneering union, MITA (Meghalaya International Traders Association) to safeguard their interest.

5.3 Export Procedures

Export of coal to Bangladesh has been carried out by the international exporters. Each international exporter usually appoints one manager and one assistant to look after the export activities. Experience from the field reveals that international exporters

currently spend Rs.15000/- – 20000/- as monthly expenditure to run their offices. The expenditure includes: (i) salary of the staff, (ii) expenditure for *Letter of Credit* (LC) advising, (iii) expenditure for pre-shipment certificate etc. First a *letter of credit* is collected by the exporters from the international importer that states the demand for export of coal. This *letter of credit* is produced in the Directorate of Mineral Resources (DMR) and against this a Challan is obtained for the coal to be exported by paying Rs.165.00 per tonne as royalty to the state government.

Then Meghalaya International Exporters Chamber of Commerce normally issues pre-shipment certificate or certificate of origin on behalf of superintendent of company of India Private limited, recognized by ministry of commerce, Government of India after charging Rs.3 per tonne of coal to be exported. After completing all these formalities, coal is exported to Bangladesh.

5.4 Nature of Coal Market

Market for coal in Meghalaya is oligopolistic. Though the number of sellers is not so many, it is not too small either. Around 500 coalmine owners or sellers are there in Jaintia Hills and among them there is a competition. As mentioned earlier the price was fixed due to administered by the government and since 1998 it became open and determined by the market forces through demand and supply mechanism. The export price was fixed at \$40 per M.T. till 1998 for the export to Bangladesh.² Therefore, the exporters were the price takers and they used to buy from the owners after taking into account the transport and loading cost plus a profit margin. Also the importers of

² Though export price was fixed at \$40 per M.T. since 1989 to 1998, in terms of rupee price was increasing due to appreciation of dollar against the rupee. The price of coal, which is exported to other states of India, varies according to the differences in commercial varieties. The price for boulder size has always been the highest and ranges between Rs 3000 per M.T. Where as, currently the price for second graded or dust variety of coal lies between Rs 2400 to Rs 2600 per M.T. as obtained from the personal field observations. The export price to Bangladesh (after the deregulation in 1998) has also been increasing gradually during last few years.

Bangladesh side were the price takers. In spite of fixity of price, export has been increasing over time due to increasing demand in the concerned industries on the other side. Also prices were not increased mainly to avoid any kind of competition from exporters of other countries like Australia, as the quality of coal available is also not very high and hence there is a fear of losing the market share.

Under these circumstances, the objective of the owners is to maximise revenue/net output by increasing production, as they do not have any perception of losing income due to exhaustibility of the resources. This is not only due to the ignorance about total stock but also due to the uncertainty about future or fear of losing ownership.³ Each individual owner here tries to extract as much coal as possible and invest the income in the secured earning venture like saving account in the bank or building assets like houses, transport means (truck, bus, jeep). From these businesses or earning rent they want to secure their future income. However, this would have very little impact on the future economy of the state and in the generation of employment. Coal trade in Meghalaya has three different components, viz., (i) local trade in coal; (ii) inter-regional trade/inter-state trade in coal and (iii) external/international trade.

5.4.1 Local Coal Trade in Meghalaya

Local coal market in Meghalaya is also oligopolistic. Even though there is no cartel among the sellers, the price remains sticky due to competition among them. It is normally seen that most of the individual coalmine owners lease out their mines to coal contractors who are popularly known as *Sardars* on the basis of contract payment per truckload of coal extracted by them. This is usually done when the coalmine owners are

³ In other states, coal and other important minerals are national properties. But in Meghalaya, coal, limestone, etc. are owned by the private people, who extract those for their personal benefit. Therefore, there is always a fear of these minerals to be nationalised in the interest of the country. Moreover, the extraction is done through 'rat-hole' method and each mine owner has suspicion that the miners of neighbouring owner may come inside his area and extract his own coal unless he extracts, as it is very difficult to locate how far the miners are extending their activities inside the tunnel.

well aware about the quantity and quality of the coal, knowing fully well that their coal reserve would fetch them handsome remuneration. The contract price per truckload is always uniform in this form of trade as the quality of coal is similar and also has similar use. However, this contract price at the mining site varies along with the distance of mining site to the final destination due to the variation in the transportation cost.

Leasing out of the areas for the extraction of coal is another form of coal trade observed in the mining region. Here the landowners lease out their land to *Sardars* or rich individuals to extract coal from their land for a certain period. This happens when there is an elements of risk associated with regard to the availability and the quality of coal. This form of trade takes place when the owner of the land does not want to undertake extraction activities, as he is uncertain about the availability and quality of the coal under own land. Experienced mine contractors, however, are always willing to take risk and ready to pay a fixed rate per unit of area under the presumption that it would bring a good return. This, therefore, is partly a gambling on the parts of both owner and contractor.

5.4.2 Inter-State Trade of Coal and Its Modus Operandi

Internal trade or inter-state trade of coal has occupied the key position so far as coal trade in Meghalaya is concerned. Since data on export of coal shows that around 20 per cent of coal produced in Meghalaya is generally exported to Bangladesh (Commissioner of Custom, Government of India, Shillong). Hence the remaining 80 per cent of the coal is used in the local industries and exported to the other regions of India. The local domestic and industrial use is very limited (only few cement factories use about 1.05 per cent of the total production of coal). Around 78 per cent of produced coal is exported to the other states of India. Approximately, 4 million M.T. of coal is produced in Meghalaya each year goes to the plains of Assam and from there to various

parts of India. The factories in the other states are the most important customers of the coal supplied from Meghalaya.

The coal is generally transported to Guwahati mostly by the agents appointed by the traders from Guwahati. The traders from Guwahati always update the required quantity and the price at which they can purchase coal. Accordingly, the agents bargain with the sellers and price is decided by the relative strength of demand and supply. After the settlement of price, coal is exported to Beltola, Guwahati and stocked-up there. From Beltola, coal is exported to other states like Punjab, Delhi, etc. Sometimes, it is observed that venture capital for the extraction of coal is provided by the traders from Guwahati. As per the contract that coalmine owner will supply coal at the price once extraction starts, which was prevalent at the time of contract. Though the market is dominated by the importers price never goes down below a certain limit so that the extraction would become unattractive. Rather, the rising demand over time in other regions of the country forced price to go up and that raises profit margin of the middleman or trader. So with the demand for more coal the mine owners have begun to mine more and more in the region. Those who own the coalmines already make an effort to employ as many labourers as they can so that they can produce maximum coal for sale and make profit (Lamin, 1995).

The procedure of inter-state trade in coal is not that much complicated compared to the international trade in coal from Meghalaya. The traders generally obtain challan from the Directorate of Mineral Resources, government of Meghalaya after paying a royalty of existing Rs. 165.00 per ton of coal to be despatched. Challans are issued on the basis of the tonnage per truck. Permissible tonnage per truck has been fixed at 15 tonnes for Shillong-Guwahati national highway. Generally, it is found that plane-traders (trader from Guwahati) employ agents in coal areas like Bapung, Sutnga, Lad Rymbai etc. to procure coal and supply to them. These agents are called (*Munshies*). *Munshies* are

provided bike, mobile phone and other facilities by the traders for better communication and increase in efficiency.

Khasi or Jaintia people do not prefer to take their coal to Guwahati and sell to the plane traders. Hence, they sell their coal to the agents of the plane traders. In coalmining areas, some agents are also found to issue ready-made challans. For this they have been charging certain commission. At weigh Bridge Rs. 50.00 is paid for measurement. In addition to that fine is also paid when they carry more than permissible tonnage per truck. Therefore, it can be said that so far as internal coal trade is concerned, the role of Khasi, Jaintia people is limited up to the main road of the coal mining area. Once coal is sold at depot, other things are taken care of by the agents of the plane traders and the exporters.

5.4.3 International Coal Trade of Meghalaya/Meghalaya's Coal Trade with Bangladesh

Trade and aid are the two important parts of Indo-Bangladesh economic relations. These two countries are not only neighbours but also have a long common historical past with similar culture and social evolutions. The people of both these countries have lived together peacefully for centuries. Presently the North -Eastern part of India has common borders with Bangladesh on three sides i.e. from north, west and east. But after Independence in 1947 to 1965, relations between India and East Pakistan (now Bangladesh) were mainly confined in the area of trade (Madan, 1996).

During the period 1965-71, there was trade holiday between India and Pakistan (Due to Indo-Pak war). So there was no trade with East Pakistan (now Bangladesh) during that period. After the birth of Bangladesh on December 16, 1971, and having a common border covering distance of around 423 K.M. between Meghalaya and Bangladesh and opening of roads the trade of goods and services restored.

A summit meet took place between Mrs. Indira Gandhi and Mr. H.M. Ershad in New Delhi on October 7, 1982, which gave fillip to Indo-Bangladesh economic relations. At that time they decided to set up a Joint Economic Commission (JEC) in order to promote mutual economic trade and to identify areas of joint ventures and mutual economic co-operation with the establishment of JEC, private trade was also allowed (Madan, 1996). This Indo-Bangladesh Joint Economic Commission meets once a year to discuss outstanding issues pertaining to trade and investment. Trade between India and Bangladesh is carried out as per the Indo-Bangladesh trade agreement which provides for the “Most Favoured Nation” treatment accorded to goods and services of both the countries (Agnihotri, 1993). Given the geographical location of Meghalaya and very few indigenous industries exist in Meghalaya, most of her mineral resources have found their way to neighbouring states and countries i.e., Bangladesh. The trade here is confined to what is known as border trade and the main component of export from Meghalaya has been coal.

5.4.4 Export of Coal from Meghalaya to Bangladesh

Major portion of coal produced in Meghalaya is exported either to Bangladesh or to other states of India. Earlier it was observed that during 2005-06 nearly 20 per cent of total coal production in Meghalaya is exported to Bangladesh. There coal is used mainly in brick manufacturing, cement industries and also some other small-scale industries. But the export to Bangladesh that takes place through different points of the border has been increasing over time both in terms of absolute quantity as well as percentage to total output in Meghalaya. However, official records of export to Bangladesh were not available before 1989-90. Moreover, there have been some unofficial transactions that have not been recorded in order to avoid royalty payment or due to the involvement of the corrupt officials. Therefore, very meagre quantity (1975 M. T.) of recorded export of

coal during 1989-90 is observed. However, over time gradual changes in export of coal to Bangladesh from Meghalaya has been recorded. The figures on recorded export of coal to Bangladesh during 1989-90 to 2005-06 have been collected from the office of the Directorate of Mineral Resources, Government of Meghalaya and the office of the Commissioner of Custom, Government of India, Shillong and presented in Table 5.1.

Table 5.1

Extraction of Coal and Total Export to Bangladesh during 1989-90 to 2005-06

Year	Extraction of Coal (1000 tonne)	Total Export to Bangladesh (M.T.)	Percentage of Extracted Coal Exported to Bangladesh
1989-90	2252.00	1975.00	0.09
1990-91	3747.00	40273.00	1.07
1991-92	3464.00	45500.00	1.31
1992-93	3487.00	155461.42	4.45
1993-94	2543.00	278690.36	10.95
1994-95	3264.00	273877.00	8.39
1995-96	3247.50	325046.00	10.00
1996-97	3240.90	438671.00	13.53
1997-98	3233.50	578992.00	17.90
1998-99	4238.00	551856.00	13.02
1999-00	4060.00	653857.00	16.10
2000-01	4065.00	817726.00	20.11
2001-02	5149.00	701845.00	13.63
2002-03	4396.30	1045905.00	23.79
2003-04	5439.10	1221567.00	22.45
2004-05	5345.20	1384270.00	25.89
2005-06	5565.70	1103336.20	19.82

Sources: (i) Directorate of Mineral Resources, Government of Meghalaya
(ii) Commissioner of Custom, Government of India, Shillong.

From table-5.1, a sharp rise in export of coal to Bangladesh is observed during 1989-90 to 2005-06. The export has increased from 40.27 thousand M.T. in 1990-91 to over 1103.33 thousand M.T. during 2005-06, i.e., it increased to more than 27 times to that of 1990-91 figure during last 15 years. Not only quantity, percentage of extracted coal exported to Bangladesh has also increased very rapidly during these years. During 1990-91 to 2005-06 it increased from about one per cent to about 20 per cent. This indicates that the rate of growth of export is more than that of extraction. It is clear from

the fact that there has been very sluggish growth of industries in Meghalaya that use coal as input or energy source and hence very slow growth of internal use of produced coal. So there is no other alternative but to export the coal for the generation of income without further value addition. Major demand for coal in Meghalaya actually comes from the rising brick kiln units and cement manufacturing units in Bangladesh. Therefore, the growth of extraction in Meghalaya over time has been due to the rise in export demand for the same that is examined by fitting linear, log-linear regression of extraction on the export during 1989-90 to 2005-06. Similarly growth of extraction and export of coal to Bangladesh has been estimated by running semi-logarithmic regression of the form $L_n M_t = \alpha + \beta.t$, where M_t is the quantity of extraction, export etc., t is time in years and α, β are the two parameters. Here β represents the annual exponential rate of growth. The regression equations are:

$$E_t = 2833693 + 1.93 X_t^* \quad t_{\text{value}} = 5.94, R^2 = 0.7016 \quad \dots \quad (5.1)$$

(0.325)

$$L_n E_t = 13.751 + 0.111 L_n X_t^* \quad t_{\text{value}} = 3.92, R^2 = 0.506 \quad \dots \quad (5.2)$$

(0.02853)

$$L_n E_t = 14.76 + 0.044t^* \quad t_{\text{value}} = 6.226, R^2 = 0.72 \quad \dots \quad (5.3)$$

(0.007)

$$L_n X_t = 10.12 + 0.2776t^* \quad t_{\text{value}} = 6.095, R^2 = 0.72 \quad \dots \quad (5.4)$$

(0.0455)

$$L_n Y_t = 0.035 + 0.234t^* \quad t_{\text{value}} = 5.0633, R^2 = 0.631 \quad \dots \quad (5.5)$$

(0.0462)

Where E_t is the extraction of coal in Meghalaya at time t , X_t represents export of coal to Bangladesh at time t , Y_t represents percentage of output exported at time t and figures in the bracket represent standard error of slope coefficients. Here $*$ indicates that the slope coefficient is highly significant at 5 per cent level of significance.

Equation (5.2) represents that elasticity of extraction with respect to export to Bangladesh over time is 0.111, which is highly significant at 5 per cent level of significance. From equation (5.3) we observe that annual exponential rate of growth of extraction during 1989-90 to 2005-06 was 4.4 per cent, which is highly significant. Similarly, equation (5.4) reveals that the annual exponential rate of growth of export of coal to Bangladesh during the same period was 27.76 per cent. Equation (5.5) shows how the percentage of extracted coal exported to Bangladesh increased over time. The equation shows that percentage of produced coal exported to Bangladesh increased significantly at an annual exponential rate of 23.4 per cent during 1989-90 to 2005-06. Diagram-5.1 and 5.2 exhibit respectively the comparative picture of extraction and export to Bangladesh as well as growth of percentage of output exported to Bangladesh over time from Meghalaya.

Diagram-5.1

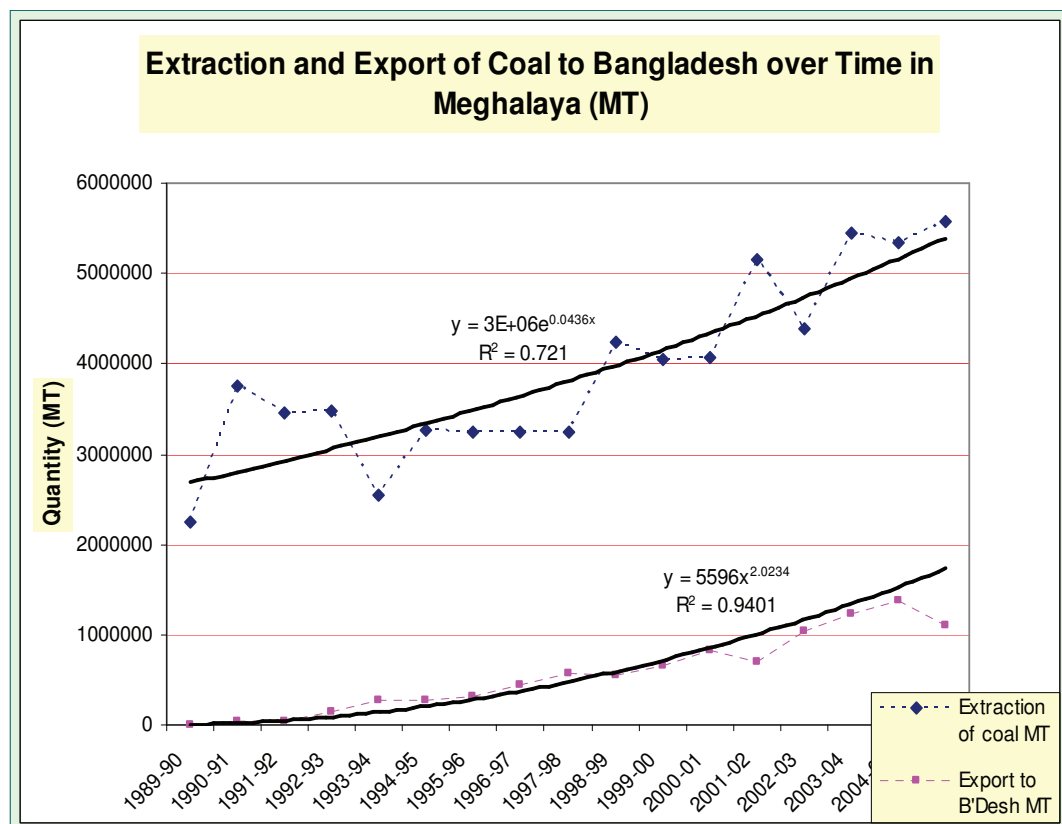
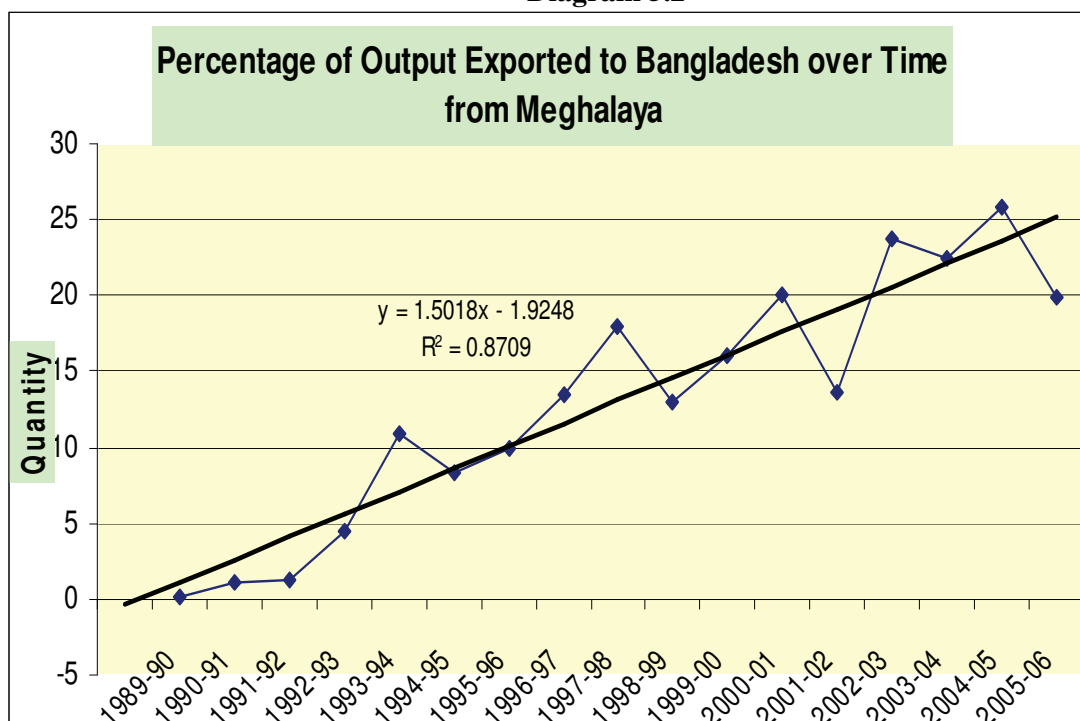


Diagram 5.2



5.4.5 Temporal Growth in the Value of Coal Exported to Bangladesh

There has been a rapid increase in the value of coal exported to Bangladesh and also the value of total export from Meghalaya to Bangladesh during 1998-99 to 2005-06. The value of coal exported to Bangladesh increased from Rs.90.5 crores in 1998-99 to Rs.198.6 crores in 2005-06. On the other hand, value of total export from Meghalaya to Bangladesh has also increased from Rs.103.3 crores in 1998-99 to Rs.211.8 crores in 2005-06, which is shown in the Table-5.2.

Table-5.2
Coal Export as Percentage to Total Export from Meghalaya to Bangladesh

Year	Value of Coal Export from Meghalaya (Rs)	Value of Total Export from Meghalaya (Rs)	Value of Coal Export as Percentage of total Export
1998-99	905435313.40	1033352559.00	87.62
1999-00	1310328009.00	1522910824.00	86.04
2000-01	1355454315.00	1484657157.00	90.78
2001-02	1661087348.00	1829731915.00	74.14
2002-03	1462583723.00	1972907169.00	79.14
2003-04	2254566107.00	2835907093.00	79.50
2004-05	1779363224.00	1851225697.00	94.49
2005-06	1985763175.00	2117803287.00	93.76

Source: Commissioner of Custom, Government India, Shillong.

However, significant change has not been observed in the percentage contribution of coal export to total export. Contribution of coal export to total export has increased by only 6.5 per cent during the same period. This is due to the simple reason that over the years, coal has always been a major component of the total export from Meghalaya to Bangladesh. The rate of change in the value of coal export from Meghalaya to Bangladesh has been explained by fitting the semi-logarithmic equation of the form $L_n Y_t = \alpha + \beta t$, where Y_t represents either value of coal export, or value of total export or percentage contribution of coal export to the total export to Bangladesh etc. β and α are the two parameters, where β represents the annual exponential rate of growth. The estimated equations are:

$$L_n Y_t = 9.19 + 0.10032t^* \quad t_{\text{value}} = 4.24, R^2 = 0.75 \quad \dots \quad (5.6)$$

(0.02365)

$$L_n Y_t = 9.35 + 0.0954t^* \quad t_{\text{value}} = 3.16, R^2 = 0.6246 \quad \dots \quad (5.7)$$

(0.0302)

$$L_n Y_t = 4.445 + 0.00489t \quad t_{\text{value}} = 0.339, R^2 = 0.188 \quad \dots \quad (5.8)$$

(0.0144)

In the equation (5.6), Y_t is the value of coal export and figure in the bracket represents standard error of the slope coefficient. From the equation it is observed that annual exponential rate of growth of value of coal export was 10.03 per cent during 1998-99 to 2005-06.

In the equation (5.7), Y_t is the value of total export. From the equation it is observed that the value of total export has increased by 9.54 per cent annual exponential rate of growth. In the equation (5.8), Y_t is the percentage contribution of coal export to total export. It is indicated from the equation that annual exponential rate of growth in the percentage contribution of coal export to the total export has been only 0.4 per cent, which is highly insignificant.

From equation 5.6 and 5.7 we observe that the annual exponential rate of growth of export of coal to Bangladesh has been higher than the annual exponential rate of growth of total export to Bangladesh during 1998-99 to 2005-06. Hence the annual exponential rate of growth of percentage of coal to total export during that period has been highly insignificant.

5.4.6 Coal Trade with Bangladesh through Different Border Points

Border trade between Meghalaya and Bangladesh is of two types: (i) informal trade that takes place without any notice of land custom stations; (ii) formal trade that takes place through different land custom stations. Coal is mainly exported through different land custom stations. There are 9 functional land custom stations in Meghalaya in total, out of which, mainly 6 stations are used for the purpose of exporting coal. These are Dawki, Borsora, Mahendraganj, Ghasuapara, Dalu and Baghmara. Also coal is exported through the land custom stations of other states like Karimganj-Steamerghat and Sutarkandi land custom stations of south Assam. Spatio-temporal variation in coal export to Bangladesh through different land custom stations is shown in Appendix-5.1.

From Appendix-5.1, it is observed that the major portion of coal exported to Bangladesh flows through Dawki, Boarsora and Ghasuapra Land Custom Stations located in Meghalaya. During 1998-99, 61.94 per cent of the total coal exported to Bangladesh passes through Dawki, while it was 12.64 per cent for Borsora, 10.27 per cent for Ghasuapara and 14.97 per cent for Sutarkandi respectively. But in 2004-05, 22.49 per cent of total coal exported to Bangladesh has taken place through Dawki, which was 29.70 per cent for Borsora, 6.7 per cent for Ghasuapara and 38.31 per cent for Sutarkandi respectively. Hence, the relative position of Land Custom Stations from the point of view of export of coal has changed a lot. However, a close observation of the

data reveals the fact that there has been a continuous upward trend in the total amount of coal being exported to Bangladesh through different Land Custom Stations.

5.5.1 Coal Export: A Case Study of Dawki Trade Route

Due to paucity of time and other hindrances a survey has been made in the Dawki Land Custom Station during April-May 2005, which is the major international trading point of coal between Meghalaya and Bangladesh. Dawki lies in the southern part of the Jaintia Hills District of Meghalaya bordering Sylhet district of Bangladesh and East Khasi Hills District of Meghalaya. It is located 58 K. M. away from the District Head-quarter of Jaintia Hills District, Jowai. Because of its strategic position, Dawki has become one of the important international coal market located in Meghalaya. This is a trading place where interaction between importers from Sylhet, Bangladesh and exporters from Meghalaya takes place. Coal trade with Bangladesh from Meghalaya through Dawki has its unique structure and character. Earlier we have observed that approximately, 22 per cent of total coal export to Bangladesh takes place through the Dawki Land Custom Station.

In any working day, 2000-3000 metric tonnes of coal are exported through Dawki. Meghalaya government earns nearly Rs. 3 lakh daily as coal Royalty from Dawki Land Custom station alone. In addition to that government of India earns foreign exchange to the extent of Rs.45 thousand dollars monthly. Figures of monthly export of coal through the Dawki Land Custom Station from April 2002 to May 2005 as presented in the Appendix- 5.2 reflect an important feature of coal trade with Bangladesh through Dawki (Official records of Dawki Land Custom Station). A close look at the data reveals that export of coal from Meghalaya to Bangladesh varies between Peak season and Lean season of each year. Peak season of coal trade with Bangladesh runs from the month of November to May. After May the export of coal to Bangladesh through Dawki become

very less, as the brick kilns remain closed due to the arrival of monsoon. Therefore, the Lean season of coal trade is extended from the month of June to September or October.

5.5.2 Modus Operandi of Trade of Coal through Dawki

There were 135 international exporters at the Dawki Land Custom Station during April-May, 2005 who used to export coal regularly to Bangladesh⁴. Dawki Land Custom Station is a very peculiar trading point, which is located not adjacent to the coalmine areas like Borsora Land Custom Station. Coal is supplied to Dawki Land Custom point from both Jaintia Hills and East-Khasi Hills. Besides international exporters, other middlemen are also operating side by side at the Dawki Land Custom Station. There are four different types of individual traders associated with the coal trade through Dawki but operating from different areas:

- (a) Traders with mines and export Licenses.
- (b) Traders with export Licenses and no mine.
- (c) Traders with mines but no export Licence.
- (d) Traders with no mine and no Licence, who normally act as a middleman.

It is found that there are some exporters who also own mines and coal depots in coal mining areas like Bapung, Ladrymbai. Most of the exporters collect coal from the coalmine owners or also from the middlemen who does not have coalmine, coal depot or even export licence.

Though the Directorate of Mineral Resources, government of Meghalaya gives permission to carry only 9 tonnes of coal per truck in Jowai-Dawki road, experience shows that the exporters export more coal per truck unofficially by paying some money (as bribe) to some of the officials of Directorate of Mineral Resources (D.M.R.), which is locally termed as “speed” money. Bangladeshi importers pay in terms of *Taka* for under-

⁴ The information is obtained from the office of the Land Custom Station at Dawki, Meghalaya.

stated amount of coal and most of the time they get one to two tonnes of coal at some lower rate and in the process all are benefited except the government royalty.

Another important feature of the coal market in Bangladesh is that the importers always try their level best to keep the price of coal below the 40 dollar. Before 1998-99, minimum export price for coal (MEP) was 40 dollar. But government of India lifted this MEP mechanism in 1998-99 to make the price of coal competitive and determined by the market forces. But, Bangladeshi Importers still try to stick to the old level of price. Sometimes, Price of coal goes down below 40 dollar, even if the quality and grade of coal is relatively superior. Therefore, Meghalaya exporters always export the lower quality of coal to Bangladesh, depending upon the offer price of the importers who mainly import and supply to their cement factories and brick kilns.

Approximately 200 truck loaders and some drivers are always engaged at Dawki. For the transportation of coal to Dawki Land Custom Station, middleman traders use either Tata S-Model trucks or modified Shaktiman trucks. Obviously, this generated employment opportunity, for some people in the form of drivers and Handyman. Field observation reveals that most of the drivers and handymen belong to Khasi, Pnar and War areas of Meghalaya. A sample study of 100 trucks reveals the fact that 99 per cent of the drivers and handymen belong to the Khasi, Pnar and war communities of Meghalaya. In this respect more than one thousand people are directly employed at Dawki Land Custom Station. Besides, coal trade has also boosted up the growth of Dawki daily market for general commodities. When coal trade is suspended, Dawki market looks dry and bleak. Hence there has been a big push in the daily transactions of Dawki market due to international trade of coal.

5.5.3 Estimation of Volume of Unofficial Coal Trade through Dawki Land Custom Station

Experience shows that in each vehicle, at least 2 tonnes of coal are unofficially traded without any fine (but with bribe) and without any record. Keeping in view of all

these, an attempt has been made to estimate the volume of unofficial coal export through Dawki Land Custom Station. From field study, it is evident that each truck does not carry less than 15 tonnes of coal. But record shows that 12-13 tonnes of coal are carried per truck. So, in each truck at least two tonnes of coal is unofficially exported. In 2004, from January to December, 26,215 trucks crossed the border carrying the coal from Meghalaya. Hence, 52,430 tonnes of coal were unofficially exported to Bangladesh through Dawki Land Custom Station. Therefore, the coal royalty to the extent of Rs.86, 50,950/- is lost by the state exchequer. Apart from that, there are areas in Khasi and Garo Hills through which everyday coal is exported unofficially which is not estimated here.

5.5.4 Trade Facilitation Bottlenecks in Meghalaya

Lack of infrastructures, proper trade facilities are the major concern in most of the Indo–Bangladesh Land Custom Stations. Following are the major observations:

- The parking lots at Dawki are lack in the basic amenities like drinking water and toilet. The approach road to the LCS is very congested. Moreover there is no government bonded warehouse in that area.
- The coal trade that takes place through Dawki; comes mainly from Bapung, Rymbai road, Ladrymbai, Kongong, Longkhat, Sutnga, Skhentalang, Jarian and are carried to the Dawki Border by trucks through the National Highway 40E popularly known as Jowai–Dawki road. The delay in the route is a normal phenomenon due to i) BSF restriction (BSF authorities check each coal loaded truck and then allow them to pass towards Dawki Land Custom Station during a particular period of time of each day, say from 9 A.M. to 10 A.M.) that makes sometimes inordinate delay ii) the delay in processing the document at the custom office iii) Consumption of time in the measurement work by the DMR officials. The delays in all such processes are sometimes intentional to make money. On an average daily 400 trucks travel through that road. Therefore the

processing and transportation cost per kilometre turns out to be very expensive due to bad condition of road and corruption in the process for making money.

- Merchandise also has to face substantial loss of time at the border. The delay takes place at the parking lot, in custom clearance and at the entry and exit points. It is mandatory for the trucks coming from Bapung, Ladrymbai and other areas to park at Amtapoh just after Amlarem sub-division. Then the trucks are allowed to move serially towards Dawki when maximum trucks are cleared from LCS point. At the border, the trucks are again made to park at the parking space. After getting the clearance from both the Directorate of Mineral Resources and the Indian Customs authority, trucks can cross the Border between 10:00 AM – 5:30 PM.

As already mentioned, the existing custom clearance procedures at the border lead to significant costs and delay. The existing custom procedures and documentation are not transparent. As a result, all the exporters employ clearing agents on a monthly basis to expedite the process. According to the expectation of the exporters, in spite of appointing clearing agents and also the payment of speed money to the customs and DMR officials, clearance of paper requires much more time than it should require. This raises cost further and hampers the activities.

The entry point at the border has one single gate, which is used for exports, imports as well as for passenger movement. At one time, only one truck can pass through the gate. As a result, the entry point remains very congested. The truck from Meghalaya after unloading at Tamabil (in Bangladesh) is allowed to re-enter India after or before export hours; they have to park in Muktapur roadside (located ahead of Dawki land customs station) and wait for longer hours.

Therefore, transaction cost has become one of the important issues for traders in most of the underdeveloped countries of the world. Recently world development report

states that corruption increases the transaction cost (World Bank, 2005). Traders in Meghalaya also face similar situations. For formal traders transaction costs include bribes paid at various stages to the officials. Transportation cost includes insurance and cost of credit. In addition to that, Meghalaya exporters have to bear with speed money and delays in processing.

5.6 Conclusion

Coal trade in Meghalaya has three components. Inter-state coal trade is the main driving force behind the operation of coal trade in Meghalaya. At the same time, the role of coal export to Bangladesh cannot be under estimated. It is also playing a vital role so far as coal mining and its trade activities are concerned. But local trade in coal is very meagre and needs to be recorded by some government agencies for the sake of research and policy making. As industrial development is limited in Meghalaya, coal is being exported without any value addition; which would otherwise generate more employment and income. However, the rising demand in other regions of India and neighbouring Bangladesh over time led to significantly rise in the extraction of coal in Meghalaya.

The international trade has two dimensions. Formal trade, that takes place through Land Custom Stations and thereby recorded. But due to corruption led inefficient official machinery some portion of the trade does not generate income to the state. Similarly, the informal trade that has been taking place through different border points should be controlled to generate more state income and utilise in the process of development of the society.

References:

- Agnihotri, S. K. (1993), "Border Trade with Bangladesh", *Journal of North-East India Council for Social Science Research*, Vol. 17, No. 2, October, Pp. 29-36.

- Bhattacharyya, S. (2004), *The Making of a Hill Leader*, Deo Gratias DTP, p-47.
- Dutta, R. (2000), "Coal Export from Meghalaya to Bangladesh: A Case Study of Borsora Trade Route" in G. Das and R.K. Purkayastha (eds.), *Border Trade: North-East India and Neighbouring Countries*, Akansha Publishing House, New Delhi, Pp. 200-208.
- Hunter, W. W. (1879), *A Statistical Account of Assam* (Vol.2), Reprint (1998), p. 236, Pp. 278 - 239.
- Madan, D. K. (1996), *Indo-Bangladesh Economic Relations and SAARC*, Deep and Deep Publications, New Delhi.
- Mero, M. K. (2000), "Exports from North-Eastern Region: Potential and Problems" in G. Das and R. K. Purkayashta (eds.), *Border Trade: North-East India and Neighbouring Countries*, Akansha Pub. House, New Delhi.
- Mun, T. (1979), "Mercantilist Doctrine at Its Height" in Isaac Ilyich Rubin (ed.), *A History of Economic Thought*, Ajanta Publications, Delhi, Pp. 49-57.
- Oldham, T. (1854), *Geology Meteorology and Economy of Meghalaya*, Mittal Publications, Delhi, P. 60.
- Saraffa, I. And Dobb, M. (1951-55), *The Works and Correspondence of David Ricardo*, Cambridge University Press, Cambridge.
- Sarma, B. K. and Goswami S. N. (2000), "Border Trade in North-East India: An Overview" in G. Das and R.K. Purkayastha (eds.), *Border Trade: North-East India and Neighbouring Countries*, Akansha Publishing House, New Delhi, Pp. 93-99.
- Syiemlieh, D. (1989), *British and Administration in Meghalaya: Policy and Pattern*, Heritage Publishers, New Delhi.
- World Bank (2005), *Bangladesh; Growth and Export Competitiveness*, Report no. 31394-B D.

Appendix 5.1

**Meghalaya's Coal Export to Bangladesh through different Land Custom Stations
(Metric Tonne)**

Name of LCS	1998-99	1999-2000	2000-2001	2001-2002	2002-03	2003-2004	2004-05
Dawki	341862.121 (61.94)	222426.457 (34.01)	420622.418 (51.43)	304061.751 (43.32)	494966.534 (47.32)	478056.000 (39.13)	311329.000 (22.49)
Borsora	69793.200 (12.64)	166804.735 (25.51)	233758.200 (28.58)	169211.830 (24.10)	242577.50 (23.19)	372466.650 (30.49)	411328.000 (29.7)
Mohendraganj	Nil	61290.47 (9.37)	17133.00 (2.09)	Nil	23515.00 (2.24)	23743.500 (1.94)	2858.000 (0.2)
Ghosualpara	56684.500 (10.27)	92597.9 (14.16)	129386.200 (15.82)	122577.100 (17.46)	109012.406 (10.42)	78059.600 (6.39)	92852.400 (6.70)
Dalu	861.000 (0.15)	1007.5 (0.15)	5087.000 (0.62)	4089.700 (0.58)	14548.800 (1.39)	13927.100 (1.14)	35529.000 (2.56)
Bahgmara	Nil	Nil	Nil	100.00 (0.014)	250.000 (0.023)	350.00 (0.02)	Nil
Karimganj	Nil	Nil	11740.000 (1.43)	8851.760 (1.26)	12594.000 (1.20)	2462.300 (0.2)	Nil
Sutarkandi	82655.364 (14.97)	202328.206 (30.940)	79057.323 (9.66)	92953.785 (13.24)	148441.165 (14.19)	252502.300 (20.67)	530374.200 (38.31)
Total	551856.185 (1000)	653857.368 (100)	817726.818 (100)	761845.926 (100)	1045905.459 (100)	1221567.45 (100)	1384270.6 (100)

Source: Office of the Custom, Government of India, Shillong.

Note: Figures in the bracket represents percentage of exports to Bangladesh.

Appendix-5.2

Monthly Export of Coal to Bangladesh through Dawki Land Custom Station of Meghalaya during April 2002 to May 2005

Month	No. of Vehicles	Quantity in (MT)
April -2002	3612(14.59)	52708.70
May-2002	1937 (13.93)	26986.50
June-2002	1057(13.64)	14419.20
July-2002	2519(12.90)	32516.32
August-2002	3330(12.60)	41982.50
September-2002	3463(13.02)	49170.32
October-2002	3734(13.16)	49170.32
November-2002	4488(13.12)	58894.30
December-2002	3205(14.48)	46410.80
January-2003	3553(13.98)	49689.90
February-2003	3382(14.57)	49291.40
March-2003	2065(13.15)	27783.30
April-2003	5094(13.46)	68584.40
May-2003	3816(12.42)	47421.00
June-2003	662(12.89)	8537.80
July-2003	86.34(12.35)	1067.00
August-2003	1662(13.48)	22409.60
September-2003	4083(13.10)	53498.30
October-2003	4552(12.99)	59152.79
November-2003	3154(13.49)	42561.54
December-2003	3371(13.98)	47154.30
January-2004	3374(13.98)	47188.00
February-2004	2363(13.34)	31532.20
March-2004	3464(13.34)	48928.60
April-2004	3316(12.310)	40824.50
May-2004	2243(11.53)	25880.60
June-2004	759(10.61)	8056.20
July-2004	470(10.94)	5141.80
August-2004	620(10.63)	6592.90
September-2004	748(10.62)	7949.80
October-2004	1897(11.05)	20969.00
November-2004	2666(11.75)	31331.10
December-2004	4095(12.15)	49778.10
January-2005	3798(12.14)	46.144.80
February-2005	2585(12.58)	32531.30
March-2005	2979(12.04)	35881.10
April-2005	2889(11.51)	33261.00
May-2005	2376(11.23)	26681.10

Source: Land Custom Office, Dawki, Meghalaya.

Note: Figures in the braked indicated the Average coal per vehicle in metric tonne.

CHAPTER-6

IMPACT OF COAL MINING AND TRADING ON THE ECONOMY OF MEGHALAYA

6.1 Introduction

The economy of Meghalaya is predominantly agrarian like that of Indian economy as a whole. Meghalaya is a land-locked hilly territory where the industrial progress has been very slow though there is no dearth of natural resources. In view of this under-developed state of industrial sector, the majority of population, especially the rural masses have to depend on agriculture for their livelihood. According to the 2001 Census Report, 47.8 per cent of the total workforce in Meghalaya are cultivators and 18.1 per cent are agricultural labourers, which implies that still now more than two third of the total population are dependent on agricultural activities. In total the primary sector is contributing 30.28 per cent to the Gross State Domestic Product according to *Meghalaya Socio-Economic Review*, 2002-03, published by Directorate of Economics and Statistics, Government of Meghalaya.

Within primary sector, mining and quarrying occupies an important position in the economy of Meghalaya. As mentioned in the earlier chapter, substantial deposits of coal are found in various parts of the state. Here the coal is of sub-bituminous variety or lignite but has some good value in terms of its ash content. However, the main drawback of such coal is the presence of high sulphur. Due to the absence of big industries, coal produced in the state is mainly used for exporting outside the region and also outside the country without any value addition. However, the coalmines in the state are totally under the ownership of private individuals though in many cases land is

under community ownership. Coal mining and its allied activities have a considerable impact on income and employment of the state of Meghalaya. The contribution of coal mining and quarrying is estimated to be around 5 per cent of the Net State Domestic Product (NSDP) of Meghalaya (Directorate of Economics & Statistics, Government of Meghalaya, 2003). Moreover, royalty collected from the despatch of coal to outside has also been contributing significantly to the revenue earnings of the government of Meghalaya. The royalty coming from the coal contributes around 16 percent of the total internal revenue receipts of the state (Official record of Directorate of Mineral Resources, government of Meghalaya, 2005-06). Hence, coal mining and quarrying and its related activities have an important bearing on the economy of Meghalaya. The present chapter is thus devoted to analyse the impact of coal mining and its related activities on the employment, income, NSDP and revenue earnings of the government as well as growth of related industries in the state of Meghalaya.

6.2 Generation of Income from the Extraction and Trading of Coal in Meghalaya

Mining and trade of coal generate income both directly and indirectly. However, it is very difficult to capture all the indirect income and the multiplier effect it generates through several other sectors (like limestone industry, brick kilns, iron re-rolling that has further impact on the construction sectors and so on) in a chain manner because of the lack of information about the technical relationships among all of them, prices of all of them and the changes in linkages and prices over time. The income generated directly by the extraction of coal and its related trade activities have been considered here. The direct employment is generated in the form of coalmine owners, mining labourer, loaders, middlemen, traders etc. The indirect employment is generated in the form of workers in tea stall, motor repairing and other businesses developed in the coal mining area. Though employment is also generated in the industries where coal

is used as input are not considered here. That is why, the present estimation of income and employment provides a lower bound of the estimates. But an idea of minimum contribution of the coalmine to the economy can be generated that would be of great help for the policy formulation. The contribution of income generated in the extraction and trading of coal to Net State Domestic Product of Meghalaya, contribution of royalty collected from the coal despatch to the revenue receipts of the state government and income generated by the different sections of people related to the mining activities like coal mine owners, coal mine labourers, loaders, businessmen and some others have been explained sequentially in different sub-sections.

6.2.1 Impact of Coal Extraction on the Net State Domestic Product of Meghalaya

In order to have an idea of relative position of mining sector in total and coalmining, first of all, contribution of different major sectors to the Net State Domestic Product is considered. The contribution of different sectors to the Net State Domestic Product of any state can be categorised into three major parts viz. Primary, Secondary and Tertiary. Mining and Quarrying is included into the Primary Sector along with Agriculture, Forestry and Logging and Fishery. The contributions of these sectors are subject to continuous changes over the years. Changes in contributions of Primary, Secondary and Tertiary sectors during 1980-81 to 2002-03 to Net Domestic Product of Meghalaya are shown in Table-6.1.

Table-6.1 reveals that though contribution of Secondary Sector to NSDP in absolute sense has increased during 1980-81 to 2002-03, in percentage term it continuously declined, significantly from about 18 to 12 per cent during the same period. The contribution of Primary Sector in percentage term however has not changed significantly during the same period. Though in absolute and percentage sense it shows temporal fluctuations, percentage contribution has declined during the whole period of

1980-81 to 2002-03 from about 36 per cent to around 33 per cent. Still now Primary Sector contributes about one-third of the NSDP of Meghalaya.

Table-6.1
Sectoral Composition of NSDP of Meghalaya during 1980-81 to 2002-03
(at 1993-94 Prices) (Rs in crore)

Years	Primary	Secondary	Tertiary	Total
1980-81	260.54 (35.93)	127.53 (17.58)	336.99 (46.47)	725.06 (100.00)
1985-86	320.95 (36.95)	114.75 (13.21)	432.78 (49.83)	868.48 (100.00)
1990-91	386.28 (32.95)	125.65 (10.72)	660.06 (56.31)	1171.99 (100.00)
1995-96	508.81 (33.74)	165.79 (10.99)	833.52 (55.27)	1508.12 (100.00)
2000-01	722.10 (33.58)	294.51 (13.70)	1133.77 (52.72)	2150.38 (100.00)
2001-02	755.95 (33.90)	275.52 (12.36)	1197.36 (53.74)	2228.23 (100.00)
2002-03	775.48 (33.17)	290.90 (12.44)	1271.91 (54.39)	2338.29 (100.00)

Source: Directorate of Economics and Statistics, Government of Meghalaya, *State Domestic Product of Meghalaya* (Linked Series from 1980 to 1992-93), *Gross Domestic Product of Meghalaya* (from 1993-94 to 2001-2002).

Note: Figures in parenthesis represent percentage to total.

However, like the other states and all India level, contribution of Tertiary Sector has increased significantly during the same period in both absolute and percentage term. The contribution of Tertiary Sector was around 46 per cent during 1980-81 and increased to over 54 per cent during 2002-03. So the contribution of Tertiary Sector has increased at the cost of both Secondary and Primary sectors and now over half of the NSDP comes from this sector alone. Within Primary Sector, contribution of mining and quarrying (whose main component is coal) has been continuously increasing. The changes in contribution of different sub-sectors to the Primary Sector net state domestic product of Meghalaya during 1980-81 to 2002-03 has been shown in Table-6.2.

Table-6.2
Sub-Sectoral Estimates of NSDP at Constant (1993-94) Prices (Rupees in crore)

Years	Contribution of Mining and Quarrying	Contribution of Other Sub-Sectors (Agriculture, Forestry & Logging and Fishery)	Primary Sector
1980-81	15.19 (5.83)	245.35 (94.17)	260.54 (100)
1985-86	43.99 (13.70)	276.96 (86.30)	320.95 (100)
1990-91	80.23 (20.70)	306.05 (79.24)	386.28 (100)
1995-96	65.53 (12.87)	443.28 (87.13)	508.81 (100)
2000-01	138.22 (19.14)	583.88 (80.86)	722.10 (100)
2001-02	183.86 (24.34)	571.49 (75.66)	755.35 (100)
2002-03	166.59 (21.48)	608.89 (78.52)	775.40 (100)

Source: Directorate of Economics and Statistics, Government of Meghalaya, *Meghalaya District Gross Domestic product* (1993-94 to 1999-2000), *Statistical Handbook Meghalaya* (2005).

Note: Figures in parenthesis represent percentage to total.

Table-6.2 shows that the contribution of mining and quarrying to the Primary Sector has increased significantly from only 5.83 per cent in 1980-81 to 21.48 per cent in 2002-03. It indicates that though contribution of Primary Sector to NSDP of Meghalaya has declined marginally, contribution of mining and quarrying (whose primary component is coal) has increased during 1980-81 to 2002-03 and percentage contribution of agriculture and other sub-sectors to NSDP has declined during the same period. Changes in contribution of mining and quarrying to NSDP of Meghalaya during 1980-81 to 2002-03 have been shown in Table-6.3.

Table 6.3
Contribution of Mining and Quarrying to NSDP of Meghalaya (Rs. in crore)

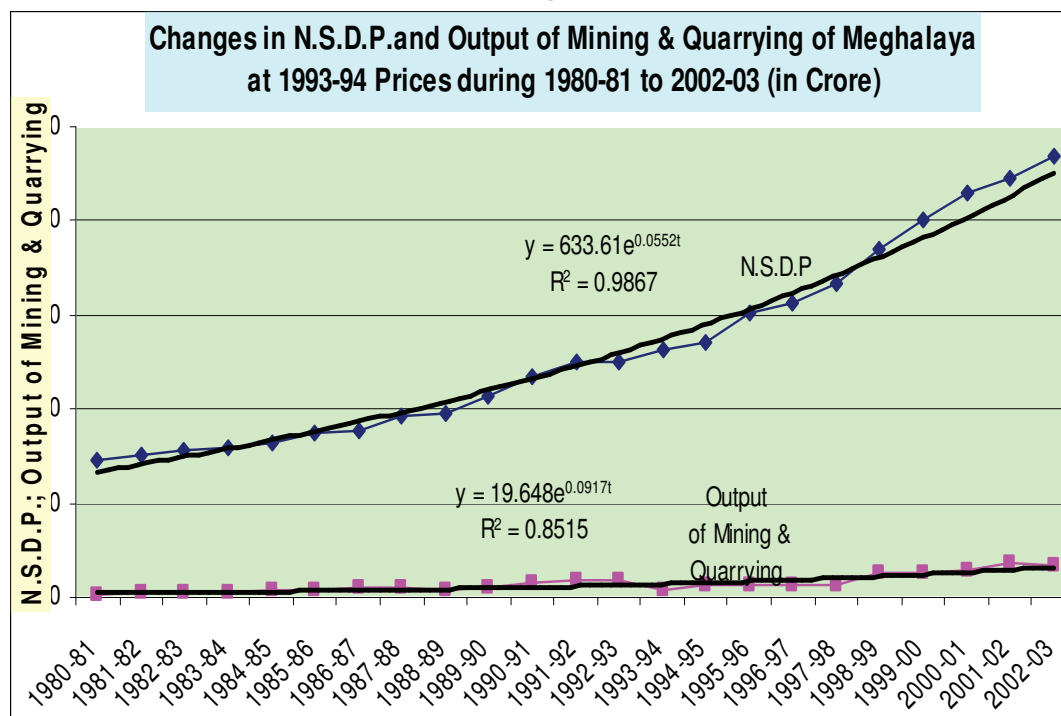
Year	NSDP at Constant Price (1993-94)	Output of Mining and Quarrying	% Contribution of Mining and Quarrying to NSDP
1980-81	705.10	15.19	2.09
1981-82	753.30	21.52	2.85
1982-83	782.40	21.72	2.77
1983-84	793.50	26.44	3.33
1984-85	825.30	33.38	4.04
1985-86	868.50	43.99	5.06
1986-87	883.80	51.17	5.78
1987-88	962.80	47.69	4.95
1988-89	977.70	41.39	4.23
1989-90	1072.20	50.34	4.69
1990-91	1171.90	80.23	6.84
1991-92	1243.60	90.61	7.28
1992-93	1259.70	90.11	7.15
1993-94	1309.80	44.28	3.38
1994-95	1352.88	66.27	4.89
1995-96	1508.12	65.53	4.34
1996-97	1562.03	68.66	4.39
1997-98	1662.55	66.40	3.99
1998-99	1843.89	128.82	6.98
1999-00	2000.39	124.91	6.24
2000-01	2150.38	138.22	6.42
2001-02	2228.23	183.86	8.25
2002-03	2338.29	166.59	7.12

Sources: (i) Directorate of Mineral Resources, Government of Meghalaya.

(ii) Directorate of Economics and Statistics, Government of Meghalaya, *Meghalaya District Gross Domestic product* (1993-94 to 1999-2000), *Statistical Handbook Meghalaya* (2005).

From Table- 6.3, it is also evident that contribution of mining and quarrying to the total NSDP of Meghalaya has steadily increased during 1980-81 to 2002-03. The contribution during 1980-81 was only Rs 15.19 crores and increased to Rs 166.59 crores during 2002-03. In terms of percentage, the contribution has increased from merely 2.09 per cent in 1980-81 to 7.02 per cent in 2002-03. It is indicated that during 1980-81 to 2002-03 the output of mining and quarrying has increased at a faster rate than that of NSDP, which is also shown in the diagram-6.1.

Diagram - 6.1



The growth rates have also been examined by fitting a semi log-linear regression of the respective variable (y_t) on time (t). The regression equations are:

$$L_n Y_t = 1.1317 + 0.0366 t \quad R^2 = 0.473 \dots \dots \dots (6.1)$$

(0.008)

$$L_n Y_t = 6.4514 + 0.0552 t \quad R^2 = 0.987 \dots \dots \dots (6.2)$$

(0.0014)

$$L_n Y_t = 2.938 + 0.0917 t \quad R^2 = 0.90 \dots \dots \dots (6.3)$$

(0.0014)

Where Y_t is the percentage contribution of mining and quarrying and figure in the bracket represents standard error of the slope co-efficient, which is highly significant at both 1 and 5 per cent level of significance in all cases. From equation-6.1 it is evident that percentage contribution of mining and quarrying to NSDP of Meghalaya has increased at 3.66 per cent annual exponential rate during 1980-81 to 2002-03. Equation-6.2 shows that, annual exponential growth rate of NSDP during the same period was 5.52 per cent. Where as the annual exponential rate of growth of output of mining and quarrying was 9.17 per cent, which is expressed by the regression equation-6.3 of the output of mining and quarrying on time t .

Therefore, it is evident that the annual exponential growth rate of output of mining and quarrying is almost twice the growth rate of NSDP of Meghalaya, i.e., why contribution to NSDP has increased significantly over time, which indicates that the other sectors has been lagging behind the mining and quarrying in terms of growth rate during last two and half decades.

Since coal mining and quarrying is the most important mining and quarrying activity (in terms of output and employment) in the state of Meghalaya, it is very important to have an idea of its contribution to the NSDP of Meghalaya. Contribution of coal mining and quarrying alone to the NSDP of Meghalaya and its changes during 1980-81 to 2002-03 has been shown in Table-6.4. Here the point to be mentioned is that in the estimation of value addition of coal we have considered the net income earned by coalmine owners, middleman traders and international and intra-national exporters. The income received by labourers mostly flows out of the state as more than 90 per cent of labourers are hailed from outside. So we have not considered the income of the coalmine labourers in the estimation of contribution of coal mining and quarrying and its related activities to the total NSDP of Meghalaya.

Table 6.4
Contribution of Coalmining and Quarrying to NSDP of Meghalaya (Rs. in crore)

Year	NSDP at Constant Price (1993-94)	Value of coal extraction	% Contribution by Coalmining and Quarrying to NSDP
1980-81	725.10	14.15	1.95
1981-82	753.30	16.42	2.17
1982-83	782.40	16.30	2.08
1983-84	793.50	16.42	2.06
1984-85	825.30	24.43	2.92
1985-86	868.50	28.84	3.32
1986-87	883.80	37.97	4.29
1987-88	962.80	31.00	3.21
1988-89	977.70	37.62	3.84
1989-90	1072.20	46.68	4.35
1990-91	1171.90	78.80	6.72
1991-92	1243.60	57.18	4.59
1992-93	1259.70	59.20	4.69
1993-94	1309.80	41.19	3.14
1994-95	1352.88	53.61	3.96
1995-96	1508.12	52.80	3.38
1996-97	1562.03	48.22	3.08
1997-98	1662.55	41.76	2.51
1998-99	1843.89	76.51	4.14
1999-00	2000.39	78.96	3.94
2000-01	2150.38	80.69	3.75
2001-02	2228.23	99.18	4.45
2002-03	2338.29	92.29	3.94

Sources: (i) Directorate of Mineral Resources, Government of Meghalaya.

(ii) Directorate of Economics and Statistics, Government of Meghalaya, *Meghalaya District Gross Domestic product* (1993-94 to 1999-2000), *Statistical Handbook, Meghalaya* (2005).

Note: Value of output of coal mining is calculated by the researcher using the figures of output and price over time.

Comparing table-6.3 and table-6.4, it can be said that while 7.12 per cent of NSDP was contributed by the whole mining and quarrying sector in 2002-03; the contribution of coal mining and quarrying alone was about 4 per cent. However one point may be noted here that percentage contribution of coal mining alone was 1.95 in 1980-81, when the contribution of total mining sector was 2.09 per cent. The implication is that during 1980's other mining sectors were not developed and gradually the contribution of those mining sectors like limestone and others have been increasing. However, still now coal mining is the single most important mining activity of Meghalaya. Table-6.4 shows a steady increase in the percentage contribution of coal

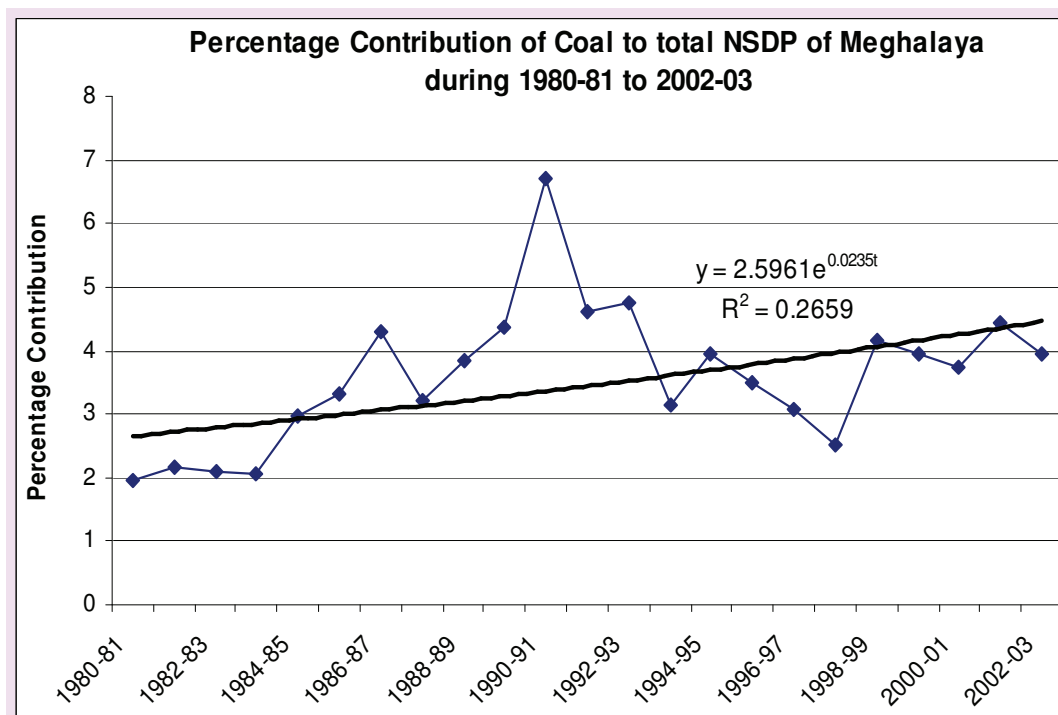
mining and quarrying output from 1.95 per cent in 1980-81 to 3.94 per cent in 2002-03. The trend in the contribution of coal mining and quarrying output is also examined by fitting a semi-logarithmic equation of type $L_n Y_t = \alpha + \beta t$, where Y_t is the percentage contribution of coalmining and quarrying output, t is the time in year and α and β are the two parameters. Here β is the annual exponential growth rate. The annual exponential growth rate of percentage contribution of coalmining and quarrying output to NSDP of Meghalaya was 2.35 per cent during 1980-81 to 2002-03, which is exhibited, in the regression equation-6.4.

$$L_n Y_t = 0.954 + 0.0235t^* \quad R^2 = 0.266 \dots \dots \dots (6.4).$$

(0.0085)

Where figure in the bracket represents standard error of the slope co-efficient, which is highly significant at 5 per cent level of significance. Changes in percentage contribution of coal to NSDP of Meghalaya during 1980-81 to 2002-03 are also shown in the diagram-6.2.

Diagram – 6.2



The diagram also reveals that though there has been an increasing trend of percentage contribution of coalmining and quarrying to NSDP of Meghalaya, it has been associated with high degree of fluctuation, especially during 1988 to 1993.

6.2.2 Contribution of Coal Mining and Quarrying to the Revenue Receipt of the Government of Meghalaya

The total revenue receipts of the government of Meghalaya have increased from Rs 9852.69 lakh in 1987-88 to Rs 53170.95 lakh in 2003-04. Similarly, the amount of royalty earned from coal has increased from Rs 868.80 lakhs in 1987-88 to Rs 8974.50 lakhs in 2003-04. Also there has been a rapid increase in the percentage contribution of royalty from coal to the total revenue earnings of the Government of Meghalaya from 8.81 per cent in 1980-81 to 16.87 per cent in 2003-04, which is shown in Table-6.5.

Table-6.5
Coal Royalty and Revenue Receipts of the Government of Meghalaya

Year	Revenue Receipts (Rs. Lakhs)	Total Amount of Coal Royalty (Rs. Lakhs)	Coal Royalty as Percentage to Total Revenue Receipts
1987-88	9852.69	868.60	8.81
1988-89	11525.97	1084.20	9.40
1989-90	11637.25	1351.20	11.61
1990-91	13508.53	2248.20	16.64
1991-92	16092.24	2078.40	12.91
1992-93	17094.96	2092.20	12.23
1993-94	20415.64	3051.60	14.94
1994-95	21787.00	3916.80	17.97
1995-96	26363.00	3897.00	14.78
1996-97	31166.00	3887.04	12.47
1997-98	35110.00	3881.04	11.05
1998-99	40034.00	5085.35	12.70
1999-00	48473.00	4872.00	10.05
2000-01	32010.00	4878.00	15.23
2001-02	42905.93	6178.00	14.39
2002-03	41375.67	5275.56	12.75
2003-04	53170.95	8974.50	16.87

Sources: (i) Directorate of Mineral Resources, Government of Meghalaya.

(ii) Directorate of Economics and Statistics, Government of Meghalaya, *Statistical Hand Book Meghalaya*, various issues.

Note: Grants in aid from the Central Government has not been included in the total revenue receipts of the Government.

The nature of growth in the royalty from coal has been analysed by fitting semi-logarithmic equations (as used earlier) of the form $L_n Y_t = \alpha + \beta t$, where Y_t is the total revenue earning of the state Government, royalty from coal or percentage contribution of royalty from coal to the revenue earnings of the state Government. The regression equations are as follows:

$$L_n Y_{Ro} = 2.424 + 0.0155t^{**} \quad t_{\text{value}} = 1.60, R^2 = 0.15 \quad \dots \quad (6.5)$$

(0.0096)

$$L_n Y_{Re} = 9.1517 + 0.1053t^* \quad t_{\text{value}} = 15.26, R^2 = 0.94 \quad \dots \quad (6.6)$$

(0.0069)

$$L_n R_y = 6.97 + 0.1208t^* \quad t_{\text{value}} = 12.01, R^2 = 0.906 \quad \dots \quad (6.7)$$

(0.01)

Where Y_{Ro} is the percentage contribution of coal royalty to total revenue, Y_{Re} is the value of total revenue and R_y is the value of royalty from coal, t is the time in years and figure in the bracket represents standard error of slope co-efficient. Here * and ** indicate that the coefficient is significant at 5 and 10 per cent level of significance.

From equation-6.5, it is evident that the annual exponential growth rate of percentage contribution of royalty from coal to the total revenue of the government was 1.55 per cent during 1987-88 to 2003-04. Equation-6.6 indicates that the annual exponential growth rate of total revenue earning of the government during 1987-88 to 2003-04 was 10.53 per cent.

Similarly, equation-6.7 represents that the annual exponential growth rate of royalty collection from coal was 12.08 per cent during 1987-88 to 2003-04, which is higher than the annual exponential growth rate of total revenue. However, the difference in rate of growth of royalty from coal and total revenue is not very large and hence the rate of growth of percentage contribution of coal royalty to total revenue during that period has been only 1.55 per cent, though it is also significant but only at the 10 per cent level of significance.

6.2.3 Extraction of Coal and Income Generation by the Individual Mine Workers

Coal mining and its related activities have important bearing for the generation of income in Meghalaya over the years. Approximately, 5 per cent of Net State Domestic Product was contributed by whole Mining and Quarrying sector in Meghalaya during 2002-03 and more than 50 per cent of it is contributed by coal mining and quarrying activities as shown earlier. Over the years, quantity of extraction has been increasing and more and more income has also been generated. Though price of coal has not been increasing significantly over the years, cost of extraction also has not changed significantly in spite of very little change in technique of mining. In this sub-section the income generated from coal mining and quarrying and its temporal variations have been discussed.

Method of Estimation

Secondary information on income generated in coal mining and its allied activities is not available. Therefore, primary information has been used to estimate the income generated in the coal mining and its related activities. For the purpose of analysis, primary information on different aspects like extraction of coal and income generated by different agents from it and its related activities, number of working days, over time changes in activities, wage and salaries of the individuals, cost on transportation etc. are collected from Bapung, Ladrymbai and Khliehriat coal mining areas and also from the Bapung, Ladrymbai, Khliehriat and Dawki trade centres of Jaintia Hills district of Meghalaya during April-May, 2005. Because of its pristine position in the production and business of coal in Meghalaya (about 70 percent of coal in Meghalaya is extracted from Jaintia Hills region) Jaintia Hills is chosen purposively for the sample survey. The areas of Bapung, Ladrymbai and Khliehriat are the main extraction areas of Jaintia hills district. Along with those areas Dawki is main international trade centre of coal. As the method of extraction is almost similar all over

Meghalaya and coal is available at similar depth in all places of Meghalaya having similar other conditions (wage, price etc except transport); cost, revenue, income etc are estimated for the whole Meghalaya on the basis of observations from the samples of Jaintia Hills District.

Experience from the field shows that coal is generally extracted on contract basis and the cost of extraction per tonne of coal was on an average Rs 800 in 2005. The cost of extraction during the earlier years have been collected from the experienced coal mine owners who have been in mining activity for more than 25 years. Multiplying the cost of unit extraction, which is paid to the labourers with the total production of coal of the respective year, total income generated by the coal mine labourers is estimated.

The income of the coalmine owners has been estimated on the basis of the difference between the total extraction cost plus other expenditures like (i) the payment to the depot managers (ii) transportation cost for fetching coal from the mining site to the main road depot; and the selling price of the coal per tonne of coal at the depot. The variations in the cost of extraction and the selling price have also been considered though it is not significant across different places. The average net income per tonne of coal has been multiplied by the total production of coal of the respective year, to estimate the total income received by the coal mine owners in total. Similarly, loading charge per tonne of coal, which was Rs 40 in 2005 has been multiplied by the total amount of coal despatched from Meghalaya in 2005-06, to find out the approximate total income of the loaders. The loading charge, which was prevailing in the past years, has also been collected from the experienced traders to approximate income of the loaders in the past years. The income of the depot managers has been estimated by taking into account the total number of depot managers and their annual income. The salary paid to depot managers has been collected from coalmine owners and has also

been crosschecked with the information obtained from the depot managers. The total numbers of coal depots are calculated on the basis of total number of coal depots owned by the coal mine owners and others in Jaintia Hills.

The income, which enters the pockets of international exporters and inter-state traders, has been estimated on the basis of the average net profit of the exporters per tonne of coal. Then the total amount of coal despatched from Meghalaya has been multiplied by the net income per tonne of coal to approximate the income of the traders. The income of the truck owners has also been estimated on the basis of the average net income generated from the transport of one metric tonne of coal and relating it with the total despatch of coal from Meghalaya. The total income of the managers and assistant managers has been estimated on the basis of per individual annual income and the total number of employment. The total number of managers and assistant managers has been approximated on the basis of total number of traders (exporters plus inter-state traders)¹. The income of the drivers and handyman has been estimated taking into consideration their annual income and their total number of employment. The total number of trucks used for both the mining and trading purposes gives an idea of the total employment of drivers and handymen.

Data have been collected from 50 coalmine owners out of about 500 owners in Jaintia Hills Districts, 200 coalmine labourers out of approximately 50,000 workers, 20 international exporters out of total 135 exporters and 40 non-coalmine owners in those areas. The samples have been chosen proportionately on the basis of the extraction and trade in those areas by simple random sampling as described in chapter-3. The information relating to the past income of the different units has been collected from

¹ It may however be noted that the number of managers, assistant managers and traders may change due to the variation in capacity of each of them. Therefore, in the present analysis the capacities or efficiencies of the managers, traders etc have been considered to be the same. This is also because of the over time improvement in efficiency, transport facility and other practices. Thus there might be some bias in the estimation. However, in the absence of any other suitable method and information this is the best possible estimation of all such categories.

those respondents who have worked in coal mining and its related activities for more than 25 years. Regarding past incomes, the information might have little error, but that is the best possible and reliable information.

6.2.3.1 Earning of the Coalmine Labourers

Study of coalmines reveals the fact that presently from the extraction of one tonne of coal the coalmine labourers earn Rs.800.00 on contract. But this was about Rs.200 in 1980-81. It is observed that there has been a continuous increase in income of the mine labourers as a whole over the years along with the extraction. Table-6.6 reveals the over time variation in estimated income of coalmine labourers in Meghalaya during 1980-81 to 2005-06.

Table 6.6
Extraction of Coal and Income Earned by Coalmine Labourers

Years	Income earned by Coalmine Labourers (Rs in lakh)
1980-81	724.00
1985-86	3289.00
1990-91	12739.80
1995-96	17861.25
2000-01	24390.00
2005-06	44525.60

Source: Field survey.

Note: Estimated by the researcher using figures of the payment to labourers per Tonne of coal collected from the experienced coalmine owners and the total production of coal during a particular year.

From Table-6.6, it is evident that in 1980-81 approximate total earning of the coalmine labourers was around Rs.724 lakhs. But it increased to around 44525.6 lakhs in 2005-06. Hence the earning of coal miners in total has increased significantly along with the rise in extraction and hence employment as there has been no significant use of labour saving technology. However, wage per labourer has increased only from Rs 60-70 in 1980-81 to Rs 300 – 320 in 2005-06. But if we compare with the rising index number of wholesale prices, which increased from 100 in 1981-82 to about 484 in 2004-05, it is realised that the rise in money wage of the coalmine labourers has not

been enough to mitigate the rise in cost of living especially if the rise in health hazard and thus loss of statistical value due to engagement in mining is considered.

6.2.3.2 Earning of the Coalmine Owners

Earlier it is stated that extraction has been going on contract basis. The common practice is that the coalmine owners appoint *Sardars* on contract basis to extract coal. Once coal is extracted, coalmine owners transport these coals to the roadside depots from where coal is sold to the traders. During 2005, on an average a coalmine owner used to get Rs.160/- as net income from one tonne of coal extracted from his land. Whereas, an average owner used to earn Rs.40/- from the same quantity of coal during 1980-81; the information of which has been obtained from the experienced coalmine owners; who have been engaged in such activities for more than 25 years.

Table-6.7
Earning of Coalmine Owners from the Extraction of Coal over Time

Years	Income Earned by Coalmine Owners (Rs in lakh)
1980-81	114.80
1985-86	632.50
1990-91	2248.20
1995-96	2435.63
2000-01	4471.50
2005-06	10018.25

Source: Field Survey by the researcher.

Note: Estimated by the researcher using the figures of extraction, price, cost etc. collected through the field survey.

Table-6.7 illustrates the changes in aggregate earnings of the coalmine owners during 1980-81 to 2005-06 as estimated by the researcher. The table also reveals the fact that the estimated total income earned by the coalmine owners as a whole has increased significantly from Rs 114.80 lakhs in 1980-81 to Rs 10018.25 lakhs in 2005-06. This implies the fact that with expanding extraction, the more and more income is entering into the pockets of coalmine owners. The income of the coalmine owners as a whole has increased by around 8726.7 per cent from 1980-81 to 2005-06; while from

the total production of coal in different years it is shown that the total production of coal has increased by 1537.5 per cent from 1980-81 to 2005-06, which is much lower than that.

6.2.3.3 Earning of the International Exporters and Inter-State Traders

International exporters used to collect coal from the middlemen or owners and supply to the other countries like Bangladesh. However, inter-state traders supply coal to the other states within the country. International exporters generally process some custom documents; but inter-state traders have nothing to do with custom documents. However, the other aspects of the trade are similar for both the traders. E.g., both international traders and inter-state traders have to pay royalty at the rate of Rs.165/- per tonne as and when they despatch coal from one place to the other. However, it is observed that both of them manage almost the same amount of profit per tonne of coal. The field investigation reveals that during April-May, 2005, Rs.170/- was the average net profit earned by the traders per tonne of coal. Table-6.8 shows the approximate amount of profit earned by both categories of traders together during 1980-81 to 2005-06 as estimated from the field data.

Table-6.8
Profit Earned by the International Exporters and Inter-State Traders
over the Years

Years	Profit earned by Traders (Rs in lakh)
1980-81	144.80
1985-86	632.50
1990-91	2248.20
1995-96	2435.63
2000-01	4471.50
2005-06	10018.25

Source: Field Survey by the researcher.

Note: Estimated by the researcher using figures of selling price per tonne, buying price per tonne, royalty per tonne, transport cost and other establishment costs.

From table-6.8 it is observed that the estimated income earned by the international exporters and inter-state traders together from coal business has increased

steadily from 1980-81 to 2005-06. During 1980-81, the total income generated by the exporters and inter-state traders was Rs 144.8 lakhs, which increased to Rs 10018.25 lakhs in 2005-06 that implies the total income of the traders has increased by approximately 8726.7 per cent from 1980-81 to 2005-2006.

6.2.3.4 Earning of the Middleman Traders

A middleman trader is one who collects coal from the owner and supplies it either to an international exporter or to an inter-state trader. Generally, they hire trucks to transport coal from the mining sites to the trading point. They purchase coal from coal depots in the mining site and sell that coal to the traders. By doing all these business, they manage certain amount of profit. From the field survey it is estimated that during April-May 2005, Rs.100/- was the average net profit per tonne of coal earned by the middlemen. However, information from experienced middlemen crosschecked with the other traders and owners, who have been working for more than 25 years reveals that the net profit was about Rs 10 per tonne during 1980-81. The total estimated income earned by the middleman traders in aggregate over time from the coal trade in Meghalaya is presented in Table-6.9.

Table-6.9

Profit Earned by Middleman Trader of Coal in Meghalaya during 1980-81 to 2005-06

Years	Profit Earned by the Middleman Traders (Rs in lakh)
1980-81	36.20
1985-86	177.10
1990-91	749.40
1995-96	779.28
2000-01	1544.70
2005-06	6232.27

Source: Field Survey by the researcher

Note: The value is estimated by the researcher using figures of purchasing price per Tonne, selling price per tonne and transport cost.

Table-6.9 depicts that the estimated total income earned by the middlemen as a whole has been increasing significantly from Rs 36.20 lakhs in 1980-81 to Rs 6232.27

lakhs in 2005-06. The hike in total income of the middlemen has been 17216.2 per cent during that period. So, middlemen as a whole have been largely benefited in terms of total earnings due to the growth of coal business in the state.

6.2.3.5 Earning of the Truck Owners

For transportation of coal, the middleman traders hire trucks. The owners of these trucks earn some profits after meeting different expenditures like (i) payment for the drivers and handymen; (ii) fuel expenses; (iii) expenditure on maintenance etc. Field observation reveals that during April-May 2005, the net profit generated by a truck owner is estimated to be Rs.40/- per tonne after meeting different expenses, whereas in 1980-81 it was merely Rs.10/- per tonne, as is observed from the information available from the experienced truck owners and other related workers. Table-6.10 given below exhibits the changes in estimated earning of the truck owners in aggregate during 1980-81 to 2005-06.

Table-6.10
Transportation of Coal and Income Earned by Truck Owners

Years	Income earned by Truck Owners (Rs in lakh)
1980-81	36.20
1985-86	189.75
1990-91	749.40
1995-96	811.75
2000-01	1219.50
2005-06	2059.60

Source: Field Survey by the researcher

Note: Estimated by the researcher using the figures of payment for fuel, payment for drivers and managers and interest payment on loan used for purchasing trucks.

From Table-6.10, it is observed that with the rising extraction of coal and its trade, total income accruing to the transport sector has increased significantly during 1980-81 to 2005-06. The total estimated income earned by the truck owners due to the transportation of coal was Rs 36.20 lakh in 1980-81, which increased to Rs 2059.60 lakh in 2005-06. This indicates that the total estimated income of the truck owners

(some of them are also the coal mine owners) has increased by about 5689.5 per cent during 1980-81 to 2005-06.

6.2.3.6 Earning of the Loaders

For the transportation of coal, the loaders are used to load trucks. As mentioned earlier, a group of six labourers used to load two trucks in one working day. During 2005, loading charge per truck of 15 tonnes was about Rs.600/-, which means the loading expenditure per tonne of coal was about Rs 40. Whereas in 1980-81, Rs.13/- per tonne used to be paid for one tonne of coal as loading charge. Therefore, by multiplying the loading charge per tonne with the total amount of coal transported, we get the total estimated earning of the loaders in Meghalaya. Table-6.11 given below depicts the variation in approximate earning of the loaders in total since 1980-81 in Meghalaya.

Table-6.11

Earnings of the Loaders due to Transportation of Coal

Years	Income Earned by the Loaders (Rs in lakh)
1980-81	47.06
1985-86	189.75
1990-91	749.40
1995-96	811.87
2000-01	1211.95
2005-06	2226.28

Source: Field Survey by the researcher

Note: Estimated by the researcher using the total amount of coal transported and loading charge per tonne of coal.

Table-6.11 exhibits that the estimated income earned by the loaders all together has increased manifold during 1980-81 to 2005-06. The total earning of the loaders was about Rs 47.06 lakh in 1980-81, which increased to Rs 22262.80 lakh in 2005-06. This shows a 47307.26 per cent hike in the total income of the loaders all together during the period of discussion.

6.2.3.7 Earning of the Depot Managers

Coalmine owners generally employ one manager to supervise the daily business of coal in depot. For this purpose the depot manager is paid a monthly salary. It is observed that during 2005, Rs.3000/- was the monthly payment to the depot managers, which was Rs.1000/- per month during 1980-81. The monthly income of all the depot managers may be approximated by multiplying average monthly salary of each depot manager by the total number of managers employed.

Table-6.12
Coal Business and Earnings of the Depot Managers

Years	Earnings of the Depot Managers (Rs in lakh)
1980-81	30.36
1985-86	111.46
1990-91	181.98
1995-96	242.64
2000-01	3639.96
2005-06	3639.96

Source: Field Survey by the researcher

Note: Estimated by the researcher using the figures of total number of coal depots and annual income of the depot managers.

The number of depot managers was about 253 in 1980-81 that increased to 1101 in 2005-06. The total approximate earning of the depot managers have been estimated and presented in Table-6.12. The earning of depot managers has increased from only Rs 30.36 lakh in 1980-81 to Rs 3639.36 lakh. Therefore even if we discount the rising income by the index number of prices we observe a huge increase in income of the depot managers like that of all other groups.

6.2.3.8 Earning of Managers and Assistant Managers at Trading Points of Coal

Managers and assistant managers are appointed by international exporters and inter-state traders to expedite their business of coal. Generally, they are paid on monthly basis. A manager is paid little more than an assistant manager. During April-May 2005, a manager was paid Rs.3500/- per month, whereas an assistant manager's

monthly salary was Rs.2500/-. The salary of manager and assistant manager was the same across all the coal depots of Meghalaya. However in 1980-81, the salary of the manager was Rs.1500/- and for the assistant manager was Rs1000/- as per the information obtained from the experienced traders. Table-6.13 shows the changes in earnings of the managers and assistant managers during 1980-81 to 2005-2006.

Table-6.13

Earning of the Managers and Assistant Managers of International and Intra-national Traders of Coal in Meghalaya

Years	Earning of the Managers and Assistant Managers (Rs in lakh)
1980-81	21.51
1985-86	124.59
1990-91	401.94
1995-96	540.96
2000-01	676.20
2005-06	811.44

Source: Field Survey by the researcher

Note: Estimated by the researcher using annual income of the managers and assistant managers and total number of their employment.

From Table-6.13 it is observed that the total income of the managers and assistant managers has increased significantly from Rs 21.51 lakhs in 1980-81 to Rs 811.44 lakhs in 2005-06. This indicates an overall increase of 3774.13 per cent in the total income of the managers and assistant managers during 1980-81 to 2005-06.

6.2.3.9 Earning of the Drivers and Handymen

Drivers and handymen are employed in the transportation of coal. A driver is paid little more than a handyman. At the time of field survey in April-May, 2005 monthly salary of a truck driver was observed to be Rs 3000/- and that of a handyman Rs 1500/-. In 1980-81 the monthly salary of a driver and a handyman was Rs.1500/- and Rs.500/-, respectively as per the information obtained from the experienced truck owners and traders. Table-6.14 represents the estimated total earning of the drivers and handymen in Meghalaya during 1980-81 to 2005-06.

Table-6.14
Transportation of Coal and Earnings of the Drivers and Handymen

Years	Earnings of the Drivers & Handymen (Rs. in lakh)
1980-81	140.16
1985-86	305.86
1990-91	1349.46
1995-96	2302.92
2000-01	2184.00
2005-06	3998.16

Source: Field Survey by the researcher

Note: Estimated by the researcher using figures of total number of trucks used in mining and trade and annual income of the drivers and handymen.

From Table-6.14 it is evident that the total income of the drivers and handymen in the transportation of coal in Meghalaya has increased enormously (in proportion to the extraction) from Rs 140.16 lakhs in 1980-81 to Rs 3998.16 lakhs in 2005-06. This shows an over all increase of 2832.56 per cent in the total income of the drivers and handymen as a whole during the aforesaid period.

Table-6.14 (A)

Over-Time Percapita Annual Earnings of The Different Coal Mine Agents in Meghalaya (Rs in Lakh)

Years	Labourers	Owners	Exporters/Traders	Middleman Traders	Loaders
1980-81	0.14	0.39	1.29	0.22	0.19
1985-86	0.18	1.20	1.87	0.25	0.21
1990-91	0.39	1.92	2.21	0.37	0.50
1995-96	0.40	2.08	2.15	0.35	0.45
2000-01	0.42	3.83	3.96	0.68	0.60
2005-06	0.56	8.58	8.88	2.76	0.60

Source: Compiled from the field survey

6.3 Extraction of Coal and Growth of Cement Industries in Meghalaya

Cement is the only major industry in Meghalaya that uses coal along with limestone for the preparation of clinker. Because of the availability of coal and

limestone (which are the two major inputs in the cement industry) Meghalaya has huge potential for the growth of cement industries. The first cement factory in the state was established in 1955 in the name of Assam Cement Company, which was later renamed as Mawmluh Cherra Cement Limited (MCCL) after Meghalaya got its statehood. Then, with the passage of time new cement industries came into existence and the production of cement in the state also increased. At present there are 9 cement firms in the state with total production reached at 272.7 thousand M.T. Therefore, it raises a question, whether the cement production has increased in proportion to the growth of extraction of coal or to what extent availability and extraction of coal in Meghalaya has helped growing cement industries in the state. Table-6.15 offers an explanation on comparative growth of cement production and extraction of coal during 1991-92 to 2004-05 in Meghalaya.

Table-6.15

Overtime Extraction of Coal and Growth of Cement Production in Meghalaya

Year	Cement Production (Metric tonne)	Extraction of Coal (Thousand tonnes)	Number of Cement firms
1991-92	11911.20	3464.00	2
1992-93	99023.50	3487.00	2
1993-94	115808.00	2543.00	2
1994-95	143223.37	3264.00	3
1995-96	134916.35	3247.50	4
1996-97	133838.85	3239.30	4
1997-98	128313.56	3234.20	5
1998-99	136527.21	4238.00	6
1999-00	153400.20	4060.00	6
2000-01	165717.00	4065.00	7
2001-02	145704.00	5149.00	7
2002-03	183503.00	4396.30	7
2003-04	182963.80	5439.10	8
2004-05	272672.00	5345.19	9

Source: (i) Commissioner of Central Excise, Government of India, Shillong.
(ii) Directorate of Mineral Resources, Government of Meghalaya.

Table-6.15 shows that total cement production in Meghalaya has increased from 199 thousand M.T. in 1991-92 to around 272.7 thousand M.T. in 2004-05. Similarly,

the extraction of coal has increased from 3464 thousand M.T. in 1991-92 to 5345.19 thousand M.T. in 2004-05. The trend rate of growth of cement production and extraction of coal during that period is estimated by fitting semi-logarithmic regression equations-6.8, 6.9 and 6.10 as presented below.

$$\begin{array}{lll} \text{Ln } Y_t = 4.60 + .0512t^* & t_v = 6.02 & R^2 = .75 \dots\dots\dots(6.8) \\ (.0085) & & \end{array}$$

$$\begin{array}{lll} \text{Ln } E_t = 7.914 + .0455t^* & t_v = 5.58 & R^2 = .722 \dots\dots\dots(6.9) \\ (.0082) & & \end{array}$$

$$\begin{array}{lll} \text{Ln } (Y/E)_t = 0.74 + 0.0048t & t_v = 0.53 & R^2 = 0.12 \dots\dots\dots(6.10) \\ (.0089) & & \end{array}$$

Where, Y_t is the production of cement in equation (6.8), and in equation (6.9) E_t represents the production of coal. Y/E is the ratio of cement output to the total extraction of coal. Here * indicates that the slope coefficient is highly significant at 5 per cent level of significance.

From the above equations, it is noticed that the annual exponential rate of growth of cement output is more than that of extraction of coal, indicating the growth rate of use of coal in cement manufacturing is more than the growth rate of extraction of coal. But still now only one per cent of extracted coal is used in the cement industries as shown earlier. This is because the capacity of cement production was very low in the early 1990s (base year) and even though the growth rate is faster, the capacity of the existing cement firms is still very low. The annual exponential growth rate of percentage of coal output used in cement production is 0.48 (equation 6.10) during 1991-92 to 2004-05.

6.4 Extraction of Coal and Its Impact on Employment

Coalmining and its related activities have important implications for the generation of income and employment in Meghalaya over the years. According to 2001 Census, only 4534 persons were engaged in the mining and quarrying activities. But the

figure most probably did not cover the whole operation of mining and quarrying. The data may be only on mine owners who are mostly own coal and it has not taken into account of labourers engaged in extraction. However, our observation in the coal-mining sector provides different result. Moreover, the activities here are labour-intensive because of poor mechanisation and traditional rat-hole method of mining is used for extraction of coal, which requires labour as primary factor. Over the years, quantity of extraction has been increasing and hence with almost identical technology required labourers have also been increasing.

There are various ways through which mining of coal generates employment and we can broadly categorise them into two different groups. One is the direct employment generated in the coal-mining sector and other is the indirect employment generated due to such mining activities in the neighbouring areas. Direct employment opportunity is created in the form of coalmine labourers, coalmine owners, drivers and handymen, loaders, managers, middleman traders and international exporters. Indirect employment generated by the coalmining and quarrying sector includes motor repairing shops, motor-parts selling shops and tea-stalls in the mining and trading areas of Meghalaya. But the employment generated indirectly in the other industries like iron re-rolling, brick kiln, cement firms etc. whose operation has been possible because of the availability of coal in the area is not estimated here. This is because of the lack of information about the technological linkages between employment in coal production and employment in those production units that operates through a chain linkage and the employment in those sectors are due to the joint influence of some other sectors along with coal. Yet, the method applied here provides the information about the minimum possible employment generated due to coal mining in Meghalaya. In this section the employment opportunities generated and its temporal variations have been discussed.

Method of Estimation

Like the contribution to income, secondary data on employment separately in coal mining and its allied activities is also not available. Therefore, primary information has been used in the estimation of employment generated by the coal mining and its related activities over the years. Primary information relating to employment in coal mining and its related activities had been generated by using the same set of sample surveyed in Jaintia Hills as mentioned earlier in case of income generation.

The study of 50 coalmine owners reveals the fact that 25 per cent of them have been working for more than 25 years, 20 per cent of them have been working for more than 20 years and 55 per cent of them have been working for more than 15 years. Hence, it is evident that the number of coalmine owners is not increasing for nearly last 15 years. The study of sample coalmine owners also reveals that on an average a coalmine owner annually extracts 4660 M.T. of coal. Dividing the total extraction of coal in 2005-06, i.e., 5565.71 thousand tonnes by the average quantity of extraction by a coalmine owner, we get the estimated total number of coalmine owners, which was the same before 15 years from today.

Regarding coalmine labourers, it is found that generally three man-days are required for the extraction of one tonne of coal. Given the same technology or technique of production, the ratio between labour and output has remained almost constant over the years. Hence, the number of coalmine labourer or man-days generated over the years has increased in proportion to the rise in the extraction of coal. But the total number of working days is only 210 days since coal extraction takes place only for 7 months (from October to April).² Per day coal extraction is estimated by dividing the total extraction of coal by 210 working days. Then per day coal extraction figure is

² Because of the rainy season, extraction remains closed during May-June to September of each year.

multiplied by 3 to get an idea of the total number of coalmine labourers engaged in the field of extraction.

In case of loaders, they normally work in a group and 6 loaders constitute a particular group. It is observed that a group of 6 loaders usually load 2 trucks in a day. For them, the total number of working days is 300 since on Sunday no work is done in most of the places of Meghalaya. If we divide the total coal despatch figure of a particular year by 300 and again multiplied by 0.20, we get the average number of loaders getting job throughout that particular year³. By multiplying the average number of loaders with 300 we can estimate the total man-days generated in the form of loader in a year due to the extraction of coal and trade. Therefore, it is clear that over time coal extraction and the number of loaders have a constant positive relation.

For international exporters, it is found that 10 per cent of them have been working for more than 25 years, 20 per cent of them have been working for more than 15 years, 60 per cent have been working for more than 10 years and 5 per cent have been working for more than 5 years. This shows that the number of exporters is not increasing as per the increase in extraction of coals⁴. But after a gap of some years the number has been increasing with the spread of trade. During 2005, the total number of international exporters was 135 in the Jaintia Hills region. But in case of inter-state traders the total volume of transaction of coal is generally found to be more than three times that of international exporters. Using this information along with the pattern of over time changes in percentage of exporters (obtained from their experiences); number of international and intra-national traders is estimated for different years.

For middleman trader, it is observed from the field experience that one international exporter normally receives coal from two middleman traders. Hence, the

³ The average load of a truck is 15 M.T. and if 6 loaders can load 2 trucks in a day, the loaders day requirement for one M.T. would be $6/30$ i.e., 0.20 labour days.

⁴ This may be due to the fact that some of the exporters have been increasing their volume of trade over the years and generating more and more personal income.

number of middleman traders is always linearly related to the number of international and inter-state traders. The same is the case with managers and assistant managers. In transportation, generally employment depends upon the number of trucks owned either by the coalmine owners and traders. The study of coalmine owners revealed that before 1988 each coalmine owner used to possess one Shaktiman truck; but after 1988 the number of trucks under the possession of each coalmine owner increased to 3 or 4. Most of the coalmine owner own coal depots and it is being monitored by a manager. The total number of Depot Managers has a direct link with the number of coalmine owners irrespective of their size. On the basis of above discussed linkages, employment generated in the coal mining sector is estimated and discussed sequentially in the following sub-sections.

6.4.1 Coalmine Labourers

Labourers are engaged in coalmines either for digging or for extraction of coal. As mentioned earlier, three labourers are required for the extraction of one tonne of coal and it remains the same as the similar technology is followed in the process of coal extraction over the years. On the basis of this, it is found that employment opportunity for coalmine labourers has been expanding over the years with the rising extraction figure. Table-6.16 given below shows the growth of employment of the coal mine labourers in coalmining activities during 1978-79 to 2005-06. The table shows that the estimated number of coalmine labourers has increased from merely 1742 during 1978-79 to about 79500 during 2005-06 all over the state of Meghalaya.

Table-6.16

Extraction of coal and Employment for Coalmine Labourers

Years	Volume of Employment (Number)
1978-79	1742
1985-86	18071
1989-90	32171

1995-96	46385
1999-00	58000
2002-03	62800
2005-06	79500

Source: Field Survey by the researcher

Note: Estimated by the researcher by using field survey data on total annual extraction of coal during 1978-79 to 2005-06 and the required labourer per tonne of coal.

6.4.2 Coalmine Owners

Coalmines are completely owned by the local people of the respective areas. Coalmine owners usually extract coal by investing their own money. Sometimes, it is observed that some coalmine owners, who are not so rich, sell their mine to other rich coalmine owners. As mentioned earlier, number of coalmine owners has no link with the volume of extraction of coal over the years⁵. It is observed that after 1988, the number of coalmine owners has remained almost stagnant. But when total extraction of coal in 2003-04, i.e., 5439 thousand M.T. was divided by the annual average extraction figure of each owner, i.e., 4660 M.T. we get the approximate number of owners that has been crosschecked with the information obtained from different Headman of the local coal mining areas. It is mentioned that 25 per cent of the owners have been working right from 1978-79 and 20 per cent of them have been working since 1983-84. Using that pattern of change, the number of coalmine owners is estimated for some discrete years that have been displayed in Table-6.17.⁶ The table shows that the total number of coalmine owners has increased from 292 in 1978-79 to 1167 in 1988-89 and after that it has remained almost the same.

Table-6.17
Extraction of Coal and Employment for Coalmine Owner over the Years

Years	Employment Opportunity Generated for Coalmine Owners (Number)
1978-79	292
1983-84	526

⁵ After a gap of certain years if a family is divided then also number of owners increased but the volume of extraction under each owner has been subject to continuous change.

⁶ In the estimation actually the experience-wise proportion of coalmine owners have been assumed to be constant over time. However, in reality the capacity of an owner to handle the mining activity may change and also the experience-wise composition of owners may change as mentioned in chapter-3.

1988-89	1167
2000-01	1167
2005-06	1167

Source: Field survey by the researcher

Note: Estimated by the researcher by using field survey information obtained from the local headman of the different villages located in coalmining areas of Jaintia Hills and the time period for which extraction has been carried by the coalmine owners.

6.4.3 Transportation of Coal and Employment Opportunity for Local People

Employment generated in transportation means employment generated due to transportation coal as well as passengers in the mining area. Here the employment in the carriers of coal is considered, as it is the only direct source of employment in transportation in the coalmining area. Employment generated in the transportation of passenger in the mining area is the indirect employment generated due to extraction of coal and thus considered in the indirect employment section. Generally, it is found that coalmine owners fetch coal from coalmine quarries to the main road depot by using Shaktiman trucks. Data obtained from the sample coalmine owners in Bapung, Ladrymbai, Khliehriat show that each and every coalmine owner owns two to three Shaktiman trucks for the transportation of coal. As mentioned earlier, employment opportunity in the transportation depends upon the total number of trucks owned by coalmine owners, middleman traders or international exporters. Since there are 1167 coalmine owners at present, the total number of Shaktiman trucks owned by them would be around 3702 during 2005. The number of trucks owned by the traders or exporters used for trade of coal is also around 3700 as per the information obtained from the traders and exporters. Hence approximately 14,800 persons have been engaged in the transportation of coal during 2005-06. But when extraction was less, employment in transportation was also very less. That implies that before 1988-89, there were very less people engaged in the transportation of coal. Table-6.18 given below shows the growth of employment in the transportation sector.

Table 6.18

Transportation of Coal and Employment for Drivers and Handymen

Years	Number of Drivers and Handymen
1978-79	1168
1983-84	2104
1988-89	8330
2000-01	12794
2003-04	14000
2005-06	14800

Source: Field survey by the researcher

Note: Estimated by the researcher by using field survey data on total number of trucks used for the transportation of coal both in mining and trading activities as obtained from the coalmine owners and traders.

From the table it is observed that the employment generated in the transportation of coal has increased substantially from about 1168 persons per day during 1978-79 to approximately 14800 persons per day in 2005-06.

6.4.4 Loaders in the Coal Depots

From the main road-side depots, trucks are loaded either for external destination like Bangladesh or for inter-state trade purpose. As mentioned earlier, a group of six workers usually load 2 trucks daily, i.e., 6 workers can load 30 tonnes of coal in a day. Considering 300 as total working days in a year and total yearly despatch of coal, total number of loaders is estimated for different years. The relationship between loading and coal despatch has remained the same over the years.

Table 6.19
Employment of Loaders for the Loading of Trucks and Despatch of Coal

Years	Employment of Loaders (Number)
1978-79	81
1983-84	475
1989-90	1501
1995-96	2164
2000-01	2710
2005-06	3710

Source: Field Survey by the researcher

Note: Estimated by the researcher by using field survey data on total amount of coal despatched from Meghalaya during different years and the loaders required per tonne of coal.

Table-6.19 shows that, employment generated in the form of loader of trucks has increased in the similar way as that of coal despatched to outside. The estimated

number of loaders increased from only 81 in 1978-79 to 1501 during 1989-90 and then further to 3710 during 2005-06.

6.4.5 Depot Managers

Once coal is extracted, it is transported to the roadside depots from where coal is sold to the traders. In each depot one person gets engagement to look after the daily transactions. In some areas like Bapung, the local people exclusively own coal depots. But, there are some areas like Ladrymbai where coal depots are owned by both the local people as well as people from outside. Study of 50 coalmine owners reveals the fact that 60 per cent of the owners are also the owner of coal depots. Therefore, out of 1167 coalmine owners in Meghalaya, about 933 of have coal depot and out of 50 depots visited, 4 depots are found to be under the ownership of people from outside the state. So it is clear that the local people own about 92.30 per cent of all the depots and the people from outside own only 8.70 per cent of the depots. There are around 1011 coal depots in Meghalaya. So, 1011 depot managers were employed during 2005 in coalmining areas of Meghalaya. And also it is reported that after every two three years 5-10 new depots are coming up. Table-6.20 given below provides a rough idea about the growth of employment opportunity in coal depots though the growth has not been uniform across time and space in Meghalaya.

Table 6.20
Coal Depots and Employment Opportunity for Depot Managers in Meghalaya

Years	Employment for Depot Managers (Number)
1978-79	253
1983-84	456
1988-89	990
2000-01	1000
2005-06	1011

Source: Field Survey by the researcher

Note: Estimated by the researcher by using field survey data on total umber of coal depots according to the coalmine owners and traders.

Table-6.20 indicated that the total estimated number of depot managers has increased from 253 in 1978-79 to 456 in 1983-84 that further increased to 1011 in 2005-06.

6.4.6 Middleman Traders

There are two kinds of middleman traders. One is middleman trader for inter-state coal trade and other is the middleman trader for external trade of coal, i.e., trade with Bangladesh. Study of 20 exporters revealed that on an average each exporter usually receive coal from two middleman traders. This is also true in case of inter-state trader. From Dawki land custom station, it is found that there are 135 international exporters and hence there would be 270 middleman traders at that time and they had transacted about 292313.6 metric tonnes of coal (Office of the LCS, Dawki). Hence one middleman trader did business of over 1082 metric tonnes of coal. Dividing the total export of coal by the average transaction of one middleman, the approximated total number of middleman trader is estimated. But inter-state middleman trader transacts 3 times of an external middleman trader as revealed from the field survey. Hence, if we divide total amount of inter-state coal transaction by 3246 metric tonnes of coal, we get the estimated total number of inter-state trader middlemen of coal in Meghalaya. But the capacity of each middleman may change over time and hence the number of middlemen, but due to lack of information it is assumed to be the constant. Therefore, the estimation is not without any error.

Table 6.21

Coal Trade and Employment of Middleman Traders Generated over time in Meghalaya

Years	Number of Middleman Traders
1978-79	224
1983-84	706
1988-89	2030
2000-01	2256
2005-06	2256

Source: Field survey by the researcher

Note: Estimated by the researcher by using field survey data on total number of inter-state traders and exporters.

Table-6.21 depicts that the estimated employment opportunity generated by the trading of coal for middlemen has also increased manifold during 1978-79 to 2005-06. The total estimated number of middlemen engaged during 1978-79 was 224 persons per day, which increased to 2256 persons per day during 2005-06.

6.4.7 International Exporters and Inter-State Traders

International exporters and inter-state traders are the people who collect coal through the middlemen and supply coal to the final destination. At Dawki there were 135 international exporters during April-May, 2005. The gross annual transaction was 292313 metric tonnes of coal. Hence the average export per international exporter was 2165 metric tonnes of coal. Therefore, 462 international exporters in Meghalaya exported during that year about one million tonnes of coal. But in case of inter-state traders, transaction was about three times of the international exporters. Hence, dividing total inter-state coal transaction by 6000 metric tonnes of coal, the total number of inter-state traders may be approximated and also personal field investigation reveals the similar result for the year 2005. But the total number of international exporters and inter-state traders is not proportionate to the total amount of coal transacted as the same trader may have to handle different quantities depending on the demand and supply of coal and hence may underutilise or over-utilise the capacity. Therefore, if the changes in quantity of trade over time is considered and accordingly variation in number of traders is estimated that would be misleading. Hence the growth of traders has been estimated by taking into account the number of years each of the existing traders are involved in trading activities of coal in the area along with the changes in quantity of export over time. However, here also per trader export may vary

over time depending on the variation in efficiency. But due to lack of information on that the experiences of the sample traders are used to approximate the trend in exporter.

Table 6.22
Coal Trade and Number of Total Exporters in Meghalaya

Years	Employment Opportunity for Traders (Number)
1978-79	112
1983-84	338
1988-89	1015
2000-01	1128
2005-06	1128

Source: Field survey by the researcher

Note: Estimated by the researcher by using field survey data on average annual transaction of coal and the duration of trading activities by the traders.

The field observations on 40 exporters reveal the fact that 10 per cent of them have been working for more than 25 years, 20 per cent of them have been working for more than 15 years, 60 per cent of them have been working for more than 10 years and 10 per cent of them have been working for 5 years or more. On the basis of this, number of traders has been approximated for different years and presented in table-6.22. The table reveals that the approximated number of export traders has increased significantly from only 112 in 1978-79 to 1128 in 2000-01. But there has been no growth in the number of traders after 2000-01.

6.4.8 Managers and Assistant Managers of Exporters

International exporters and inter-state traders, generally appoint managers and assistant managers to expedite their trading operation. At Dawki land custom station there were 270 managers plus assistants during 2005 which was also same during 2004. During 2003-04, 292313 metric tonnes of coal was exported to Bangladesh. Using this information, as mentioned earlier, we approximated the number of managers and assistant managers who have been operating in Meghalaya over the years. Table-6.23 shows that the approximate number of managers and assistant managers has increased significantly from only 224 in 1978-79 to 2257 in 2005-06.

Table 6.23
Coal Business and Employment Opportunity for Managers and Assistant Managers in Meghalaya

Years	Number of Managers and Assistant Managers
1978-79	224
1983-84	706
1988-89	2030
2000-01	2257
2005-06	2257

Source: Field Survey by the researcher

Note: Estimated by the researcher by using field data on total number of exporters and traders.

From the foregoing analysis it is found that there has been a considerable increase in the direct employment in coal mining and its allied activities. In 1978-79, around 1742 persons were engaged as labourers in coalmining and quarrying, which increased to about 79500 persons in 2005-06. Similarly, the numbers of coalmine owners were only 292 in 1978-79, which increased to 1167 in 1988-89 and after that it has remained almost stagnant. Also 1168 drivers and handymen were employed in the transportation of coal in 1978-79, which increased to about 14808 in 2005-06. Approximately 81 persons were engaged for loading of coal to the trucks in 1978-79 that increased to around 3710 during 2005-06. In 1978-79, 253 persons were employed as the depot managers that increased to 1011 in 2005-06. The employment opportunity also increased for middleman traders from approximately 224 persons in 1978-79 to 2,256 in 2005-06. Employment opportunity has also increased for managers and assistant managers in the trade sector of coal from 224 persons in 1978-79 to 2257 in 2005-06. The number of traders has also increased from 112 persons to 1128 persons.

Therefore, with the increase in extraction of coal in Meghalaya, the approximated volume of total direct employment has increased from 4096 persons in 1978-79 to 105029 persons during 2005-06, which is illustrated in Table-6.24. The impact of extraction of coal on the direct employment generated has been analysed by fitting Log-Linear equation of type $L_n Y_t = \alpha + \beta L_n X_t$, where Y_t is the generation of direct employment at time t and X_t is the extraction of coal at time t ; t is the time in

years and α , β are the two parameters. Here β is the elasticity of direct employment with respect to the extraction over time. The estimated equation is

$$L_n Y_t = 3.548 + 0.934 L_n X_t^* \quad t_{\text{value}} = 43.35, R^2 = 0.9863 \dots\dots\dots(6.11)$$

(0.0215)

The figure in the bracket represents standard error of slope-coefficient. Equation-6.11 reveals that the elasticity of employment with respect to extraction is 0.934 during 1978-79 to 2005-06, which is highly significant at 1 per cent level of significance.

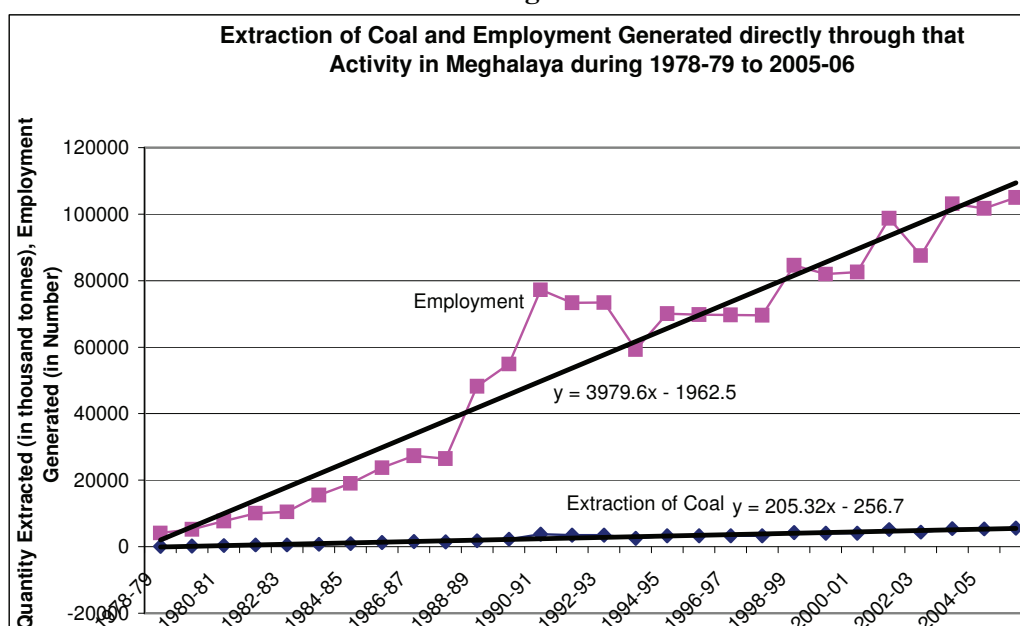
The comparative picture of estimated direct employment generated due to coal mining activities during the period 1978-79 to 2005-06 is shown in Table-6.24.

Table 6.24
Coal Extraction and Direct Employment

Year	Extraction of Coal (M.T.)	Volume of Employment (Number)
1978-79	122.00	4,096
1979-80	196.00	5,203
1980-81	362.00	7,085
1981-82	521.00	10,062
1982-83	548.00	10,466
1983-84	713.00	15,496
1984-85	949.00	19,025
1985-86	1,265.00	23,750
1986-87	1,507.00	27,368
1987-88	1,448.00	26,506
1988-89	1,807.00	48,273
1989-90	2,252.00	54,925
1990-91	3,747.00	77,279
1991-92	3,464.00	73,376
1992-93	3,487.00	73,397
1993-94	2,543.00	59,276
1994-95	3,264.00	70,057
1995-96	3,247.50	69,802
1996-97	3,239.30	69,683
1997-98	3,234.20	69,609
1998-99	4,238.00	84,620
1999-00	4,060.00	81,959
2000-01	4,065.00	82,600
2001-02	5,149.00	98,808
2002-03	4,396.30	87,549
2003-04	5,439.10	1,03,145
2004-05	5,345.19	1,01,739
2005-06	5,565.72	1,05,029

Source: Directorate of Mineral Resources, Government of Meghalaya.

Note: Volume of Employment has been estimated by the researcher using field survey data.

Diagram –6.3

Changes in extraction of coal and variation in estimated direct employment in Meghalaya during 1978-79 to 2005-06 are also shown in the diagram-6.3.

6.5 Extraction of Coal and Indirect Employment generated in Meghalaya

Extraction of coal and its trade generate indirect employment in different forms, all of which is very difficult to capture as mentioned earlier. Here the nearest possible observable indirect employments have been recorded. The observation of the survey in mining areas and Dawki trading point of Meghalaya reveals some indirect employment generated due to extraction of coal and its related activities. Here the observations are all correspond to the time of survey in 2005. Due to lack of information, over time changes in such employment could not be shown.

6.5.1 Employment in Motor Repairing Workshops within the Coal mining and Trading areas of Jaintia Hills of Meghalaya

It is observed from the field data that there are 96 motor repairing shops right from Khliehriat to Dawki bordering Tamabil of Bangladesh. On an average three people are engaged in each motor repairing shop. Hence, there were 288 persons

employed in the motor repairing workshops within the coal mining and trading areas of Jaintia Hills of Meghalaya during 2005.

6.5.2 Motor-Parts Shops

Study of mining areas in Jaintia Hills exhibits that there are 50 motor-parts selling shops in the coal mining and trading areas. Each shop provides employment to at least one person. So, 50 people are getting employment in motor-parts shops, which is primarily due to the existence of coal mining activities.

6.5.3 Tea Stalls in Mining Area and in Trading Points

This is a very important kind of indirect employment generated by the coal mining activities. Study of coal mining areas in Jaintia Hills reveals that the ratio of coal depot and tea stall is about 10:1. Since there are 900 coal depots in coal areas of Meghalaya, so there are at least 90 tea stalls in these areas. Each tea stall generates employment for at least 2 persons. Hence, there are about 180 persons who are employed in such activities mainly due to the existence of coal mining.

6.5.4 Tea Stalls at International Border Point

Every transaction day at Dawki witnesses gathering of 300 to 400 persons who are involved in trading activities. These people take light refreshments and tea from tea stalls located on both sides of the road. There are 20-tea stalls run by local ladies at Dawki trading point. Each tea stall gives engagement to 2 persons. Hence around 40 persons get employment indirectly due to the extraction of coal and its trade only at Dawki. There are also other land custom stations from where coal is exported to Bangladesh. Besides Dawki, there are other seven land custom points from where coal

is exported. If we assume that there are 10 tea stalls in each station, then there would be 70 tea stalls in other land-custom stations together. Hence the total number of persons employed will be around 140. Therefore, it is clear that nearly 180 persons are employed indirectly by coal extraction and its trading. Indirect employment at inter-state trading point is also generated. There are different categories of indirect employment that are found at Beltola, Guwahati, Assam through which coal is despatched to other states of India. There are around 100 hotels, 50 motor repairing shops, 50 motor parts shops, 15 Public Call Offices (PCOs), 30 weigh bridges, 15 grocery shops that have been running mainly due to the inter-state coal market. Around 10000 people are employed both directly and indirectly at Beltola (Guwahati) inter-state coal market as per the information obtained from the field survey there.

6.6 Conclusion

From the whole discussion of this chapter, it is evident that the extraction of coal and its allied activities in Meghalaya have substantial impact on the income and employment. It has important bearing on the revenue of the state, income of the individual coal mine owners, traders, exporters, mine labourers and others who have been associated with the activities. Moreover, with the passage of time and expansion of mining activities income of all sections of population related to it and revenue of the government has been growing proportionately. Also extraction of coal in Meghalaya generates indirect income partly for those who have been engaged in the industries (whether in Meghalaya or elsewhere) where coal is one of the important inputs. But due to the paucity of information that part has not been considered here. Besides that, extraction of coal and its allied activities also create employment opportunities both directly and indirectly. Directly, it creates employment for mine owners, mine labourers, exporters, drivers and handyman and also for some others. There has been a

continuous upward trend since 1978-79 in the generation of direct employment opportunities by the coal mining and trading activities of Meghalaya. Indirectly, it creates employment for some people in the tea stalls near by the mining and trading centres, in motor-repairing and motor-parts shops, in weigh bridges, in PCOs, in hotels and also in grocery shops. Similarly, the growth of cement and brick manufacturing has also been expanding due to the large-scale extraction of coal in Meghalaya, which has been contributing to the income and employment that is also partially due to the coal mining in the neighbouring area. However, the future prospect of employment and income will depend on the future of the mining activities in the area.

CHAPTER-7

IMPACT OF COALMINING AND TRADING ON THE LOCAL ECONOMY OF JAINTIA HILLS

7.1 Introduction

Jaintia Hills district is the eastern most district of Meghalaya and covers a geographical area of 3819 sq. km. It is bounded by Assam (north and east), Bangladesh (south) and Khasi Hills (West). The population in Jaintia Hills district is 2.9 lakhs according to the 2001 Census Report and the density of population is 78 per square kilometre, which is much lower than the density of population in the state, i.e., 103 per square kilometre and far behind the all-India average density. The total work participation rate in the districts is 42.83 per cent.

The district has rich mineral resources. Considerable quantities of coal deposits are found in the district along with limestone. The total coal deposit in the district has been estimated at 42.30 million tonnes. Important coalfields of Jaintia Hills are located in Bapung, Ladrymbai, Lakadong, Sutnga, Jarain, Lumshnong and some other places. Extraction of coal has carried out by the primitive method commonly known as the “rat-hole” mining. Most of the mining activities are small-scale ventures controlled by individuals who own the land.

Jaintia Hills district was primarily agrarian economy before 1970s. But, after the discovery of coal in 1973 at Bapung and its adjoining areas, the economy of Jaintia Hills gradually shifted from purely agrarian economy to a commercial economy of coal. Though extraction of coal has started long back (1815) in some

areas of the state; in Jaintia Hills the extraction of coal has started much later and after the attainment of statehood in 1973.

Within a very short period of time the district became the major coal producing area of Meghalaya. Bapung coal is famous today all over India and also abroad, i.e., Bangladesh. Presently, about 70 per cent of the total extraction of coal in Meghalaya is recorded by Jaintia Hills. A significant amount of Net District Domestic Product (NDDP) is contributed by the mining and quarrying output. For example, in 1999-2000, 27.95 per cent of NDDP was contributed by mining and quarrying in Jaintia Hills. Similarly, Jaintia Hills district has also been contributing substantially to the total output of mining and quarrying in the state of Meghalaya, 69.27 per cent of the total mining and quarrying output of the state was contributed by Jaintia Hills alone in 1999-2000.

Mining and quarrying in Jaintia Hills primarily means the coalmining and quarrying because of the large-scale coal extraction activities in the district. Besides this, Dawki Land Custom Station, which is one of the important external trading points in Meghalaya is also located in Jaintia Hills bordering Khasi Hills. Through Dawki Land Custom Station, 61.94 per cent of the total coal export to Bangladesh took place in 1998-99 but it declined to 22.49 per cent in 2004-05. The decline was observed mainly due to increase in the quantity of export through other land custom stations. Therefore, extraction of coal has important implications for the trade and other related activities and thus development of local economy of Jaintia Hills.

7.2 Some Earlier Studies

Coalmining has both positive and negative impact on the local economy. On the one hand it generates income and employment in several ways directly and

indirectly. On the other hand it adversely affects the soil, water quality, forest resources, etc. Studies on economic impact of coal mining are very few. There are some studies that deal with environmental impacts of coal mining in Jaintia Hills. Basically these studies are descriptive in nature.

Lamin (1995) has described that coalmining in Jaintia Hills has brought about so many changes like steady flow of labourers from outside as well as from different parts of the state itself to the mining areas of the state. He observed that sometimes there arises conflict between the outside labourers and local labourers. According to him, the emergence of Ladrymbai market (located in the mining site of Jaintia Hills) is entirely due to coalmining activity. Hence it raises employment and generates income and welfare of the people particularly of the locals. He has also mentioned the negative consequence of mining as some paddy fields are left fallow as their owners had no time to cultivate due to their preoccupations with mining activity. Thus coalmining also led to underutilisation of land resources due to high opportunity cost of the owners. Moreover, the productivity of soil is adversely affected due to the deposit of coal dust and acid mine drainage that reaches the nearby agricultural field.

Dasgupta *et al.* (2002) have made an attempt to analyse the adverse impact of coalmining on the soil characteristics. Through the testing of soil (nutrients of coalmine areas of different ages) they have shown that the nutritional content declines with the age of mine or with the rising extraction of coal. Also the moisture content, sand, etc. have been increasing over time with the continuous mining activities. According to them, these soil changes make it less suitable for growth and development of plants.

Rai (2002) has explained the impact of coalmining on the local environment of Jaintia Hills. He gave a description of how coalmining activity in Jaintia Hills has

adversely affected the local environment; which is exhibited through the shortage of potable water, deforestation, water pollution, increase in wasteland, land subsidence and dust pollution. He investigated that the environment is adversely affected because of unscientific primitive mining techniques and small-scale coalmining.

Singh and Swer (2004) have outlined the fact that underground coal production has adverse effect on water resources. According to them, unscientific coal mining practised in Jaintia Hills is the primary cause of deterioration of water quality. They also observed that the influx of acid mine drainage into the rivers and streams of the area are mainly responsible for degradation of water quality leading to degradation of aquatic habitat. They also highlighted about the acid mine drainage contamination that has been adversely affecting the various uses of water including agriculture and domestic water supplies.

Sahu and Goel (2004) have assessed the social implications of coalmining in Jaintia Hills. By using the chi-square test they observed that the local labourers and the local inhabitants show positive attitude towards the influx of labourers from outside for the purpose of mining activities. They also found that there have been a spur of wine shops and also spur of anti-social activities due to the coalmining activities in Jaintia Hills.

7.3 Extraction of Coal and Contribution of Coal Mining and Quarrying to NSDP of Jaintia Hills District

First of all, district-wise contribution of mining and quarrying to NSDP of Meghalaya and their variations over time has been discussed. The importance of mining and quarrying in different districts is explained by the absolute and percentage contributions of mining and quarrying to the NSDP of Meghalaya. Table-7.1 given below illustrates the over time changes in the inter-district variation in contribution of

mining and quarrying to NSDP of Meghalaya from 1994-95 to 1999-2000, from where relative position of Jaintia hills district is also reflected.

Table 7.1
Over-Time Inter-District Variation in Contribution of Mining and Quarrying to NSDP in Meghalaya (Rs in crore)

Years	Jaintia Hills	East Khasi Hills	West Khasi Hills	Ri Bhoi	East Garo Hills	West Garo Hills	South Garo Hills
1994-95	4704 (69.93)	327 (4.86)	197 (2.86)	4 (0.06)	7 (0.10)	9 (0.13)	1484 (22.06)
1995-96	4120 (62.87)	307 (4.69)	367 (5.60)	9 (0.14)	13 (0.20)	18 (0.27)	1719 (26.23)
1996-97	4529 (65.96)	253 (5.14)	340 (4.95)	8 (0.12)	13 (0.19)	18 (0.26)	1605 (23.38)
1997-98	4877 (73.45)	251 (3.78)	248 (3.78)	16 (0.24)	13 (0.20)	17 (0.26)	1218 (18.34)
1998-99	9693 (75.24)	405 (3.14)	344 (2.68)	16 (0.12)	24 (0.19)	33 (0.26)	2367 (18.37)
1999-00	8652 (69.27)	409 (3.27)	649 (5.20)	21 (0.17)	31 (0.25)	42 (0.33)	2687 (21.51)

Source: Directorate of Economics and Statistics, Government of Meghalaya, Shillong.

Note: Figures in the parentheses represent percentage to total of the state.

From Table-7.1, it is observed that Jaintia Hills District contributes the major portion to the total mining and quarrying output of Meghalaya. Jaintia Hills district has always been contributing more than 60 per cent to the total output of mining and quarrying in Meghalaya. Besides South Garo Hills, all other districts are contributing less than even 10 per cent of the total output. Jaintia Hills district alone contributed 69.93 per cent to the total output of mining and quarrying in Meghalaya in 1994-95, which increased to 75.24 per cent in 1998-99 and again declined to 69.27 per cent in 1999-2000. From this it is evident that mining and quarrying is an important economic activity of Jaintia Hills. Table-7.2 given describes the changes in the contribution of mining and quarrying to NDDP of Jaintia Hills during 1994-95 to 1999-2000.¹

Table-7.2
Contribution of Mining and Quarrying to N.D.D.P. of Jaintia Hills

¹ Here data are available only for the period 1994-95 to 1999-2000 from the Directorate of Economics and Statistics, Government of Meghalaya.

(Rupees in crore)

Years	N.D.D.P. of Jaintia Hills	Output of Mining and Quarrying	Output of Coal Mining and Quarrying
1994-95	199.91	47.04 (23.53)	39.23 (19.62)
1995-96	217.93	41.20 (18.90)	35.12 (16.11)
1996-97	225.56	45.29 (20.07)	33.83 (14.99)
1997-98	241.54	48.77 (20.19)	35.92 (14.87)
1998-99	302.84	96.93 (32.00)	58.61 (19.35)
1999-00	309.55	86.52 (27.95)	57.18 (18.47)

Sources: (i) Directorate of Mineral Resources government of Meghalaya.

(ii) Directorate of Economics and Statistics, Government of Meghalaya.

Note: Figures in parenthesis represent percentage to N.D.D.P. of Jaintia Hills.

From Table-7.2, it is evident that mining and quarrying has been contributing significantly to the N.D.D.P. of Jaintia Hills. The percentage contribution was 23.53 during 1994-95 and it increased to 27.95 per cent during 1999-2000 i.e. a gross increase of about 4 per cent. In absolute sense however, output of mining and quarrying in total has increased significantly from Rs 47 crore to Rs 86.52 crore during 1994-95 to 1999-2000. Similarly, it is also revealed that the percentage contribution of coal mining and quarrying to the N.D.D.P. of Jaintia Hills has been increasing in absolute sense from Rs 39.23 crore to Rs 57.18 crore during 1994-95 to 1999-2000. However, the percentage contribution of coal mining and quarrying has declined marginally from 19.62 per cent in 1994-95 to 18.47 per cent in 1999-2000. This is because of the relatively faster growth of other mining activities; whose contribution was about Rs 8 crore and increased to Rs 29.34 crore in 1999-2000.

7.4 Impact of Extraction of Coal on the Earning of People in Jaintia Hills

People of Jaintia Hills including owners and non-owners of coalmine, other businessmen, etc. generate income directly and indirectly from the coalmine activities as mentioned in the earlier chapter. Hence coalmining plays an important role in the social and economic activities of the local inhabitants of Jaintia Hills. The local people including owners and non-owners generate resources from such activities that

can be invested for further raising income, employment and sustain growth process. Moreover, due to extraction and transportation activities, other businesses have been flourishing in the area. Also due to rising income, education, healthcare, etc. have been improving. Also, due to extraction of coal and related other businesses, cultural interaction between the local and outside people have been taking place (though at limited scale), which is very helpful for the enrichment of any society. Here a special attempt has been made to assess the impact of coal mining and its related activities on the local people of Jaintia Hills. The income generated directly, indirectly and also from other sources by the owners, non-owners and businessmen has been considered. But due to the paucity of information the socio-cultural aspects have been not considered here.

Method of Estimation of Income of the Different Sample Units

In order to estimate the annual income generated by an individual coalmine owner, the annual extraction of coal by the sample coalmine owners was collected through questionnaire. The annual extraction of coal was multiplied with the average net profit per tonne (which was obtained from different sample coalmine owners) to get annual net income of the coalmine owners.

The information on income which is indirectly generated by the coalmine owners, information was collected from the coalmine owners regarding activities like transportation of coal and management of coal depot etc undertaken by themselves. In case of coalmine labourers, information on income was also directly investigated through questionnaire. Regarding the income of the exporters the same method was followed like that of coalmine owners. In case of non-coalmine owners, who are also neither businessmen and nor labourers of coalmines, the information on income and activities was directly collected from the respondents. The data have been collected

from 50 coalmine owners out of about 500 owners in Jaintia Hills Districts, 200 coalmine labourers out of approximately 50,000 workers, 20 international exporters out of total 135 exporters and 40 non-coalmine owners from Bapung, Ladrymbai and Khliehriat coal mine areas and also from the Bapung, Ladrymbai, Khliehriat and Dawki trade centres respectively in Jaintia Hills District of Meghalaya during April-May, 2005. The method and choice of samples have already been described in chapters 3 and 6. Table-7.3 given below describes the earning of the sample coalmine owners of local areas of Jaintia Hills.

Table-7.3
Distribution of Coalmine Owners According to Their Annual Earnings

Earning Class (Rs in lakh)	No. of Coalmine Owners	Average Income directly from Mining (Rs)	Average Income indirectly from Mining (Rs)	Average Income from Other Sources (Rs)	Total Annual Average (Rs)
2.1 – 8.0	22	2,79,272.60 (76.03)	48,545.00 (13.21)	3,94,545.00 (10.79)	3,67,272.10 (100.00)
8.1 – 14.0	18	7,26,464.00 (67.81)	2,83,535.00 (26.47)	61,272.00 (5.71)	10,71,271.00 (100.00)
14.1 – 20.0	6	10,13,333.00 (63.17)	4,60,000.00 (28.67)	1,30,666.00 (8.14)	16,03,939.00 (100.00)
20.1 – 26.0	1	19,20,000.00 (75.70)	4,80,000.00 (18.93)	1,36,000.00 (5.36)	25,36,000.00 (100.00)
26.1 & above	3	22,40,000.00 (76.97)	5,40,000.00 (18.55)	1,30,000.00 (4.47)	29,10,000.00 (100.00)
Average		7,20,000.00	2,64,800.00	68,800.00	10,53,600.00
Standard Deviation		50,346.80	1,88,768.70	72,850.98	6,93,005.90
Co-efficient of Variation		69.87734	71.28728	105.88805	65.77505

Source: Field study by the researcher.

Notes: (i) Indirect mining income implies income from the transportation of coal; self-management of coal depot.
(ii) Income from other sources implies income from house rent, local taxi and other business that has very little connection with the coal activities in the area.

From Table-7.3, it is evident that there is an inverse relationship between the quantity of direct earning from the coal mining and that of other sources across the individual mine owners. It indicates that the small owners give more importance to other alternative occupations. The average annual income directly from the coal mining of a coalmine owner is Rs.720000 and annual average indirect income from

coal mining is Rs.264800 and that from other sources is Rs.68800. The total annual average income from all sources together is Rs.1053600. The co-efficient of variation is the highest in case of income from other sources and very less in case of income from direct mining. That means there is more income disparity in case of income from other sources. The co-efficient of variation in total income is 65.78 in case of coalmine owners.

Table-7.4
Distribution of Exporters according to Their Annual Earnings in Jaintia Hills

Earning Class (Rs. in lakh)	No. of Exporters	Average Annual Income directly from Mining (Rs)	Average Annual Income indirectly from Mining (Rs)	Average Annual Income from Other Sources (Rs)	Total Annual Average (Rs)
3.1 – 9.0	8	4,80,000.00 (87.15)	55,000.00 (9.9)	15,750.00 (2.86)	5,50,750.00 (100.00)
9.1 – 15.0	9	7,28,888.80 (68.83)	1,82,222.20 (17.20)	1,47,777.70 (13.95)	10,58,888.70 (100.00)
15.1 – 21.0	2	12,80,000.00 (71.11)	3,20,000.00 (17.77)	2,00,000.00 (11.11)	18,00,000.00 (100.00)
21.1 & above	1	15,20,000.00 (66.10)	4,80,000.00 (20.86)	3,00,000.00 (13.04)	23,00,000.00 (100.00)
Average		7,44,000.00	1,50,000.00	1,28,800	10,22,800.00
Standard Deviation		2,94,911.20	1,13,044.00	1,65,832.38	5,17,885.30
Co-efficient of Variation		39.63861	75.36267	128.75185	50.63408

Source: Field study by the researcher.

Notes: (i) Income from indirect export includes income coming from transportation of coal by exporters, truck and self-management of export business etc.

(ii) Income from other sources here includes income from other businesses like hotel, PCOs, cable TV, grocery, wine shop and income from vehicle (transport) etc. although some of the hotels and PCOs have been running well due to coal mine activities in the area.

From Table-7.4, it is exhibited that with the increase in the quantity of export, the income from other sources also increases. This indicates that big exporters are more engaged in alternative occupations. The annual average net income of the sample exporters directly from export of coal is Rs.744000 indirectly from export is Rs.150000 and from other sources is Rs.128800. The co-efficient of variation is the highest in case of income from other sources, which is 128.75 and lowest in case of income from direct export of coal. These things imply that net income from direct export has less inequality than net income from other sources. However, average net

income from direct export of coal for an exporter is very near to the average net income from direct mining of a coalmine owner.

Table-7.5
Distribution of Non-Coalmine Owners, Who are not in any way related to Coal Mining, Trading or Transport Activities According to Their Annual Income Earnings

Earning Class (Rs)	No. of Non-Coalmine Owners	Average Income (Rs)
24.1 – 48.0	11	39,000.00
48.1 – 72.0	17	61,764.70
72.1 – 96.0	8	89,625.00
96.1 – 120.0	4	1,10,000.00
Average		72,975.00
Co-efficient of variation		38.534

Source: Field study by the researcher.

From Table-7.5, it is evident that the average annual income of a non-coalmine owner who is not engaged in coal trade or transport but in agriculture or service or other business is Rs.72975. Co-efficient of variation in annual income is 38.534. From the comparative analysis of the income of coalmine owners, exporters and non-coalmine owners, it is observed that the average annual income of the coalmine owners and exporters is very high compared to the non-coalmine owners. But the co-efficient of variation is very less in case of non-coalmine owners, compared to that of coalmine owners and exporters.

Activities related to coal mining provide better earning scope than non-coal related activities for labourers in Meghalaya in general and Jaintia Hills in particular. To assess the extent of difference in the income of coalmine labourers and non-coalmine labourers, data on income of 200 coalmine labourers and of 100 non-coal sector labourers in Jaintia Hills have been collected and compared. Table-7.6 reflects a comparative picture of monthly earning of coalmine labourers and non-coalmine labourers (who are engaged in similar other activities like agricultural labourers) in

the coal mining areas of Jaintia Hills during April- May 2005.

Table-7.6
Distribution of Sample Coalmine Labourers and Non-Coalmine Labourers
according to Their Monthly Income Range in Jaintia Hills

Earning Range (Rs)	No. of Coalmine Labourer	No. of Non-Coalmine Labourers
2501 – 3000	-	80
3001 – 3500	46	10
3501 – 4000	34	10
4001 – 4500	70	-
4501 – 5000	08	-
5001 – 5500	18	-
5501 – above	24	-

Source: Field study by the researcher.

The table reveals that all the coalmine labourers have monthly income more than Rs 3000, whereas most of the non-coal mine labourer has monthly income less than Rs 3000. 21 per cent of coalmine labourers have monthly income more than Rs 5000. It is observed from the sample that the average monthly income of coalmine labourer is Rs.4246.50, whereas labourers in non-coal sectors earn on an average Rs 2600 per month. Since coal-mining activities have better prospect of earning, labourers are attracted to this sector though the activity in this sector is associated with different kinds of risks (health, life). But the labourers especially from other region, due to lack of job opportunity do not hesitate to undertake such job and thus give very less importance on the occupational hazard. Table-7.7 shows that about 65 per cent of the non-owner in the mining areas also earn directly or indirectly from the coal mining or its related activities like running of retail business, tea stalls in the area or driving coal trucks, acting as middlemen or depot manager etc.

Table-7.7
Distribution of Sample Non-Coalmine Owner Families according to the Source
of Major Income

Primary Source of Income	Number and Percentage of Non-owner Family
Agriculture	7 (17.5)
Retail Business	4 (10.0)
Government Service	3 (7.5)

Tea Stalls	5 (12.5)
Driving Coal Truck	8 (20.0)
Driving other Vehicles	4 (10.0)
Middleman Trader	4 (10.0)
Depot Manager	5 (12.5)

Source: Field survey by the researcher.

7.5 Extraction of Coal and Composition of Mine Labourer in Jaintia Hills

The place of origin of the labourers is an important indication of the geographical composition of the labourers and thus the preference of people (local and outsiders) to work as mine labourer and thus their involvement in such activities. In one of the earlier studies, *Environmental Impact of Coalmining in Jaintia Hills District* by Pandey (1993), it is revealed that none of the mine-labourers belong to the coal mining areas of Jaintia Hills. The study found that among all the labourers, 61 per cent were from Nepal, about 35 per cent were from Assam and the rest were from West Bengal.

Table 7.8
Distribution of Mine Labourers according to the Place of Origin

Sl. No.	The Place of Origin	No. of Mine Labourers
1	Assam	90
2	Nepal	86
3	Khasi, Jaintia & Garo Hills	14
4	West Bengal	10

Source: Field study by the researcher.

On the other hand, he observed that all the mine owners hailed from the local area of the Jaintia Hills. In the present study also it is observed that out of 200 coalmine labourers, 90 are from Assam, 86 mine labourers are from Nepal, 14 are from Khasi, Jaintia and Garo Hills and 10 are from West Bengal. So the most important feature of the changes found in the coalmining sector is that the local labourers have started entering into the coalmining sector even though the percentage is only 7 per cent (Table-7.8). Regarding the coalmine owners, the earlier findings (Pandey, 1993) have remained the same. In the trade of coal, local people from Jaintia Hills are

predominantly operating at Dawki Land Custom Station. The study of Dawki Land Custom Station revealed that more than 90 percent of the people working at Dawki trade point are from local areas of Khasi and Jaintia Hills. Therefore, still now most of the coalmine labourers hail from other regions due to lack of job there and a few local labourers are working as miners due to rising scarcity of alternative safe opportunity in the interior areas also and lack of capital to do other business. But still now most of the local people prefer to be engaged in safe activities.

7.6 Impact of Coal Mining and its trade on Asset Holding

The pattern of tangible asset holding of the coalmine owners and non-coalmine owners is considered here. Table-7.9 given below exhibits the distribution of coalmine and non-coalmine owners according to the pattern of owning tangible assets of various kinds that normally reflect their standard of living and pattern of expenditure on such assets. Also it reflects the pattern of utilisation of income generated by the people either from mining or other sources. This is done to know whether the coalmine owners are more interested to invest in raising more assets or just to lead a luxurious life and their differences with the non-coalmine owner.

Table-7.9 shows that coalmining and its related activities have important implication for the asset-holding pattern of the people in Jaintia Hills. Coalmine owners are comparatively in a better off position in the tangible asset holding. Take for example, 100 per cent of coalmine owners own colour television, whereas only 10 percent of non-coalmine owners possess colour television. Similarly, 100 per cent of coal-mine owners possess mobile phone, while 25 percent of non-coal owners have mobile phone.

Table 7.9
Distribution of Houses of Coalmine Owners and Non-Coalmine Owners
according to the Holding of Tangible Assets

Sl. No.	Items	No. of Household of the Coalmine Owners	No. of Household of the Non-Coalmine Owners
1	Having House in Town	40 (80.00)	3 (7.5)
2	Luxurious Vehicles	37 (74.00)	5 (12.5)
3	Black & White Television	-	25 (62.50)
4	Colour Television	50 (100.00)	10 (25.00)
5	Washing Machine	10 (20.00)	-
6	Music System	40 (80.00)	15 (37.50)
7	Expensive Camera	35 (70.00)	-
8	VCD, DVD Player	30 (60.00)	5 (12.50)
9	Mobile Phone	50 (100.00)	10 (25.00)
10	Landline Phone	50 (100.00)	10 (25.00)
11	Cable Connection	45 (90.00)	5 (12.50)

Source: Field study by the researcher.

Note: Figures in parenthesis represent percentage to the total.

Therefore, it can be concluded that coal-mining and its related activities has contributed significantly to the wealth and welfare of the people who are directly involved in such activities. Therefore, coal-mining and its related activities is helping to build tangible assets by coalmine owners relatively more than the non-owners as their income is much higher than the non-owners. The non-coalmine owners are deprived of all these benefits. Had it been under state ownership, the whole area would have been benefited uniformly. Moreover, the owners are interested in investing in houses, transport vehicles or other secured ventures to raise secured revenue permanently without taking any risk and lead a luxurious life that can be seen from the distribution of their income for different purposes presented in the Appendix-7.1.

7.7 Impact of Coal Mining on Vehicle Ownership by Coalmine Owners in Jaintia Hills²

Vehicle ownership is also an important economic indicator of status of wealth. The impact of coal mining and its related activities on the local economy can be examined by using this indicator. Table-7.10 given below explains the pattern of

² Here the non-coalmine owners are also benefited due to coalmining, who earn as depot manager, assistant manager, trader or due to engagement in transport of coal.

ownership of vehicles by coalmine owners, which is compared with that of non-coalmine owners in the coal mining areas of Jaintia Hills.

Table-7.10
Distribution of Coalmine Owners and Non-Coalmine Owners According to Vehicle Ownership

Sl. No.	Types of Vehicles owned	No. of Coalmine Owners	No. of Non-Coalmine Owners
1	Saktiman Trucks	50 (100.00)	10 (25.00)
2	Tata Model Trucks	20 (40.00)	2 (5.00)
3	Maruti/Local Taxi	26 (52.00)	4 (10.00)
4	Other Personal Vehicles like Bolero, Alto, Marshall	29 (58.00)	5 (12.50)

Source: Field study by the researcher.

Note: Figures in parenthesis represent percentage to the total number of people studied.

From Table-7.10, it is very clear that coalmine owners are in a better-off position so far as the pattern of vehicle ownership is concerned. 58 per cent of the sample coalmine owners have personal vehicles like Alto, Bolero, Marshall, while only 12.50 per cent of the sample non-coalmine owners have personal vehicles. 100 per cent of coalmine owners have Saktiman trucks, while 25 per cent of non-coalmine owners have Saktiman trucks and those are used for carrying coal. 40 per cent of coalmine labourers have Tata model trucks while 5 per cent of non-coalmine owners have Tata model trucks. Hence, coalmining and its related activities have important implication for vehicle ownership in coalmining areas of Jaintia Hills. The coalmine owners have relatively more income than that of non-owners and hence they have the capacity to invest more in vehicles to raise further income. Therefore, coalmining and its related activities have increased the per capita vehicle possession in the local economy of Jaintia Hills especially of those who own the mine. It can be shown through the rising number of vehicles during 1990-91 to 2004-05 of different categories in Jaintia Hills district.

From Table-7.11, it is evident that the number of private trucks, private cars

and tourist and local taxis has increased continuously since 1990-91 in Jaintia Hills. The total number of private trucks was 1870 in 1990-91, which increased to 3829 in 2004-05. Similarly, total number of cars was 339 in 1990-91 and it increased to 1737 in 2004-05. Also there has been enormous growth in the Tourist and Local Taxis in Jaintia Hills. The total number of Taxi was only 21 in 1990-91 that increased to 1213 in 2004-05. In total the number of vehicles has increased by about 108 per cent during last 14 years.

7.8 Expenditure on Children's Education by Coalmine Owners and Non-Coalmine Owners

Expenditure on children's education is one of the important characteristics for the human capital formation in the economy of any region. Now-a-days, though the awareness of children's education has increased across almost all sections of population, the actual expenditure is significantly affected by the income. Though coalmine owners and non-owners both are benefited due to the coal mining activities in the area, the owners are benefited more. Therefore, they have more capacity to invest in their children's education if they have the intension to do so. Hence an investigation was made to assess the impact of coal mining and its related activities on the expenditure of children's education. Table-7.12 given below illustrates the expenditure pattern of coalmine owners and non-coalmine owners on children's education in mining areas of Jaintia Hills. The table shows that the expenditure on the

Table-7.11
Growth of Registered Vehicles in Jaintia Hills during 1990-91 to 2004-05 (Figures in Number)

Year	Trucks		Bus		Mini-Bus		Car		Jeep		Tractor		Trailer		Two Wheelers		Three Wheelers		Auto		Others		Total
	Govt.	Pvt.	Govt.	Pvt.	Govt.	Pvt.	Govt.	Pvt.	Govt.	Pvt.	Govt.	Pvt.	Govt.	Pvt.	Govt.	Pvt.	Govt.	Pvt.	Govt.	Pvt.	Govt.	Pvt.	
1990-1991	16	1870	1	111	-	21	8	339	56	501	13	18	21	83	9	219	-	205	21	2	13	126	3401
1992-1993	16	2068	1	115	-	39	8	524	56	567	13	18	21	97	9	313	2	217	76	2	14	126	4050
1994-1995	17	2300	1	135	-	55	8	695	66	585	13	18	21	102	9	359	-	2	228	106	15	137	4600
1997-1998	14	2902	-	228	-	-	8	1022	67	708	13	22	18	109	9	407	-	-	563	177	19	131	6195
2001-2002	27	3439	19	268	-	-	8	1320	81	831	14	27	18	116	11	589	-	7	714	46	22	180	7377
2004-2005	27	3829	20	339	-	-	8	1737	82	918	14	32	18	146	11	815	-	14	1213	-	-	158	9385

Source: Commissioner of Transport, Government of Meghalaya.

children's education by the coalmine owners is comparatively much higher than the non-owners, who have relatively less income. Also one can correlate quantity of expenditure on education with the income across the owners and non-owners. But due to paucity of data it is not shown here. However, from the table one can safely argue that the tendency of spending more on children's education has increased in the area due to coalmining activity. Otherwise, the owners' spending pattern would be similar to that of non-owners' unless they would own coalmine hence earn huge income.

Table-7.12
Distribution of Coalmine Owners and Non-Coalmine Owners according to
Monthly Expenditure on Children's Education

Range of Expenditure	No. of Coalmine Owner	No. of Non-Coalmine Owner
501-2500	-	25
2501-4500	2	7
4501-6500	2	3
6501-8500	15	5
8501-10,500	14	-
10,501 & above	17	-

Source: Field Survey by the researcher.

7.9 Cross-Border Trade of Coal and Its Impact on the Local Economy of Jaintia Hills

Cross-border trade of coal through Dawki Land Custom Station is an important external trade activity, which generates various impacts for the local economy of Jaintia Hills. In any working day, 2000-3000 metric tonnes of coal is exported to Bangladesh through Dawki. Hence a considerable amount of income and employment is generated for the local people of Jaintia Hills. The study of Dawki Land Custom Station revealed that the local youths get both direct and indirect employment at different levels due to trade activities. Local people are directly employed as international exporters, middleman traders, managers and assistant managers, drivers and handymen. Another important point noticed here is that local

kongs (ladies) are also significantly benefited because of cross-border trade of coal. At Dawki Land Custom Station, there are nearly 20 hotel-cum-tea stalls run by the local ladies who have been earning their livelihood. Similarly, a study of 100 coal-loaded trucks indicated that 98 per cent of drivers and handymen belong to the local areas of Jaintia Hills. Therefore the coal trade here has multiplier effect on income and employment in the local area.

Another important field observation is that everyday 300-400 trucks have been parked at Amtapoh (near Amlarem Sub-Division of Jaintia Hills). So at parking point 5-10 tea stalls are operated by the local ladies. Moreover, a large number of hawkers are also found to sell *biri*, *kwai*, (local bettle leaf), cigarette, pineapples, oranges and other edible articles on any working day. They are all from local areas of Jaintia Hills only. Around 50 local taxies shuttle between Dawki Land Custom Station and Dawki daily market. The drivers are mostly local youths from Jaintia Hills. Loading coal into the trucks for export to Bangladesh is another important occupation, which attracts the local youth since this, unlike mining activities, does not involve any kind of insecurity of life. Therefore, in total though all these activities about 315 people (both men and women) have been engaged, which is subject to change depending on the sphere of activities in the area.

7.10 Nature of Growth in the Local Economy of Jaintia Hills

Coal can be used in the industries, where it is used as major input or coal can be exported to other regions or other countries and the earnings from the export can be used for capital formation and development of any other sector so as to sustain the progress of the local economy. In Meghalaya, the quality of available coal is not

suitable for metallurgical and other similar industries. But this variety can be used in brick kiln, cement industries and iron re-rolling activities. Sometimes, the coal is imported by the industries in other states of the country to blend with the good quality coke, which is used mainly in steel manufacturing. Also, every year huge amount of coal is exported to Bangladesh, where it is used in brick kiln, cement industries and tea gardens. However, very limited such industries have grown in Meghalaya depending upon the locally available coal. Only some cement firms, brick kilns and small tea gardens are there.

According to the Department of Central Excise Shillong, at present there are nine cement manufacturing companies in Meghalaya. Also there are 166 cement-based small-scale industries operating in Meghalaya in 2004-05. In 1991-92, the number of cement based small scale industries were 128 and there were only two cement industries like Jaintia cement manufacturing and Mawmluh Cherra Cement Limited and the number of cement firms has increased to nine at present. There are only two cement firms in the name of Jaintia cement and Star cement in Jaitia Hills. After 2000, some brick manufacturing companies has started coming also. At present there are 22 brick manufacturing companies in Meghalaya. But the consumption of coal by these industries is not even more than 2 per cent of the total coal production. So the only alternative here is to export the coal to different parts of the country and to Bangladesh and to develop other sectors like horticulture, floriculture and information technology sector, etc which has very good potential in Meghalaya. But the income generated through the export of coal is mostly invested in the real estate sector. Also some of the owners reinvest a part of their earnings for the expansion of coal mining itself. The study of 50 coalmine owners revealed the fact that 30 of them

have estate businesses either in Shillong or in Jowai. But, there is no real capital formation in the local economy on which the growth of employment and income may sustain and the progress of local economy in the long period of time, when coal resources would be exhausted. Another sector where income from the export of coal enters is the transport sector. Here it may be mentioned that some capital formation has been taking place when coalmine owners invest their earnings in the transport sectors. Most of the coalmine owners in Jaintia Hills have possessed different types of vehicles like Saktiman trucks, Tata S-model trucks, Maruti and other vehicles like Tata Sumo, Bolero, Alto, etc. for the transportation of coal and the passengers.

The major part of income generated from coalmining and its related activities is not invested in the creation of other alternative production sector. This fact can be tested from the overtime credit-deposit ratio of the different districts, which is presented in Table-7.13. From table, it is evident that people in Jaintia Hills are not investing much in different profitable undertakings since credit-deposit percentage of scheduled Commercial Banks in Jaintia Hills has always been the lowest among all the districts since 1995. People in Jaintia Hills have enough monetary deposits, which is higher than any other district except East Khasi Hills. The significant growth in the total monetary deposits in Jaintia Hills is largely due to the growth of earnings in the coalmine sector. But the matter of concern is that income generated from the coal mining and its related activities is not invested in the local economy for the creation of alternative sources to generate further income and employment, so that

Table-7.13
District-wise Overtime Deposits and Credits in Scheduled Commercial Banks (Rs in crore)

Sl. No.	Districts	1982		1995		1999		2001		2005	
		Deposit	Credit	Deposit	Credit	Deposit	Credit	Deposit	Credit	Deposit	Credit
1	Jaintia Hills	3.28	0.82 (25.00)	42.64	6.39 (14.99)	90.34	12.60 (13.95)	137.56	15.46 (11.24)	257	33 (12.84)
2	East Khasi Hills	58.61	13.50 (23.03)	492.03	71.00 (14.43)	853.13	124.45 (14.59)	1336.89	206.06 (15.41)	2304	811 (35.20)
3	West Khasi Hills	0.67	0.32	18.12	4.75 (26.21)	34.75	10.78 (31.02)	43.53	9.82 (22.56)	78	31 (39.74)
4	Ri Bhoi	-	-	24.89	4.03 (16.19)	42.49	12.32 (29.00)	82.45	17.47 (21.19)	150	68 (45.33)
5	East Garo Hills	0.48	0.12 (25.00)	16.67	5.47 (32.81)	30.13	8.22 (27.28)	46.35	10.26 (22.14)	87	44 (50.57)
6	West Garo Hills	3.45	1.36 (39.92)	51.38	10.36 (20.16)	89.30	19.75 (22.12)	116.17	26.19 (22.54)	185	115 (62.19)
7	South Garo Hills	-	-	4.61	1.02 (22.13)	6.90	3.19 (46.23)	8.95	3.15 (35.20)	17	7 (41.18)
8	Meghalaya	66.49	16.12 (24.24)	650.34	103.02 (15.84)	1147.04	191.31 (16.68)	1771.90	288.41 (16.28)	3078	1109 (36.03)

Source: Directorate of Economics and Statistics, Government of Meghalaya.

Note: Value in the parentheses represents credit-deposit percentage.

even when coal would be exhausted, the workforce engaged in this sector would be shifted to the created alternative occupations.

7.11 Conclusion

From the whole analysis of this chapter it is evident that the coal mining and its related activities have been contributing substantially to the NDDP of Jaintia Hills. During 1999-2000, it contributed around 18.47 per cent to the NDDP of Jaintia Hills. Similarly, income generated by coalmine owners, international exporters and coalmine labourers has been significantly higher than the non-coalmine owners and non-coalmine labourers who have been depending on other activities not related to coal; or partially related to coal. Extraction of coal and its related activities have been helping coalmine owners, international exporters and others related to it to accumulate tangible assets like houses in Shillong, vehicles, etc that is further used to raise income. Besides, coalmine owners and exporters are in a position to enjoy luxurious personal vehicles like Bolero, Alto, Marshal and other vehicles and other durables. The parents who are in coal mining and trading are more conscious and able to provide better education to their children compared to the parents who are not in the coal mining and trading. Local youths and women of Jaintia Hills are also benefited due to the generation of employment opportunities in the cross border trade in Jaintia Hills. But the overall picture of income and investment by all sections of people along with the nature of extraction of coal in Jaintia Hills raise doubt, whether the local economy would survive for long time or not as even though the owners or their next generation would not suffer much due to their investment in secured venture, the employment, revenue of the government authority and other sections like businessmen, transporters would be seriously affected.

References:

- Dasgupta, S., Tiwari, B.K. and Tripathi, R.S. (2002), “Coal Mining in Jaintia Hills, Meghalaya: An Ecological Perspective” in P.M. Passah and S. Sharma (eds.), *Jaintia Hills: Its Environment, Land and People*, Reliance Publishing House, New Delhi.
- Lamin, Henry (1995), *Economy and Society in Meghalaya*, Har-Anand Publications, New Delhi.
- Pandey, H. N. (1993), *Studies on Environmental Impact of Coalmining in Jaintia Hills District*, Final Technical Report of the project, sponsored by Meghalaya State Pollution Control Board, North Eastern Hill University, Shillong.
- Rai, R.K. (2002), “Implication of Coal Mining on Environment in Jaintia Hills,” Meghalaya in P.M. Passah and S. Sarma (eds.), *Jaintia Hills: Its Environment, Land and People*, Reliance Publishing House, New Delhi.
- Sahu, B.P. and Goel, N.P. (2004), “Social and Environmental Impact Assessment of Opencast Mining in Meghalaya: A Case Study of Jaintia Hills,” in Zahid Husain and S.K. Barik (eds.), *Development and Environment*, Regency Publications, New Delhi.
- Singh, O. P. and Swer S. (2004), “Diminishing Life-Sustaining Role of Water in Jaintia Hills of Meghalaya due to Coal Mining”, in Z. Husain and S.K. Barik (eds.), *Development and Environment*, Regency Publications, New Delhi.

Sl. No.	Annual Income (Rs in '000)	Expenditure on Children's Education (Rs in '000)	Consumption Expenditure (Rs in '000)	Other Expenditures (Rs in '000)	Saving or Reinvestment in Mines (Rs in '000)
1	200	36 (18.00)	72 (36.00)	25 (12.5)	67 (33.5)
2	200	48 (24.00)	60 (30.00)	30 (15.00)	62 (31.00)
3	312	60 (19.23)	84 (26.92)	25 (8.01)	143 (45.83)
4	400	72 (18.00)	80 (20.00)	30 (7.5)	218 (54.5)
5	312	84 (26.92)	96 (30.77)	30 (9.62)	102 (32.69)
6	436	90 (20.64)	120 (27.52)	25 (5.73)	201 (46.10)
7	448	96 (21.43)	108 (24.11)	40 (8.93)	204 (45.54)
8	540	96 (17.78)	96 (17.78)	40 (7.41)	308 (57.04)
9	540	84 (15.56)	108 (20.00)	45 (8.33)	303 (56.11)
10	636	90 (14.15)	120 (18.87)	50 (7.86)	276 (43.40)
11	636	96 (15.09)	108 (16.98)	50 (7.86)	282 (44.34)
12	636	162 (25.47)	100 (15.72)	60 (9.43)	314 (49.37)
13	600	96 (16.00)	96 (16.00)	66 (11.00)	342 (57.00)
14	600	90 (15.00)	120 (20.00)	60 (10.00)	330 (55.00)
15	472	96 (20.34)	120 (25.42)	50 (10.59)	206 (43.64)
16	640	102 (15.94)	96 (15.00)	40 (6.25)	402 (62.81)
17	720	93.6 (13.00)	84 (11.67)	50 (6.94)	492.4 (68.39)
18	672	98.4 (14.64)	120 (17.86)	50 (7.44)	403.6 (60.06)
19	640	102 (15.94)	130 (20.31)	60 (9.38)	348 (54.38)
20	720	108 (15.00)	125 (17.36)	80 (11.11)	407 (56.53)
21	720	144 (20.00)	120 (16.67)	100 (13.89)	360 (50.00)
22	900	120 (13.33)	130 (14.44)	100 (11.11)	553 (61.44)
23	828	126 (15.22)	125 (15.10)	110 (13.29)	427 (51.57)
24	836	120 (14.35)	120 (14.35)	130 (15.55)	466 (55.74)
25	1080	108 (10.00)	130 (12.04)	90 (8.33)	752 (69.63)
26	1010	114 (11.29)	120 (11.88)	80 (7.920)	696 (68.91)
27	1060	108 (10.19)	110 (10.38)	90 (8.49)	752 (70.94)
28	836	104.4 (12.49)	120 (14.35)	75 (8.97)	536.6 (64.19)
29	1060	120 (11.32)	130 (12.26)	80 (7.55)	730 (68.87)
30	800	108 (13.50)	120 (15.00)	90 (11.25)	482 (60.25)
31	1000	108 (10.80)	120 (12.00)	75 (7.50)	697 (69.70)
32	1180	120 (10.17)	100 (8.47)	80 (6.78)	880 (74.58)
33	1160	132 (11.38)	130 (11.21)	90 (7.76)	808 (69.66)
34	1260	132 (10.48)	135 (10.71)	100 (7.94)	893 (70.87)
35	1260	144 (11.43)	120 (9.52)	90 (7.14)	906 (71.90)
36	1192	156 (13.09)	125 (10.49)	75 (6.29)	836 (70.13)
37	1200	168 (14.00)	140 (11.67)	80 (6.67)	812 (67.67)
38	1320	144 (10.910)	150 (11.30)	80 (6.06)	946 (71.67)
39	1480	132 (8.92)	160 (10.81)	90 (6.080)	1098 (74.19)
40	1476	144 (9.76)	150 (10.16)	100 (6.78)	1082 (73.31)
41	1560	130 (8.33)	160 (10.26)	110 (7.05)	1158 (74.23)
42	1680	144 (8.57)	170 (10.12)	120 (7.14)	1246 (74.17)
43	1600	132 (8.25)	160 (10.00)	100 (6.25)	1208 (75.5)
44	1728	144 (8.33)	150 (8.68)	110 (6.37)	1324 (76.62)
45	1200	132 (8.57)	110 (9.17)	90 (7.50)	868 (72.33)
46	1600	140 (5.03)	115 9 (7.19)	75 (4.69)	1270 (79.38)

Sl. No.	Annual Income (Rs in '000)	Expenditure on Children's Education (Rs in '000)	Consumption Expenditure (Rs in '000)	Other Expenditures (Rs in '000)	Saving or Reinvestment in Mines (Rs in '000)
47	3100	156 (5.33)	160 (5.16)	100 (3.23)	1280 (41.29)
48	3003	160 (5.68)	175 (5.83)	125 (4.16)	1130 (37.63)
49	2536	144 (4.49)	180 (7.10)	130 (5.13)	2082 (82.10)
50	2940	132 (13.57)	175 (5.95)	125 (4.25)	2508 (85.31)
Average	1059.30	115.33 (13.570)	123.06 (15.010)	102.92 (8.24)	683.95 (60.62)
C-V	64.17	25.30 (37.82)	21.98 (46.07)	132.88 (32.41)	72.41 (22.76)

Source: Field survey by the researcher

Notes: (i) C-V implies co-efficient of variation.

(ii) Other expenditure includes expenditure for durable assets, instalment payment for purchasing house, instalment payment for purchasing vehicle, medical expenses, etc

CHAPTER-8

CONCLUSION AND POLICY IMPLICATION

8.1 Summary of Findings

The availability of coal in Meghalaya and its spatio-temporal variations in production, pattern of coal trade and its impacts on various aspects of the economy of Meghalaya in general and Jaintia Hills in particular have been discussed elaborately. This chapter is devoted first to briefly outline the observations of the entire foregoing discussion and policy implications emanated from the analysis are highlighted towards the end of the discussion.

The variety of coal available in Meghalaya is of sub-bituminous or lignite type. It is available in different coal mining areas across all the three hill regions of Meghalaya. West Daranggiri coalfield of Garo Hills region, Langrin coalfield of Khasi Hills region and Bapung coalfield of Jaintia Hills region are three major coalfields in Meghalaya. Garo Hills region has the highest amount of coal reserves followed by Khasi Hills region and Jaintia Hills region. But, Jaintia Hills region has been contributing substantially (around 70 per cent) to the total production of coal in Meghalaya over the years though it has only around 7 per cent of total reserves of Meghalaya. However, over time with the rise in demand and price in other parts of the country and neighbouring Bangladesh, the rate of extraction in other parts of Meghalaya has also been increased as these mines are becoming economic.

The most striking feature of coalmine in Meghalaya is that the mines are owned by the private individuals, though in other parts of the country any mineral of national importance is a national property. Though here coal is owned by a number of private individuals, if the rate of depletion of stock over time is considered and the rate of growth in price of it is compared with the long term interest rate; it is observed that the annual average rate of growth of price is much lower than the long term interest rate or social rate of discount. Therefore, by Hotelling Principle, there has been over-extraction of coal in Meghalaya but the owners are consistent in their behaviour. Actually, the coalmine owners have lower time preference for the future than what it would have been. That means they are not much concerned about the preservation for the future and they value their present welfare more than the future.

Moreover, by extracting coal and investing in secured bank deposit or building houses the coal owners can earn more than if they preserve and extract in future. Moreover there is uncertainty in future as (i) quality of coal in Meghalaya is not very high. Hence the export demand in Bangladesh may not increase if price is increased as they can import from other country (Australia) good quality coal at reasonably lower rate, (ii) the land tenure system may change and there is always a fear of losing ownership right due to unforeseen nationalisation movement of coal, (iii) if alternatives of this type of coal is available in future, it would remain unutilised and demand may reduce drastically in the market. However, from the analysis of pattern of extraction it becomes clear that if the current trend of exploitation of coal in Meghalaya is continued then it will not last for a long period and would be exhausted within 15-16 years, provided a considerable portion of indicated and inferred stock would be available. Even if the rate of extraction becomes slow, the availability would not be extended to a considerable period of time.

From the analysis of utilisation of coal, it is observed that the local use of coal extracted in Meghalaya is very limited and around 2 per cent of the total production. This implies that around 98 per cent of coal extracted in Meghalaya is being utilised either in other states of India or in Bangladesh. But, one point may be mentioned here that around 75 per cent of coal extracted in Meghalaya is utilised in other states of India like Punjab, Rajasthan, Haryana, Madhya Pradesh, Uttar Pradesh, Bihar and Delhi. This coal is mainly used in brick manufacturing units, tea gardens, in the preparation of coke, in cement manufacturing and also in some small-scale industries like iron re-rolling units etc.

Trade in coal from Meghalaya to present Bangladesh has been continuing right from pre-independence period. However, systematic export of coal to Bangladesh from Meghalaya has started when the Mineral and Metal Trading Corporation of India (MMTC) started exporting coal in 1988-89. Currently, international exporters of Meghalaya export coal regularly according to the demand from Bangladesh.

Here the market for coal is oligopolistic. There is competition among the few buyers and sellers. The export price of coal in Meghalaya till 1998-99 was fixed at \$ 40 per tonne by the government of India. Thereafter, the export price has been kept open to the market forces of demand and supply i.e., the market is deregulated.

Local coal market in Meghalaya is also oligopolistic. Even though there is no cartel among the sellers, the price remains sticky due to competition among them. The contract price per truckload of coal is always uniform as the quality of coal is similar and also has similar use. But the price at which the owners or contractors of mine sell at the mining point and hence the profitability of the owners differs according to the

differences in distance of the mines from the main road-side depots, which ultimately affects the decision and extent to which coal will be extracted.

Inter-state trade in coal extracted from Meghalaya has occupied the prime position so far as volume of trade is concerned. The agents appointed by the plain traders (Guwahati) always bargain with the sellers (coalmine owners) and price is decided by the relative strength of demand and supply. Most of the time, the inter-state market is dominated by the importers, but price never goes down below a certain limit so that the extraction would become unattractive.

From the analysis of growth of export of coal to Bangladesh, it is evident that there has been a sharp rise in export of coal to Bangladesh during 1989-90 to 2005-06. The export has increased from 40.27 thousand M.T. in 1980-91 to over 1103.33 thousand M.T. during 2005-06. There has also been a rapid increase in the value of coal exported to Bangladesh. The value of coal exported to Bangladesh has increased from Rs.90.50 crores in 1998-99 to Rs.198.60 crores in 2005-06. From the pattern of industrial growth and local use of coal in Meghalaya along with the comparison of extraction and exports, it is revealed that the over time growth in extraction in Meghalaya is mainly driven by the rise in export of it.

Coal is mainly exported to Bangladesh through different land custom stations. There are 9 functional land custom stations in Meghalaya in total, out which, mainly 6 stations are used for the purpose of exporting coal. These are Dawki, Borsora, Mahendraganj, Ghasuapara, Dalu and Baghmara. Also Meghalaya coal is exported to Bangladesh through the land custom stations of other states like Karimganj-Steammarghat and Sutarkandi land custom stations of South Assam.

Among different land custom stations, Dawki is the prime land custom station located in Jaintia Hills district. This is a trading place where interaction between

importers from Sylhet, Bangladesh and exporters from Meghalaya takes place. In any working day, 2000-3000 metric tonnes of coal are exported through Dawki. Meghalaya Government earns nearly Rs. 3 lakhs daily as coal Royalty from Dawki land custom station alone. Besides that some amount of coal is also unofficially exported through different land custom stations of Meghalaya. From the analysis of volume of unofficial coal trade through Dawki land custom station, it is evident that in each truck two tonnes of coal is unofficially exported. In 2004, the estimated unofficial trade was 52,430 metric tonnes of coal, which was exported to Bangladesh through Dawki. The unofficial trade is mainly due to the involvement of corrupt officials and greed of the exporters to earn more that led to the loss of money by the government exchequer. There are also lack of proper trade facilities and infrastructures in most of the Indo-Bangladesh land custom stations that inhibits the smooth running of transactions. Though major portion of export to Bangladesh has been taking place through Bangladesh, the importance of Dawki has been declining due to the rise in export through other land custom stations and that is due to the growth of extraction in the areas nearby the other stations.

From the sectoral composition of NSDP of Meghalaya, it is observed that though contribution of secondary sector to NSDP in absolute sense has increased during 1980-81 to 2002-03, in percentage term it continuously declined significantly from about 18 per cent to about 12 per cent during the same period. The contribution of primary sector in percentage term however has not changed significantly during the same period. Though in absolute and percentage sense it shows temporal fluctuations, percentage contribution declined over the whole period of 1980-82 to 2002-03 from about 36 per cent to 33 per cent. Still now primary sector contributes about one-third of the Net State Domestic Product of Meghalaya. The contribution of tertiary sector

was around 46 per cent during 1980-81 and increased to over 54 per cent during 2002-03. Though the contribution of primary sector to NSDP of Meghalaya has declined marginally, contribution of mining and quarrying (whose primary component is coal) has increased during 1980-81 to 2002-03. Similarly, the percentage contribution of mining and quarrying to the NSDP in Meghalaya has increased at 3.66 per cent annual exponential rate during 1980-81 to 2002-03. It is also evident that the annual growth rate of output of mining and quarrying is almost twice the growth rate of NSDP of Meghalaya.

From the analysis of the contribution of coalmining and quarrying to the NSDP in Meghalaya, it is found that there has been a steady increase in the percentage contribution of coalmining and quarrying output from 1.95 per cent during 1980-81 to 3.94 per cent in 2002-03. Similarly, the amount of royalty earned from coal has also increased from Rs.868.80 lakhs in 1987-88 to Rs.8974.50 lakhs in 2003-04.

Coal mining in Meghalaya contributes significantly to the income and employment of different sections of population directly and indirectly. As data on income of all the agents are not available from the secondary sources, from the figures on extraction and variation in income generated per unit of extraction; over time changes in income of different groups are estimated and explained. From the overall discussion, it is observed that the earning of the coalmine labourers altogether has increased significantly from around Rs.724 lakhs in 1980-81 to Rs.44525.6 lakhs in 2005-06. The income of the coalmine owners as a whole has increased by around 8726.7 per cent from 1980-81 to 2005-06. The estimated income earned by the international exporters and inter-state traders together from coal business has increased steadily from estimated Rs.144.8 lakhs in 1980-81 to Rs.10018.25 lakhs in

2005-06. The estimated total income earned by the middlemen as a whole has been increasing significantly from Rs.36.20 lakhs in 1980-81 to Rs.6232.27 lakhs in 2005-06. The hike in total income of the middlemen has been 17,216.2 per cent during that period due to the growth of coal business in the state.

Trucks are the only means for the transportation of coal that is owned either by the owners themselves or other individuals. The income of the truck owners also has increased over time with the rise in extraction and trade of coal. The total estimated income earned by the truck owners due to the transportation of coal has increased from Rs.36.20 lakhs in 1980-81 to Rs.2059.60 lakhs in 2005-06. This indicates that the total estimated income of the truck owners has increased by about 5689.5 per cent during 1980-81 to 2005-06. The total earning of the loaders was about Rs.47.06 lakhs in 1980-81, which increased to approximately Rs.22262.80 lakhs in 2005-06. Therefore it shows a huge 47307.26 per cent hike in the total income of the loaders altogether during that period. The total estimated income of the depot managers has also increased from Rs.30.36 lakhs to Rs.3639.96 lakhs during 1980-81 to 2005-06 though the number of depot managers is not proportional to the quantity of extraction. The total estimated income of the managers and assistant managers of exporters has increased significantly from Rs.21.51 lakhs in 1980-81 to Rs.84.44 lakhs in 2005-06. Also, total estimated income of the drivers and handymen together has increased enormously from Rs.140.16 lakhs in 1980-81 to Rs.3998.16 lakhs in 2005-06. It is also noticed that the growth rate of cement output is more than that of extraction of coal. But till now only 1 per cent of extracted coal is used in the cement factories. It indicates that though coal is one important input of cement manufacturing, the rising cement production and hence the use of coal has been too little compared to the extraction.

Regarding the impact of extraction of coal on employment in Meghalaya, it is observed that the employment opportunity has expanded from only 1742 persons in 1978-79 to 79,500 persons in 2005-06. The total number of coalmine owners has increased from 292 in 1978-79 to 1167 in 1988-89 and thereafter it has remained the same. The employment opportunity generated in the transportation of coal has increased substantially from 1168 persons per day in 1978-79 to 14,800 persons per day in 2005-06. The total estimated employment opportunity generated in the loading of coal to the trucks has also increased from 81 persons per day in 1978-79 to 3710 persons per day in 2005-06. The total estimated depot managers have increased from 253 in 1978-79 to 456 in 1983-84 and further to 1011 persons in 2005-06.

The total estimated employment opportunity for middleman traders has increased from 224 persons in 1978-79 to 2256 persons in 2005-06. Similarly, the estimated total employment for traders has increased significantly from 112 in 1978-79 to 1128 in 2000-01. But there has been no growth in the number of traders after 2000-01. The total estimated employment opportunity for Managers and Assistant Managers of international traders has also increased from 224 persons in 1978-79 to 2257 persons in 2005-06.

From the analysis of the impact of extraction of coal on the generation of indirect employment, it is found that a considerable amount of indirect employment is generated in the form of workers in tea stalls nearby the mining sites and trading centres, in motor repairing shops and also in other businesses.

From the observations of impact of extraction of coal and its related activities on the local economy of Jaintia Hills, it is evident that the coal mining and its related activities has been contributing substantially to the NDDP of Jaintia Hills. During 1999-2000, it contributed around 18.47 per cent to the NDDP of Jaintia Hills.

Similarly, income generated by the individual coalmine owners, international exporters and coalmine labourers has been significantly higher as compared to the non-coalmine owners and non-coalmine labourers, who have been depending on other activities not related to the coal. Extraction of coal and its related activities are also helping coalmine owners, international exporters and others related to it to accumulate tangible assets like houses in Shillong, vehicles, etc. that is further used to raise income. Besides, coalmine owners and exporters are in a position to enjoy luxurious personal vehicles like Bolero, Alto, Marshal and other vehicles and other durables. The parents who are in coal mining and trading are more conscious and are able to provide higher education to their children in a better way compared to the parents who are not in the coal mining and trading. Local youths and ladies of Jaintia Hills are also benefited significantly due to the generation of employment opportunities in the cross border trade in Jaintia Hills directly and indirectly. However, relatively very less proportion of earning by the owners and traders are invested to develop the alternative sectors. Rather, they prefer to reinvest a part of income for the expansion of coal mining without thinking of the future of mining economy, or they invest in real estate and secured bank deposit for sustainable earning of their family or heirs.

8.2 Conclusion and Policy Implication

Minerals are subject to the discovery-depletion cycle. This cyclical nature of mineral exploitation is very critical in regional development. The depletion of mineral resources is a primary concern for an economy, which is built upon the strength of the exploitation of mineral resources only. This is the case for the economy of Meghalaya and particularly of Jaintia Hills; where the extraction of coal is one of the major

activities. It is clear from the over all discussion that the stock of coal in Meghalaya would be exhausted within 15-16 years if the current rate of extraction continues and both indicated and inferred stock would be available for extraction. Even though we assume that it would not be possible to maintain this rising trend of extraction after some years and thus it would last a few more years, that will not be long enough which can allow the next generation of those mine owners to survive only on the naturally supplied stock of coal without searching for and investing in alternative opportunities. Though in many countries technologies have been changing to find alternative of coal, in India coal is still being extensively used for domestic purposes, in iron and steel, cement and other industries and also in thermal power projects. India will have to go a long way to obtain economically full-scale substitutes of coal either on its own or from the advanced countries.

Of course, it is not advisable to suggest for the deceleration in rate of extraction as the quality of coal in Meghalaya is not so good (sub-bituminous) and therefore in future it may remain unutilised if competition rises and better quality is supplied by the other countries to Bangladesh (as already started from Australia). Moreover, alternatives to energy sources may come into existence or transfer from the developed world. In that case, coal of Meghalaya would be redundant first because of its poor quality. Similarly, the fear of nationalisation of coal in Meghalaya is another factor, which supports the rationality of mine owners to continue their extraction. Further, extraction of coal in Meghalaya is export oriented since 98 per cent of the total production of coal is exported either to Bangladesh or to other states of India. Also coal mining and its trade in Meghalaya contributes significantly to the NSDP of Meghalaya and total revenue receipts of the government of the state. The wealth and the economic status of the local people in Jaintia Hills have been increasing with the

rising extraction and trade. But the overall picture of income and investment by all sections of people along with the nature of extraction of coal in Jaintia Hills raise doubt, whether the local economy would survive for long time or not as even though the owners or their next generation would not suffer much due to their investment in secured venture; the employment, revenue of the authority and other sections like businessmen, transporters would be seriously affected. The policy implication is that the income generated from the mining and its related activities should be invested in the development of alternative productive sectors, which would create employment opportunities and absorb the workforce that will be out of employment when coal mining and quarrying will be ceased due to the exhaustion of coal reserves in Meghalaya. But the observation with regard to the investment behaviour of the coalmine owners and traders indicates a gloomy and bleak feature of the local economy. The owners and their heirs may survive from their investment in secured opportunity (earning rent from houses owned in town, etc.) but it would not generate sufficient employment, contribute significantly to the state revenue and provide sustainable growth of the local economy. Similarly, the government is not investing at least the royalty earned from coal for the development of industries sufficiently, which is clear from the slower growth of industries and employment in the secondary sector. Therefore, efforts should be there to develop alternative sectors to coal and related activities that would help continuous progress of the economy.

8.3 The Scope for further Study

There is much room for further extension and improvement of the analysis by incorporating the impact of coal mining on forest coverage, health of labourers and

local people and also its impact on productivity of agricultural crops. Data can be generated on all these aspects as information on these categories is not available from the secondary sources. Moreover, the basic reasons for the expansion of unofficial or illegal trade of coal may be addressed at different levels. In the net contribution of coal mining on the economy of Meghalaya, the value of adverse impact on the forest resources, health of the labourers, drinking water and neighbouring agricultural land should be taken into consideration for the policy formulation in regard to the wage rate, improvement in the techniques and thus efficiency of mining by taking abatement measures, determining tax and compensation and thus most possible socially efficient extraction and finally by overall monitoring for the welfare of the society in Meghalaya. Lastly, there has been a constant interaction though at limited scale between the local inhabitants and the outsiders as many of the workers in mining are held from outside, hence there is conflict and cooperation that affect the social values. This aspect can also be investigated properly through the primary observations along with the historical information.

SELECT BIBLIOGRAPHY

- Agnihotri, S. K. (1993), "Border Trade with Bangladesh", *Journal of North-East India Council for Social Science Research*, Vol. 17, No. 2, October, pp. 29-36.
- Ali, S. A. (1979), *Resource for Future Economic Growth*, Vikas Publishing House, New Delhi, pp. 10-11.
- Bhattacharya, R. N. (2001), "Economics of Natural Resources", in R.N. Bhattacharya (ed.), *Environmental Economics: An Indian Perspective*, Oxford University Press, Chapter. 2.
- Bhattacharyya, S. (2004), *The Making of a Hill Leader*, Deo Gratias DTP, P - 47.
- Chadwick, M. J. Highton N. H. and Lindman, N. (1987), *Environmental Impacts of Coal Mining and Utilization*, Pergamon Press, pp.1-27.
- Chakrabarti, S. and Majumdar, S. (2004), "The Coal Reserves of North-East India", in Z. Hussain and S. K. Barik (eds.), *Development and Environment*, Regency Publication, New Delhi, pp.221-228.
- Conrad, J. M. and Clark, W. C. (1989), *Natural Resource Economics: Notes and Problems*, Cambridge University Press, Chapter-3.
- Dasgupta, P. and Heal, G. (1974), "The Optimal Depletion of Exhaustible Resources", *The Review of Economic Studies: Symposium on the Economics of Exhaustible Resources*, pp.3-28.
- Dasgupta, S., Tiwari, B.K. and Tripathi, R. S. (2002), "Coal Mining in Jaintia Hills, Meghalaya: An Ecological Perspective", in P.M. Passah and S. Sarma (eds.), *Jaintia Hills: Its Environment, Land and People*, Reliance Publishing House, New Delhi.

- Devaranjan, S. and Fisher, A. C. (2001), Hotelling's "Economics of Exhaustible Resources": Fifty Years Later in U. Sankar (ed.), *Environmental Economics*, Oxford University Press, pp.86-123.
- Dickey, D. and Fuller, W. (1981), "Likelihood Ratio Tests for Autoregressive Time Series with a Unit Root." *Econometrica*, Vol. 49, pp. 1057-1072.
- Dutta, R. (2000), "Coal Export from Meghalaya to Bangladesh: A Case Study of Borsora Trade Route", in G. Das and R.K. Purkayastha (eds.), *Border Trade: North-East India and Neighbouring Countries*, Akansha Publishing House, New Delhi, pp.200-208.
- Encyclopaedia Britannica*, Vol.19, 15th edition.
- Gale, J. J. (2000), "Coal and Energy for the Twenty-First Century in India" in P. Audinet, R. R. Shukla and F. Grare (eds.), *India's Energy: Essays on Sustainable Development*, Manohar Publication.
- Geological Survey of India (1974), *Geology and Mineral Resources of Meghalaya*, Vol.30, Miscellaneous Publications.
- Geological Survey of India, (2001), *Proceedings of National Seminar on Recent Advances in Geology of Coal and Lignite Basins of India*, Special publication, 54, Kolkata.
- Geological Survey of India (2004), *New Coal Wing*, Vol.24, No.1, Kolkata.
- Goswami, P. J. (2004), "Coal Production in North-East India: Its Impact on Environment and Economy" in Z. Husain and S. K. Barik (eds.), *Development and Environment*, Regency Publication, New Delhi, pp.290-294.
- Government of India, Directorate of Census Operations: *Census of India, 2001, Series-18*, Provisional Population Totals, Paper-3 of 2001.
- Government of Meghalaya, Directorate of Economics and Statistics: *Meghalaya District Gross Domestic Product, 1993-94 to 1999-2000*.

Government of Meghalaya, Directorate of Economics and Statistics: *Gross Domestic Product of Meghalaya*, 1993-94 to 2001-2002.

Government of Meghalaya, Directorate of Economics and Statistics: *State Domestic Product of Meghalaya Linked Series*, 1980-81 to 1992-93

Government of Meghalaya, Directorate of Economics and Statistics: *Statistical Hand Book Meghalaya*, Various Issues, Meghalaya, Shillong.

Government of Meghalaya, Directorate of Economics and Statistics: *Meghalaya Socio-Economic Review*, 2003.

Gray, L. (1914), "Rent under the Assumption of exhaustibility", *Quarterly Journal of Economics*, Vol. 28, pp.466-489.

Hanley, N., Shogren, J. F. and White, B. (1997), *Environmental Economics in Theory and Practice*, Macmillan India Ltd.

Hardin, G. (1968), 'The Tragedy of Commons', *Science*, Vol.162, pp.1243-1248.

Hartwick, J. M. (1977), "Intergenerational Equity and the Investing of Rents from Exhaustible Resource", *American Economic Review*, Vol. 67, pp.972-974.

Heal, G. (1978), "Resource Prices and Resource Scarcity", In: *Proceedings of the Wisconsin Seminar on Natural Resource Policies in Relation to Economic Development and International Co-operation*, Vol. 1, Madison: Institute for Environmental Studies, University of Wisconsin.

Hotelling, H. (1931), "The Economics of Exhaustible Resources", *Journal of Political Economy*, Vol. 39, pp.137-73.

Howe, C .W. (1978), *Natural Resource Economics: Issues, Analysis and Policy*, John Wiley and Sons, New York.

Hunter, W.W. (1879), *A Statistical Account of Assam* (Vol.2) reprint (1998), p. 236, *Ibid*, pp.278 - 239.

- Johanson, P. and Lofgren, K. (1985), *The Economics of Forestry and Natural Resources*, Basic Blackwell, New York, pp.23-44.
- Johnson, D. G. (2000), "Population, Food and Knowledge", *The American Economic Review*, Vol. 90, No. 1, pp.1-14.
- Khanna, N. (2001), "On the Economics of Non-renewable Resources", Invited contribution to *Encyclopaedia of Life and Social Sciences*, UNESCO.
- Krutilla, J. V. (1967), "Conservation Reconsidered", *The American Economic Review*, Vol. 57, No. 4, Sept., pp.777-786.
- Kula, E. (1992), *Economics of Natural Resources and the Environment*, Chapman and Hall, London, Chapter-1, Chapter-4.
- Lamin, H. (1995), *Economy and Society in Meghalaya*, Har-Anand Publication, New Delhi, pp.109-129.
- Madan, D. K. (1996), *Indo-Bangladesh Economic Relations and SAARC*, Deep and Deep Publications, New Delhi.
- Maiti, A. and Chakrabarti, S. (2004), "Underground Resources of the North-East: Some Issues and Questions in Z. Husain and S. Barik (eds.), *Development and Environment*, Regency Publications, New Delhi, pp. 211-219.
- Malthus, T. R. (1815), *On the Nature and Progress of Rent*, Lord Baltimore Press, Baltimore.
- Meadows, D. H., Meadows, D. L., Randers, J. and Behrens, W. (1972), *The Limits to Growth*, Pan Books, London.
- Mero, M.K. (2000), "Exports from North-Eastern Region: Potential and Problems", in G. Das and R.K. Purkayastha (eds.), *Border Trade: North-East India and Neighbouring Countries*, Akansha Pub. House, New Delhi.
- Mun, T. (1979), "Mercantilist Doctrine at Its Height" in Isaac Ilyich Rubin (ed.), *A History of Economic Thought*, Ajanta Publications, Delhi, pp.49-57.

- Oldham, T. (1854), *Geology Meteorology and Economy of Meghalaya*, Mittal Publications, Delhi, p.60.
- Oldham, T. (1854), *Geology, Meteorology and Economy of Meghalaya*, Mittal Publications, New Delhi, pp.53-77.
- Oldham, T. (1854). *Geology, Meteorology and Economy of Meghalaya*, Mittal Publications, New Delhi, pp.53-77.
- Pandey, H. N. (1993), *Studies on Environmental Impact of Coalmining in Jaintia Hills District*, Final Technical Report of the project, sponsored by Meghalaya State Pollution Control Board, North Eastern Hill University, Shillong.
- Rai, R. K. (2002), "Implications of Coal Mining on Environment in Jaintia Hills, Meghalaya", in P.M. Passah and S. Sarma (eds.), *Jaintia Hills: Its Environment, Land and People*, Reliance Publishing House, New Delhi.
- Reliance Review of Energy Markets* (2002), compiled and edited by the Research Group, Reliance Industries Ltd.
- Ricardo, D. (1817), *Principles of Political Economy and Taxation*, Recent Publication by Pelican Books, 1971, London.
- Ross, J. E. (1980), "Natural Limits to Natural Resources", in Peter Dorner and Mohmoud A. El-Shafie (eds.), *Resource and Development*, The University of Wisconsin Press, London, Chapter-3.
- Rout, L., De, U. K. and Das, G. (2005), "Dynamics of Coal Extraction in Meghalaya and Its Implication" paper presented in the National Seminar on North East India's Natural Resource Management with Special reference to Meghalaya on 5th June 2005, organised by NEICSSR at Shillong.
- Sahu, B.P. and Goel, N.P. (2004), "Social and Environmental Impact Assessment of Opencast Mining in Meghalaya: A Case Study of Jaintia Hills," in Zahid

- Husain and S.K. Barik (eds.), *Development and Environment*, Regency Publications, New Delhi.
- Saraffa, I. And Dobb, M. (1951-55), *The Works and Correspondence of David Ricardo*, Cambridge University Press, Cambridge.
- Sarma, B. K. and Goswami S. N. (2000), "Border Trade in North-East India: An Overview" in G. Das and R.K. Purkayastha (eds.), *Border Trade: North-East India and Neighbouring Countries*, Akansha Publishing House, New Delhi, pp. 93-99.
- Simon, J. (1981), *The Ultimate Resource*, Princeton University Press, Princeton, USA.
- Simon, J. (1996), *The Ultimate Resource 2*, 2nd Edition, Princeton University Press, Princeton, USA.
- Simon, J. and N. Myers (1994), *Scarcity or Abundance? A Debate on the Environment*, Norton, New York.
- Singh, O.P. and Swer S. (2004), "Diminishing Life-Sustaining Role of Water in Jaintia Hills of Meghalaya due to Coal Mining", in Z. Husain and S.K. Barik (eds.), *Development and Environment*, Regency Publications, New Delhi.
- Solow, R. (1974a), "On the Intergenerational Allocation of Resources" *Review of Economic Studies* (Symposium), pp.29-45.
- Solow, R. (1974b), "The Economics of Resources or the Resources of Economics", *American Economic Review*, Vol. 64, pp.1-14.
- Solow, R. (1986), "On the Intertemporal Allocation of Natural Resources", *Scandinavian Journal of Economics*, Vol. 88, pp.141-149.
- Syiemlieh, D. (1989), *British and Administration in Meghalaya: Policy and Pattern*, Heritage Publishers, New Delhi.

- Withagen, C. (1998), “Optimal Extraction of Non-Renewable Resources”, in Jeroen C.J.M. Van den Bergh (ed.), *Handbook of Environmental and Resource Economy*, Edward Elgar.
- World Bank (2005), Bangladesh; Growth and Export Competitiveness Report no. 31394-B D.